Ontario
Health Quality Ontario
Qualité des services de santé Ontario

Optimizing Chronic Disease Management in the Community (Outpatient) Setting (OCDM)

This document is a compilation of 15 reports related to Avoidable Hospitalizations, which are also published individually. Each report retains its original pagination, table of contents, and reference list. The compilation contains the following titles:

September 2013

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Health Quality Ontario
Qualité des services de santé Ontario

Optimizing Chronic Disease Management in the Community (Outpatient) Setting (OCDM): An Evidentiary Framework

OHTAC OCDM Collaborative

September 2013

Ontario Health Technology Assessment Series; Vol. 13: No. 3, pp. 1–78, September 2013

About Health Quality Ontario

Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Optimizing chronic disease management in the community (outpatient) setting (OCDM): an evidentiary framework

Ontario Health Technology Advisory Committee (OHTAC) OCDM Collaborative

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Conflict of Interest Statement

All reports in the *Ontario Health Technology Assessment Series* are impartial. There are no competing interests or conflicts of interest to declare.

Peer Review

All reports in the *Ontario Health Technology Assessment Series* are subject to external expert peer review. Additionally, Health Quality Ontario posts draft reports and recommendations on its website for public comment prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

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List of Abbreviations

ADL	Activity of daily living
AF	Atrial fibrillation
ARAT	Action research arm test
ARI	Acute respiratory illness
BP	Blood pressure
CAD	Coronary artery disease
CAP	Community-acquired pneumonia
CBT	Cognitive behavioural therapy
CCAC	Community Care Access Centre
CD	Chronic disease
CDSMP	Chronic Disease Self-Management Program
CHD	Coronary heart disease
CI	Confidence interval
CIMT	Constraint-induced movement therapy
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DBP	Diastolic blood pressure
DEMS	Diabetes electronic management system
EBA	Evidence-based analysis
ECG	Electrocardiogram
ED	Emergency department
EDI	Electronic data interchange
EHR	Electronic health record
eTool	Electronic tool
FMA	Fugl-Meyer motor assessment
GP	General practitioner
HbA1c	Hemoglobin A1c
HF	Heart failure
HQO	Health Quality Ontario
HR	Hazard ratio
HRQOL	Health-related quality of life
IADL	Instrumental activity of daily living
ICD	Implantable cardioverter defibrillator
ICER	Incremental cost-effectiveness ratio
IMV	Invasive mechanical ventilation

LOS	Length of stay
LTC	Long-term care
LVEF	Left ventricular ejection fraction
MCS	Mental component summary
MD	Mean difference
MI	Myocardial infarction
NCA	Nurse continence advisor
NNT	Number needed to treat
NP	Nurse practitioner
NPPV	Noninvasive positive pressure ventilation
NPWT	Negative pressure wound therapy
NR	Not reported
NRT	Nicotine replacement therapy
OCDM	Optimizing Chronic Disease Management
OHTAC	Ontario Health Technology Advisory Committee
OR	Odds ratio
OT	Occupational therapist
PCI	Percutaneous coronary intervention
PCS	Physical component summary
PFMT	Pelvic floor muscle training
PSW	Personal support worker
PT	Physiotherapist
PVP	Photoselective vaporization of the prostate
QALY	Quality-adjusted life-year
QOL	Quality of life
RCT	Randomized controlled trial
RR	Relative risk
RT	Recreational therapist
SBP	Systolic blood pressure
SCBC	Specialized community-based care
SF-36	Short Form (36) Health Survey
TIA	Transient ischemic attack
TURP	Transurethral resection of the prostate
WMD	Weighted mean difference

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Rationale and Objective

Chronic diseases represent an increasing burden for both individuals and the health care system. In 2005, 62% of women and 55% of men in Ontario self-reported having at least 1 chronic disease, and 29% of Ontario adults aged 25 and older reported having 2 or more chronic diseases. (1) According to the POWER Study, chronic disease prevalence (including multimorbidity) varies by sex, age, and socioeconomic status. (1)

The Canadian health care system was designed for acute care needs and is focused on episodic care, but given the increasing prevalence of common chronic diseases (e.g., diabetes, chronic obstructive pulmonary disease [COPD], circulatory diseases) and the costs of their management, the focus of care needs to shift at least partially towards effective and efficient chronic disease management. Effective management in the outpatient setting can improve patients' quality of life (QOL) and functional status, reduce rates of ambulatory care–sensitive admissions, and delay or prevent disease-specific adverse outcomes and mortality. It may also reduce the costs of health care delivery by ensuring more efficient and appropriate use of care.

This mega-analysis is the first attempt by any jurisdiction to develop a broad-based evidentiary platform to inform public policy on community-based health care services. The objective was to compile a clinical evidence base and economic analysis to guide investment in interventions that can optimize chronic disease management (diabetes, COPD, coronary artery disease [CAD], heart failure, stroke, atrial fibrillation, chronic wounds) in the outpatient setting by improving patient outcomes and promoting system efficiencies. This work will contribute to provincial programs and strategies to improve chronic disease management and reduce rates of avoidable acute health service utilization.

Clinical Need and Target Population

Diabetes

Diabetes is a disorder of the metabolism; either the pancreas produces little or no insulin, or the body's cells do not respond appropriately to the insulin that is produced. The latter form, type 2 diabetes, is the most common, accounting for more than 90% of the disease burden. (2) Type 2 diabetes is associated with older age, ethnicity, and family history, but its prevalence is also increasing with rising rates of obesity; more than 75% of Canadians with type 2 diabetes are overweight or obese. (2) Diabetes is associated with long-term complications that affect almost every part of the body and include blindness, cardiovascular disease (CVD), stroke, kidney damage/failure, nerve damage, and amputations. Adults with diabetes are at high risk for CVD; people with diabetes are 2 to 4 times more likely to develop CVD than those without diabetes. (2)

Prevalence and Impact

The number of people with diabetes has increased dramatically over the last 20 years, making it 1 of the most costly and burdensome chronic diseases of our time. (3;4) In 2008/2009, almost 2.4 million Canadians were living with diabetes. (2) Prevalence has increased dramatically over the last decade in Ontario; age- and sex-adjusted diabetes prevalence has risen by 69%, from 5.2% in 1995 to 8.8% in 2005, and has already surpassed the global prevalence predicted by the World Health Organization for 2030. (5) In the 2006/2007 fiscal year, 9.4% of Ontario adults aged 20 and older had diabetes, based on a validated administrative data algorithm. (6)

The personal costs of diabetes may include reduced QOL and the increased likelihood of complications. (7) The financial burden of diabetes is substantial; it is one of the most commonly encountered conditions in primary practice, (8) accounting for nearly 7 million visits to family physicians each year in Ontario alone. (9) It is estimated that by the year 2020, diabetes will cost the Canadian health care system $16.9 billion (Cdn) per year. (7)

Chronic Obstructive Pulmonary Disease

COPD is a disease state characterized by airflow limitation that is progressive, chronic, and not fully reversible. The rate of disease progression varies, but typically patients fluctuate between stable disease and acute exacerbations, which become more frequent as the disease advances. Common symptoms include chronic and progressive breathlessness, cough, sputum production, wheezing, and chest congestion. Systemic effects include weight loss, nutritional abnormalities/malnutrition, and skeletal and muscle dysfunction. Patients may also experience a variety of other symptoms, such as worsening exercise tolerance, fatigue, malaise, and decreased oxygen saturation. Common comorbidities are ischemic heart disease, osteoporosis, respiratory infection, bone fractures, depression and anxiety, diabetes, sleep disorders, anemia, glaucoma and cataracts, and cancer. (10)

Prevalence and Impact

According to the Canadian Community Health Survey, in 2007 about 4.4% of Canadians reported being diagnosed with COPD by a health care provider. (11) However, based on a validated algorithm using Ontario administrative health data sets, Gershon et al (12) estimated the 2007 age- and sex-standardized prevalence of COPD in Ontario to be 9.5%, an increase from 7.8% in 1996. This 23% rise in prevalence corresponded to an increase of 64.8% in the number of adults with COPD. (12) Prevalence estimates of COPD are believed to underestimate the true prevalence because of underdiagnosis and limited diagnoses of mild cases; individuals often do not seek out health care services until they reach the moderate to severe stages of the disease.

COPD is expected to be the third leading cause of death in Canada by 2020 (currently it is fourth). The 2007 age- and sex-standardized mortality rate in Ontario was 4.3%, translating to 32,156 deaths. (13) As well, aside from mortality, COPD has a considerable impact on the individual; based on the 1998/1999 National Population Health Survey, 51% of Canadians with COPD reported that their disease restricted their activity at home, work, or elsewhere. (14) In addition, people with moderate to severe COPD typically experience 1 or more acute exacerbations per year. Exacerbations affect health-related quality of life (HRQOL) and lung function; may lead to hospitalization and invasive treatment, such as invasive mechanical ventilation; and increase the risk of mortality.

COPD also has a substantial effect on the health system; it is a leading cause of health care utilization, both in Canada and around the world. In 2001, there were 632 hospitalizations per 100,000 population aged 55 and older due to COPD in Ontario. (15) As of 2007, COPD accounted for the highest hospitalization rate of major chronic diseases in Canada. (15) Flare-ups and acute exacerbations are the most frequent cause of medical visits, emergency department (ED) visits, hospitalizations, and death among patients with COPD. (16)

Coronary Artery Disease/Cardiovascular Disease

CAD or CVD is a narrowing of the small blood vessels that supply blood and oxygen to the heart. Plaque builds up inside the coronary arteries and hardened plaque narrows the vessels, reducing the flow of oxygen-rich blood to the heart. Chest pain is the most common symptom of CAD, but other symptoms include shortness of breath and fatigue with exertion. Some of the potential complications of CAD include angina or myocardial infarction (MI). Canadians run a high risk of developing

CAD: 9 out of 10 individuals have at least 1 risk factor (smoking, physical inactivity, being overweight, high blood pressure, high cholesterol, or diabetes), and 4 in 10 have 3 or more risk factors. (17) Still, CAD and its associated secondary events are largely preventable with risk factor modification; among individuals with CAD, risk factor modification and chronic disease management can improve health, functional status, and QOL.

Prevalence and Impact

About 1.3 million Canadians self-reported CAD, including 23% of those aged 75 and older. (17) CAD remains a leading cause of death and disability among Canadian women and men, accounting for 32% of all deaths in 2004. (17) The number of people living with CAD is expected to rise over the next 25 years due to an aging population, changes in health behaviours, improved diagnostic testing, and treatment options that extend the lives of people with CAD. However, rising rates of obesity and diabetes are likely to result in increasing CAD prevalence and threaten to reverse declining mortality rates. (18)

In 2000, the cost of CAD in Canada amounted to $22.2 billion (Cdn): $7.6 billion (Cdn) for health care costs (direct costs) and $14.6 billion (Cdn) for lost economic productivity due to disability or death (indirect costs). (19) According to the Public Health Agency of Canada, 16.9% of all hospitalizations in Canada in 2005/2006 could be attributed to CAD. (17) The proportion doubled when hospitalizations with CAD as a related condition were included. CAD also accounted for the highest proportion of days in hospital compared to other health problems (17% of all days). (17)

Heart Failure

Heart failure includes a complex set of symptoms indicating that the heart muscle is weakened and the heart as a pump is impaired; it is caused by structural or functional abnormalities and is the leading cause of hospitalization in elderly Ontarians. (20) Heart failure occurs after the heart muscle has been damaged (e.g., by high blood pressure, CAD, or certain infections); the heart becomes too weak to pump enough blood to meet the needs of the body. There has been a progressive increase in the proportion of people aged 65 and older with heart failure, partially due to improved survival after coronary and cerebrovascular events; survivors are at increased risk for developing heart failure.

Prevalence and Impact

Based on data from the Canadian Community Health Survey, the prevalence of heart failure in Canada (among those aged 12 and older) is approximately 1%. (21) Prevalence sharply rises after age 45; rates in this age group range from 2.2% (22) to 12%. (23) The wide range is due to the different criteria used to identify heart failure patients and differences in disease severity (from mild to severe) that affect the identification of patients. (24) Extrapolating the national prevalence of heart failure to the Ontario population, an estimated 98,000 residents in Ontario have heart failure, (21) and about 5% of those have end-stage disease. (25)

Between 1997 and 2007, there were 419,552 cases of heart failure in Ontario. (20) Slightly more women (51%) than men had heart failure, and 80% of the overall cohort was aged 65 or older. (20) The prognosis for patients is poor; 5-year mortality associated with heart failure is estimated to be as high as 60%; (26) the major causes of death among patients with heart failure are sudden death and death from worsening disease. (27)

Stroke

A stroke is a sudden loss of brain function caused by the interruption of blood flow to the brain (ischemic stroke) or the rupture of blood vessels in the brain (hemorrhagic stroke). The longer the brain goes without the oxygen and nutrients supplied by the blood, the greater the risk of permanent brain damage. About 80% of strokes are ischemic, and 20% are hemorrhagic. Transient ischemic attacks (TIAs) are caused by a temporary interruption of blood flow to the brain. TIA symptoms are similar to those of an ischemic stroke, but will go away within hours or even minutes (transient). TIAs are important warning signs that indicate increased risk of ischemic stroke.

Prevalence and Impact

There are over 50,000 strokes in Canada each year; after age 55, the risk of stroke doubles about every 10 years. (17) Stroke is the leading cause of adult disability in Canada and the third leading cause of death. (28) Six percent of all deaths in Canada—about 14,000—are due to stroke. (29)

Despite a decline in hospitalization rates for acute stroke in the past 10 years, Canada's aging population (along with increasing prevalence of risk factors) is expected to lead to an overall rise in the absolute number of strokes over the next 20 years. (19) Stroke costs the Canadian economy about $3.6 billion (Cdn) per year, including physician services, hospital costs, lost wages, and decreased productivity. (19)

Atrial Fibrillation

Atrial fibrillation is characterized by an irregular (usually rapid) heart rate. During atrial fibrillation, electrical charges are generated from areas of the heart other than the synovial node and cause rapid and irregular contractions of the atria, so that blood is ineffectively pumped through the body. Atrial fibrillation can be a primary diagnosis or it may be associated with other diseases, such as high blood pressure, abnormal heart muscle function, chronic lung diseases, and CAD. The most common symptom of atrial fibrillation is palpitations. Symptoms caused by decreased blood flow include dizziness, fatigue, and shortness of breath, but some patients with atrial fibrillation experience no symptoms.

Strokes are a complication associated with atrial fibrillation. Rapid contractions or quivering of the atria can cause blood to stagnate and form blood clots, which, if dislodged, can cause strokes. (30) The risk of stroke increases further in the presence of other risk factors, including age, previous history of stroke, reduced left ventricular ejection fraction, and valvular heart disease. Patients with atrial fibrillation may have a 5-fold increased risk of stroke compared to age-matched controls. (31)

Prevalence and Impact

According to data from the United States, (31) the incidence of atrial fibrillation increases with age, with a prevalence of 1 per 200 people aged 50 to 60 years, and 1 per 10 people over 80 years of age. In Ontario, the prevalence of atrial fibrillation is about 1.1% of the population aged 20 and older, and this rate is expected to rise as the population ages. (32) In 2004, the Institute for Clinical Evaluative Sciences estimated that the rate of hospitalization for atrial fibrillation in Canada was 582.7 per 100,000 population; (33) they also reported that of patients who were discharged alive, 2.7% were readmitted within 1 year for stroke. (33) In a previous Health Quality Ontario (HQO) report, the prevalence of atrial fibrillation in Ontario was estimated to be 98,758 for residents 20 and older, based on extrapolations from the findings of a United States prevalence study. (34)

Chronic Wounds

Chronic wounds have various etiologies, including pressure, diabetes, venous pathology, and surgery. Without adequate management, chronic wounds pose a significant risk to patient safety and can result in infection, limb loss, sepsis, and even death. A pressure ulcer is defined as a localized injury to the skin/and or underlying tissue, occurring most often over a bony prominence and caused by pressure, shear, or friction, either alone or in combination. Those at risk for pressure ulcers include the elderly and critically ill, those with neurological impairments, and others with conditions associated with immobility. Up to three-fifths of leg ulcers have a venous etiology. Chronic leg ulcers are associated with decreased QOL, restricted mobility, anxiety, and depression; severe or continuous pain is reported by up to 65% of people with chronic wounds. (35)

Prevalence and Impact

The prevalence of pressure ulcers in Canadian health care facilities is estimated to be 25% in acute care; 29.9% in nonacute care; 22.1% in mixed health care settings; and 15.1% in community care. (36) The estimated cost of caring for a pressure ulcer in the community is $27,000 (Cdn). Approximately 15% of patients with diabetes will develop foot ulcers in their lifetime, and 14% to 24% of those will require amputation. (37) The average total cost per amputation in Ontario ranges from $40,000 to $74,000 (Cdn). (37) The prevalence of venous leg ulcers ranges from 0.8% to 1.3%, and 2% in those over 65 years of age. The recurrence rate is approximately 70% if effective prevention strategies are not put in place post-healing. (37)

Methods

This section briefly describes the methods used to define the scope of the mega-analysis; conduct the systematic reviews of the clinical literature, the economic analysis, and the syntheses of the qualitative literature; and to contextualize the evidence.

A. Mega-Analysis

Scoping

The scoping phase involved searches for interventions that could optimize chronic disease management in the outpatient setting and reduce acute health care utilization (urgent care visits, ED visits, and hospitalizations) for patients with at least 1 of the following conditions: diabetes, COPD, CAD/CVD, heart failure, stroke, atrial fibrillation, and chronic wounds. The scoping process involved identifying and reviewing individual studies, meta-analyses, systematic reviews, and narrative reviews of interventions intended to improve chronic disease management and reduce avoidable hospitalizations. The search was conducted using keyword searches on MEDLINE and several health technology assessment and systematic review websites (the Wiley Cochrane Library, the Centre for Reviews and Dissemination/International Agency for Health Technology Assessment, and the National Institute for Health and Clinical Excellence), as well as other relevant websites, such as the Commonwealth Fund and the Agency for Healthcare Research and Quality.

Ontario experts in health systems, primary care, or chronic disease management—as well as members of the Ontario Health Technology Advisory Committee (OHTAC)—provided input on the project scope and recommended topics to include in the analysis.

Disaggregation of Technologies

After determining the scope of the project and the interventions to be included in the review, each topic was systematically reviewed using published literature. Patient/clinical and health system outcomes of interest were determined a priori so that, where possible, outcomes common to the 7 conditions could be compared across technologies. The following common outcomes were examined:

- health care utilization
- hospitalization
- readmissions to hospital
- ED admissions
- urgent care visits
- hospital length of stay (LOS)
- mortality
- disease-specific measures
- patient-specific measures
- QOL
- functional status
- patient satisfaction

Reaggregation

Evidence of effectiveness was combined with evidence of cost-effectiveness, feasibility of implementation, and societal and ethical considerations. Qualitative meta-syntheses were also conducted to provide additional context about the impact of selected interventions on patients with chronic diseases.

B. Evidence-Based Analyses of Clinical Effectiveness and Safety

Research Methods

Literature Search

For each of the systematic reviews, a literature search was performed using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database to identify potential studies. The publication search dates varied by review, but typically ranged over 5 to 10 years of literature (specific details are available in the individual reports). Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

The inclusion and exclusion criteria listed below were used for all analyses. Some analyses used additional criteria specific to the topic of interest, which are detailed in the individual reports.

Inclusion Criteria

- English-language full-text reports
- health technology assessments, systematic reviews, meta-analyses, randomized controlled trials (RCTs), and observational studies
- studies that included patients in 1 of the relevant disease cohorts (type 2 diabetes, COPD, CAD, heart failure, stroke, atrial fibrillation, chronic wounds) or in a general chronic disease or multimorbid population

Exclusion Criteria

- < 18 years of age
- animal studies
- duplicate publications
- grey literature

Statistical Analysis

When possible, results were pooled using Review Manager Version 5.1. (38) Continuous data were pooled to calculate relative risks (RRs) using the Mantel-Haenszel test and a random effects model. Dichotomous data were pooled to calculate weighted mean differences using the inverse variance method and a random effects model. When data could not be pooled, results were summarized descriptively. *P* values < 0.05 were considered statistically significant. For a complete description of search strategies, review methods, and statistical analyses, please see the individual reports.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (39) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (39) For more detailed information, please refer to the latest series of GRADE articles. (39)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

C. Economic Modelling

Models were constructed by condition. Cost-utility analyses were conducted to evaluate health care resource costs and outcomes in each chronic disease cohort. For health outcomes that could be modelled, the costs and effects of interventions that were clinically effective (based on evidence of statistical significance) were included. Specifically, interventions were included only if:

- the clinical review demonstrated a statistically significant difference in health outcomes
- the outcomes had implications for resource utilization and/or health outcomes
- the studies were conducted in a chronic disease population

The analysis was conducted from the perspective of the Ontario Ministry of Health and Long Term Care. An annual discount rate of 5% was applied to both costs and quality-adjusted life-years. A 5-year time horizon was used in all analyses.

For a full description of the methods and results of the economic analysis, please see *Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation* in the report series.

D. Qualitative Meta-Synthesis

A search strategy similar to the one used for the clinical reviews was used to search the qualitative literature. Published qualitative research was analyzed using integrative qualitative meta-synthesis. Qualitative meta-synthesis, also known as qualitative research integration, is an integrative technique that summarizes research over a number of studies with the intent of combining findings from multiple papers. Qualitative meta-synthesis has 2 objectives: first, the aggregate of a result should reflect the range of findings while retaining the original meaning; second, by comparing and contrasting findings across studies, a new integrative interpretation should be produced.

Predefined topic and research questions guided research collection, data extraction, and analysis. Topics were defined in stages as available relevant literature was identified and corresponding evidence-based analyses (EBAs) proceeded. All qualitative research relevant to the conditions under analysis was retrieved. In consultation with HQO, a theoretical sensitivity to patient centeredness and vulnerability was used to further refine the dataset. Finally, specific research questions were chosen and a final search performed to retrieve papers relevant to these questions.

For a full description of the methods and results of the qualitative meta-syntheses, please see the qualitative reviews in the report series.

E. Contextualization of the Evidence

An expert panel was convened by OHTAC to assist in contextualizing the results of the EBAs and economic analyses. The roles of the panel were as follows:

- to provide direction on the scope of the project, including relevant background knowledge, grey literature, and relevant subgroup analyses for the evidence reviews
- to provide direction on the selection of interventions for inclusion
- to review the EBAs of the included interventions, comment on the accuracy of the interpretation of evidence, and identify any omissions of evidence
- to identify any health system, societal, ethical, or economic issues that were relevant to evaluating the effectiveness of the included interventions

Project Scope

After an initial scoping of reports and reviews, a list of drivers and interventions was developed. Based on the results of the scoping, the research team developed a health system trajectory to identify points of intervention (Figure 1). The expert panel validated the trajectory as representative of the system.

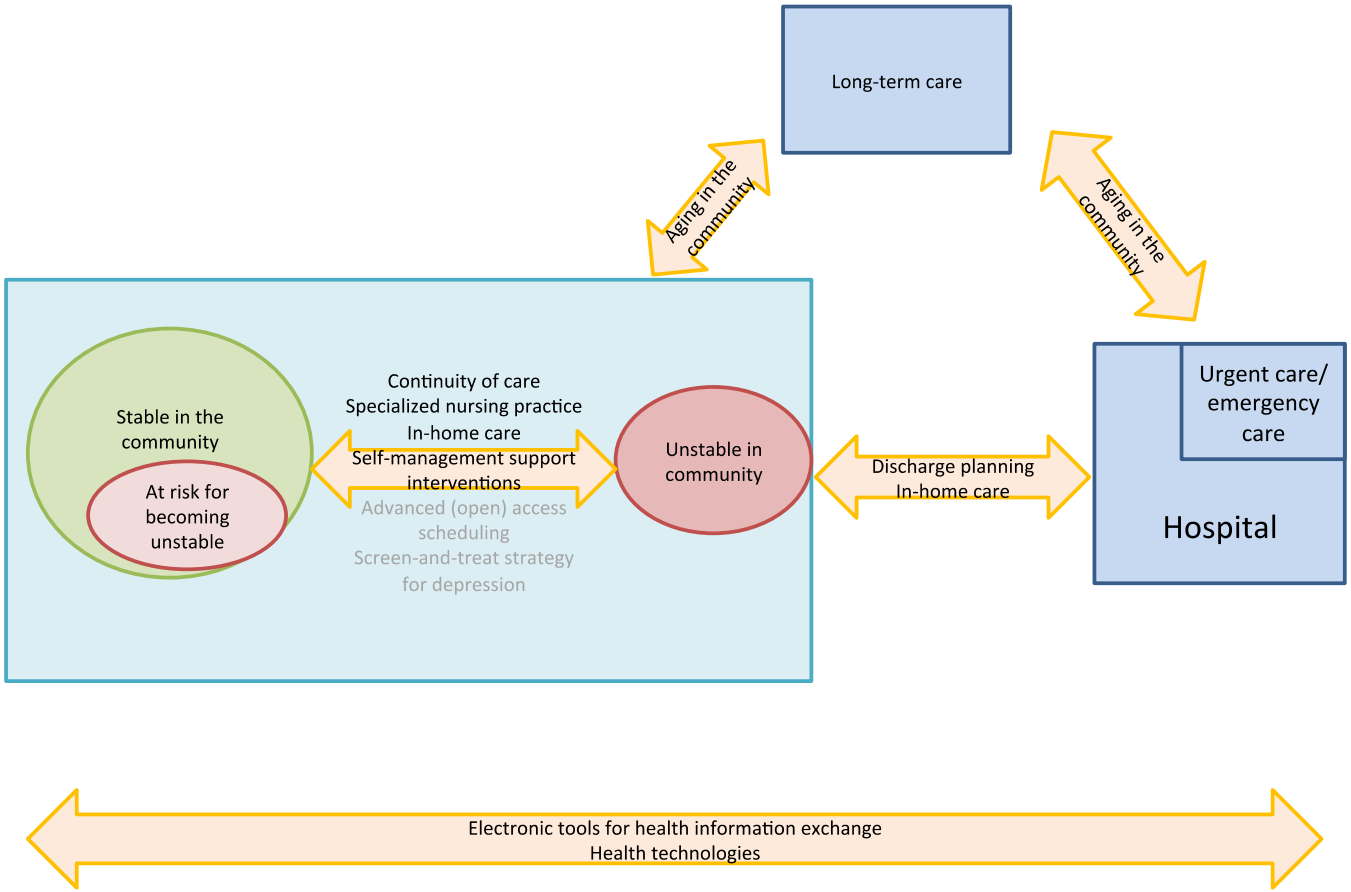

Figure 1: Health Care System Trajectory for Adults With Chronic Diseases

Note: Greyed out text refers to interventions that did not have a significant clinical effect

The interventions and research questions included in the final mega-analysis were as follows:

- **Discharge planning:** What is the effectiveness of discharge planning bundles at reducing health resource utilization and improving patient outcomes compared to usual care alone?
- **In-home care:** What is the effectiveness of care delivered in the home (i.e., in-home care) compared to no home care or usual care/care received outside of the home (e.g., a health care setting)?
- **Continuity of care:** Is higher continuity of care effective at reducing health resource utilization and improving patient outcomes?
- **Advanced (open) access scheduling:** What is the effectiveness and cost-effectiveness of advanced access scheduling compared to traditional scheduling for the management of chronic diseases in Ontario adults?
- **Screening and management of depression:** In a chronic disease population, is a screen-and-treat strategy for depression associated with an improvement in chronic disease outcomes?
- **Self-management support interventions:** What is the effectiveness of self-management support interventions for persons with chronic disease compared to usual care?
- **Specialized nursing practice:** What is the effectiveness of specialized nursing practice in comparison to usual care in improving patient outcomes and health system efficiencies for chronic disease management in the primary health care setting?
- **Electronic tools for health information exchange:** What is the impact of electronic tools (eTools) for health information exchange on patient outcomes and health services utilization when used to improve the care coordination of adults with chronic disease? What specifications of eTools contribute to their effectiveness?
- **Health technologies:** What Medical Advisory Secretariat (now Evidence Development and Standards, HQO)–reviewed health technologies are effective and cost-effective in optimizing chronic disease management in the outpatient setting (i.e., in the community)?

A review of cardiac rehabilitation was initially included in the scope of work, but because of the complex nature of the intervention—including variations in programs by subpopulation and cardiac condition—it was not included in the final analysis.

Interventions that were not prioritized for review due to resource constraints included the following:

- care coordination/case management
- primary care team composition and team member scope of practice
- chronic disease management models
- electronic medical records (e.g., alerts, pop-ups, electronically generated standardized order sets)
- respite care
- palliative care
- telehealth/telemonitoring
- accountable care models

Results of Evidence-Based Analyses

This section provides a summary of the findings from each of the individual EBAs, categorized according to where the intervention would fit on the trajectory (Figure 1). For complete descriptions of methods and results, please refer to the individual reports in the series; full reviews are available at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations. For a summary of included studies, effect estimates, and GRADE levels of evidence, please see Appendix 1.

1. Discharge Planning

Objective of Analysis

The objective of this analysis was to determine if discharge planning bundles (e.g., support services, follow-up activities, and other interventions that span prehospital discharge to the home setting) are effective at reducing health resource utilization and improving patient outcomes compared with usual care alone.

Intervention

The few definitions of hospital discharge planning indicate that this is a process that takes place between hospital admission and the discharge event. (40) Prehospital discharge and communication is important as a start to the discharge planning process; it provides an opportunity to summarize the visit, teach patients how to safely care for themselves at home, and address any remaining questions or concerns. Discharge planning helps patients communicate with caregivers and primary care providers about how best to manage their chronic needs after leaving the hospital. Variations in the implementation of discharge planning and differences between guidelines and programs make it difficult to interpret data on the effectiveness of discharge planning. This review looked at 2 groups of interventions that addressed the transition from hospital to the community setting:

- individualized predischarge planning
- individualized predischarge planning plus postdischarge support

Both groups included varying combinations of interventions, making it more difficult to identify which elements were effective. It was also not possible to compare the 2 groups to each other; each was compared to usual care, and there were no head-to-head comparisons.

Research Questions

What is the effectiveness of discharge planning bundles at reducing health resource utilization and improving patient outcomes compared to usual care alone?

Included Studies

A literature search was performed on December 13, 2011, that included studies published between January 1, 2004, and December 13, 2011. A meta-analysis of discharge planning for patients with heart failure was published in 2004; this work built on that review. The search was limited to RCTs, systematic reviews, and meta-analyses. One reviewer screened the database (2,707 citations, with duplicates removed); 11 studies (7 systematic reviews and 4 RCTs) were included in the final analysis.

Results

Table 1: Individualized Predischarge Planning (Versus Usual Care)

Outcome	Population	Measure	Studies	Result	GRADE
Health service utilization	Population admitted to hospital	Readmission	2 systematic reviews	Significant reduction	Moderate
		LOS	1 systematic review	Significant reduction	Moderate
Mortality		Mortality	1 systematic review	No difference	Moderate
Clinical measures	Not reported				
QOL/functional status	Population admitted to hospital	HRQOL	1 systematic review	Significant improvement	Very low
Nonclinical patient outcomes		Patient satisfaction	1 systematic review	Significant improvement	Very low

Abbreviations: HRQOL, health-related quality of life; LOS, length of stay; QOL, quality of life.

Table 2: Individualized Predischarge Planning Plus Postdischarge Support (Versus Usual Care)

Outcome	Population	Measure	Studies	Result	GRADE
Health service utilization	Population admitted to hospital	Readmission[a]	2 systematic reviews and 4 RCTs	Significant reduction	Low
		LOS[a]	1 systematic review	No difference	Low
Mortality		Mortality[a]	1 systematic review and 1 RCT	No difference	Low
Clinical measures	Not reported				
QOL/functional status	Population admitted to hospital	HRQOL[a]	1 systematic review and 2 RCTs	Significant improvement	Very low
Nonclinical patient outcomes		Patient satisfaction	1 RCT	Significant improvement	Very low

Abbreviations: HRQOL, health-related quality of life; LOS, length of stay; QOL, quality of life; RCT, randomized controlled trial.
[a]The study by Phillips et al (41) was specific to a population with heart failure.

Cost-Effectiveness

The review of individualized predischarge planning plus postdischarge support found significant clinical effectiveness for congestive heart failure patients. An evaluation of cost-effectiveness in a congestive heart failure cohort found that individualized predischarge planning plus postdischarge support was dominant compared to usual care.

Conclusions

Individualized Predischarge Planning Compared With Usual Care

- Based on moderate quality evidence, individualized predischarge planning was more effective than usual care at reducing readmissions and initial hospital LOS.
- Based on moderate quality evidence, individualized predischarge planning was not more effective than usual care at reducing mortality.
- Based on very low quality evidence, individualized predischarge planning was more effective than usual care at improving HRQOL and patient satisfaction.

Individualized Predischarge Planning Plus Postdischarge Support Compared With Usual Care

- Based on low quality evidence, individualized predischarge planning plus postdischarge support was more effective than usual care at reducing readmissions.
- Based on low quality evidence, individualized predischarge planning plus postdischarge support was not more effective than usual care at reducing hospital LOS or mortality.
- Based on very low quality evidence, individualized predischarge planning plus postdischarge support was more effective than usual are at improving HRQOL and patient satisfaction.

2. In-Home Care

Objective of Analysis

The objective of this analysis was to determine the effectiveness of in-home care in optimizing chronic disease management in the community.

Intervention

In-home and continuing care include health services delivered in the home and in the community to recovering, disabled, chronically ill, or terminally ill individuals. By offering a variety of health services (including nursing, personal care, physiotherapy, occupational therapy, speech therapy, social work, dietician services, homemaking, respite care, and other services such as day programs for Alzheimer's disease, Meals on Wheels, and friendly visitor programs), in-home and community care can maintain or improve the health status of individuals in need. {Health Canada, 2010 1876 /id}

For the purposes of this EBA, in-home care was defined as care predominantly in the patient's home, including ongoing in-home assessment, case management, and coordination of a range of services provided in the home or in the community that are curative, preventive, or supportive in nature and that aim to enable clients to live at home, preventing or delaying the need for long-term care (LTC) or acute care. {Health Canada, 2010 1876 /id}

In Ontario, formal home care services are either government- or privately funded. Community Care Access Centres (CCACs) administer the former; there are 14 CCACs (1 per Local Health Integration Network) in communities across Ontario. CCAC advice and services are covered by the Ontario Health Insurance Plan. (43) Among Ontario adults aged 65 and older, 8% of women and 6% of men receive government-funded services. (44)

Research Question

What is the effectiveness of care delivered in the home (i.e., in-home care) compared to no home care or usual care/care received outside of the home (e.g., a health care setting)?

Included Studies

A literature search was performed on January 25, 2012, for studies published between January 1, 2006, and January 25, 2012. The start date for the literature search was selected based on scoping of the literature and identification of a number of systematic reviews that had already been completed at that time. The search was limited to RCTs, systematic reviews, meta-analyses, and health technology assessments. It was also limited to interventions that included at least 1 in-home care visit. Studies that used telemonitoring or telemedicine to deliver care were excluded. One reviewer screened the database (1,277 citations, with duplicates removed); 17 studies (1 health technology assessment, 4 systematic reviews, and 12 RCTs) were included in the final analysis.

Results

Table 3: In-Home Care Interventions (Versus Usual Care)

Outcome	Population	Measure	Studies	Result	GRADE
Health service utilization	HF population	Mean unplanned admissions/readmissions	1 RCT	Significant reduction	Moderate
		HF-specific admissions	2 RCTs	No difference	Moderate
		Mean number of HF-specific admissions	2 RCTs	No difference	Moderate
		Mean number of ED visits	1 RCT	Significant reduction	Moderate
		Mean LOS	2 RCTs	No difference	Moderate
Mortality	Chronically ill multimorbid population	All-cause mortality	1 RCT	No difference	High
	HF population	Combined all-cause mortality and hospitalization	3 RCTs	Significant reduction	Moderate
		All-cause mortality	5 RCTs	No difference	Moderate
		CVD-specific mortality	2 RCTs	No difference	Moderate
Clinical measures	Diabetes population	HbA1c, BP, lipid levels	1 RCT	Significant benefit for HbA1c, no difference for BP or lipid levels	Low
	Stroke population	BP, lipids	1 RCT	No difference	Low
QOL/functional status	HF population	SF-36, PCS	1 RCT	Significant improvement	Low
		SF-36, MCS	1 RCT	No difference	Low
		HF-specific well-being (nurse-led intervention)	2 RCTs	Significant improvement	Low
		HF-specific well-being (pharmacist-led intervention)	1 RCT	No difference	Low
	COPD population	St. George's Respiratory Questionnaire	1 RCT	No difference	Indeterminate
	Chronic disease population	ADLs	1 RCT	Significant improvement	Moderate
		IADLs	1 RCT	No difference	Moderate
		Mobility	1 RCT	No difference	Moderate
Nonclinical patient outcomes	Not reported				

Abbreviations: ADL, activity of daily living; BP, blood pressure; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; ED, emergency department; HbA1c, hemoglobin A1c; HF, heart failure; IADL, instrumental activity of daily living; LOS, length of stay; MCS, mental component summary; PCS, physical component summary; QOL, quality of life; RCT, randomized controlled trial; SF-36, Short Form (36) Health Survey.

While all results were suggestive of a protective effect of home care, few were statistically significant.

Cost-Effectiveness

The review of in-home care interventions found significant clinical effectiveness in heart failure patients. An evaluation of cost-effectiveness in a heart failure cohort found that in-home care was dominant compared to usual care.

Conclusions

- Based on moderate quality evidence, there was a significant beneficial effect of in-home care on unplanned hospitalizations and ED visits in heart failure patients. However, also based on moderate quality evidence, there was no difference between in-home care and usual care for rates of heart failure–specific hospitalizations or hospital LOS in heart failure patients.
- Based on high to moderate quality evidence, there was no difference between in-home care and usual care for all-cause mortality in multimorbid chronic disease patients (high quality) and for all-cause mortality or CVD-specific mortality in heart failure patients (moderate quality). However, based on moderate quality evidence, there was a significant beneficial effect of in-home care on the combined events of all-cause mortality and hospitalizations in heart failure patients.
- Based on low quality evidence, there was a significant beneficial effect of in-home care on blood glucose control (hemoglobin A1c [HbA1c]) in diabetes patients. There was no difference between in-home care and usual care for blood pressure or lipid levels in diabetes and stroke patients.
- Based on low quality evidence, there was a significant beneficial effect of in-home care on HRQOL as assessed by the physical component summary of the Short Form (36) Health Survey (SF-36), but no difference between groups on the mental health component summary.
- Based on low quality evidence, there was a beneficial effect of nurse-led in-home care on heart failure–specific HRQOL in heart failure patients. There was no difference between pharmacist-led in-home care and usual care for heart failure–specific HRQOL.
- Based on moderate quality evidence, there was a significant beneficial effect of in-home care on activities of daily living in multimorbid chronic disease patients, but no difference in measures of mobility or instrumental activities of daily living.

3. Continuity of Care

Objective of Analysis

The objective of this analysis was to determine if continuity of care is associated with health resource utilization and patient outcomes.

Intervention

Continuity of care is not an intervention per se, but rather a quality of the relationship between the patient and the provider. Most of the research focuses on continuity of care with a primary care or main provider. There are 3 defined areas of continuity of care: informational, management, and relational or interpersonal. This EBA addressed management and relational continuity, but not informational continuity.

- *Informational continuity* is continuity whereby previous patient information is available (usually through a patient chart or an electronic medical record) and used to provide patient-appropriate care. Ideally the patient information is available to multiple health care professionals in different settings.
- *Management continuity* involves the use of standards and protocols to ensure that care is provided in an orderly, coherent, complementary, and timely fashion. Often this applies when care is being provided by multiple providers. This also includes accessibility (availability of appointments, medical tests), flexibility to adapt to care needs, and consistency of care and transitions of care (e.g., the coordination of home care by a family physician).
- *Relational continuity (interpersonal)* refers to the ongoing relationship between the care provider and the patient. It refers to the duration of the relationship as well as the quality of the relationship, which is affected by the attentiveness, inspiration of confidence, and the medical knowledge of the health professional.

Research Question

Is higher continuity of care effective at reducing health resource utilization and improving patient outcomes?

Included Studies

A literature search was performed on December 8, 2011 (updated January 27, 2012), that included studies published between January 1, 2002, and January 27, 2012. A 10-year timeframe was chosen because a comprehensive systematic review by Cabana and Jee was published in 2004 that included studies up until 2002; this work built on that review. One reviewer screened the database (6,462 citations, with duplicates removed); 23 studies (8 systematic reviews, 15 observational studies) were included in the final analysis.

Results

Table 4: Higher Continuity of Care (Versus Lower Continuity of Care)

Outcome	Population	Measure	Studies	Result[a]	GRADE
Health service utilization	General population	Hospitalizations	3 observational studies[b]	Significant reduction (all 3 studies)	Low
		ED visits	3 observational studies	Significant reduction (all 3 studies)	Low
	Diabetes population	Hospitalizations	5 observational studies	Significant reduction (4 of 5 studies); 1 study showed reduced hospitalizations, but the result was not statistically significant	Low
		ED visits	3 observational studies	Significant reduction (all 3 studies)	Low
	COPD population	Hospitalizations	1 observational study	Significant reduction	Low
		ED visits	1 observational study	Significant reduction	Low
Mortality	Diabetes population	Mortality	1 observational study	Mortality was lower for those with high continuity vs. those with low continuity	NR
Clinical measures	Diabetes population	HbA1c	2 observational studies	Both studies reported significant improvements in HbA1c for patients with higher continuity	Low
	Diabetes population	BP, lipids	1 observational study	No effect of continuity on clinical measures	NR
	CAD population	LDL-C	1 observational study[c]	No benefit of increased connectedness with a physician over a practice	Very low
QOL/functional status	Not reported				
Nonclinical patient outcomes	Multiple populations	Patient satisfaction	3 systematic reviews	Increased satisfaction	Low

Abbreviations: BP, blood pressure; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; ED, emergency department; HbA1c, hemoglobin A1c; LDL-C, low-density lipoprotein cholesterol; NR, not reported; QOL, quality of life.
[a]Association with increased continuity.
[b]One study was limited to adults aged 65 and older.
[c]Study compared continuity with a physician to continuity in a practice.

Cost-Effectiveness

The review of continuity of care found increased continuity to be associated with a significant benefit for patients with COPD or diabetes. Because continuity of care itself is not an intervention, it was not possible to estimate its costs. However, a sensitivity analysis of the costs and benefits of interventions to increase continuity of care for patients in these cohorts found that interventions would be cost-effective or dominant across most combinations of cost and incremental improvements.

Conclusions

- Despite heterogeneity in how continuity is measured, based on low quality evidence, higher continuity of care decreased health service utilization (hospitalizations and ED visits).
- There was insufficient evidence to comment on the relationship of continuity of care with disease-specific outcomes.
- Based on low quality evidence, higher continuity of care was associated with improved control of blood glucose (lower HbA1c levels) in patients with diabetes.
- Based on low quality evidence, there appeared to be a positive association between high continuity of care and increased patient satisfaction, particularly among patients with chronic disease.

4. Advanced (Open) Access Scheduling

Objective of Analysis

The objective of this analysis was to evaluate whether implementation of an advanced access scheduling system—intended to ensure that patients have access to same-day appointments with a physician (primary care or specialty care)—reduced other types of health service utilization (hospital, ED, acute care LOS) and/or affected clinical measures and patient satisfaction among adults with chronic diseases.

Intervention

Advanced access scheduling (also known as *open access* or *same-day access* scheduling) was developed by Mark Murray, Catherine Tantau, and Donald Berwick. The authors applied queuing theory and principles of industrial engineering adapted to clinical settings, and posited that access delays could be reduced substantially without employing additional resources. Advanced access is premised on the idea that demand for appointments is predictable and, by balancing supply and demand and working through an existing appointment backlog, it is possible to implement an appointment system that allows patients to see a physician within 24 hours of requesting an appointment.

Some appointments—such as follow-up appointments scheduled by the physician or appointments booked on the day of a patient's choosing rather than on the day of calling—are consistent with advanced access scheduling, but the volume of these appointment types should be taken into consideration when measuring demand and assigning open supply. "[T]he anchor metric for advanced access [success] is delays, measured as the time in days to the third next available routine appointment." (45)

The Advanced Access and Efficiency for Primary Care initiative was implemented in Ontario in 2008 by the Quality Improvement and Innovation Partnership and continues to be implemented through HQO. The aim of the program is to realize improvements in access to primary care and efficiency in the delivery of primary care within 6 months of initiating the program. The core objective is to ensure that patients calling to schedule a physician visit are offered an appointment with their primary care provider on the same day or a day of their choosing. As such, the program stresses the importance of continuity, as well as same-day access to care. Measures of successful implementation include time to the third next available appointment (less than 1 day) and that 85% of patients from multiprovider practices see their own provider at each visit.

Research Question

What is the effectiveness and cost-effectiveness of advanced access scheduling compared to traditional scheduling for the management of chronic diseases in Ontario adults?

Included Studies

A literature search was performed on January 29, 2012, that included studies published to January 29, 2012. While no date cut-off was used to limit the search, advanced access was developed in the late 1990s and more widely applied in the early 2000s; no literature exists on this intervention prior to that time. One reviewer screened the database (3,075 citations, with duplicates removed); 6 papers (1 systematic review, 1 observational study with concurrent controls, and 4 observational studies with historical controls) were included in the final analysis.

Results

Table 5: Advanced (Open) Access Scheduling (Versus Traditional Scheduling)

Outcome	Population	Measure	Studies	Result[a]	GRADE
Health service utilization	Diabetes population	Hospitalizations	1 observational study and 1 quasi-experimental study	No difference	Low
		ED visits	1 observational study	No difference	Very low
		ED/urgent care visits	1 observational study and 1 quasi-experimental study	Inconsistent findings: 1 study reported a significant reduction, while the other reported no difference	Very low
		LOS (% of patients admitted for > 3 days)	1 observational study	Significant reduction	Very low
	CHD population	Hospitalizations	1 observational study	Significant reduction	Very low
		ED visits	1 observational study	No difference	Very low
		LOS (% of patients admitted for > 3 days)	1 observational study	Significant reduction	Very low
Mortality	Not reported				
Clinical measures	Diabetes population	HbA1c, LDL-C, BP	2 observational studies and 1 quasi-experimental study	Inconsistent findings: 1 study reported inconsistent results across measures, 1 study reported significant improvements, 1 study reported no differences	Very low
	CHD population	HbA1c, LDL-C, BP	1 observational study	Inconsistent results across measures	Very low
QOL/functional status	Not reported				
Nonclinical patient outcomes	Geriatric population	Preference for advanced access scheduling over traditional scheduling	1 observational study	Slight preference for advanced access scheduling; no statistical results reported	Very low

Abbreviations: BP, blood pressure; CHD, coronary heart disease; ED, emergency department; HbA1c, hemoglobin A1c; LDL-C, low-density lipoprotein cholesterol; LOS, length of stay; QOL, quality of life.
[a]Association with advanced access.

Cost-Effectiveness

An economic evaluation of advanced access scheduling was not conducted, because no significant clinical benefit was noted for the outcomes of interest.

Conclusions

- Based on low quality evidence, implementation of advanced access scheduling was not associated with significant changes in hospitalization rates for patients with diabetes. However, based on very low quality evidence, advanced access scheduling was associated with a significant reduction in hospitalization rates for patients with coronary heart disease (CHD).
- Based on very low quality evidence, implementation of advanced access scheduling was not associated with significant changes in ED visit rates for patients with diabetes or patients with CHD.
- Based on very low quality evidence, implementation of advanced access scheduling was associated with a significant reduction in the proportion of patients with diabetes or CHD admitted to hospital whose LOS was greater than 3 days.
- There was inconsistent evidence of changes in chronic disease clinical measures (HbA1c, LDL-C, systolic blood pressure) for patients with diabetes or patients with CAD/CHD after advanced access implementation; the quality of the evidence was very low.

5. Screening and Management of Depression

Objective of Analysis

The initial objective of this review was to systematically review the literature regarding the effectiveness of screening for depression and /or anxiety in adults with chronic diseases in the community setting. However, there were no published studies that evaluated this question. As a result, a secondary, non-systematic, post-hoc analysis was conducted to evaluate whether a screen-and-treat strategy for depression was associated with an improvement in chronic disease outcomes.

Intervention

Depression is recognized by the World Health Organization as the leading cause of disability and the fourth leading contributor to the global burden of disease. (46) Projections suggest that by 2020, depression will be second only to CVD as a public health concern. (47) Despite this, depression continues to be under-recognized and undertreated. (47)

In a large prospective Canadian community-based study, (48) Patten and colleagues found an increased risk of major depression in subjects with chronic medical disorders compared to those without such disorders. The 2005 Canadian Community Health Survey, cycle 3.1, (49) measured the prevalence of comorbid mood disorders among individuals with various chronic physical conditions in Ontario. The highest prevalence was seen among those who had had a stroke (15.5%), followed by those with CVD (9.8%) and diabetes mellitus (9.3%). (49)

Screening for depression identifies patients with this condition, allowing them to access care earlier in the course of their illness. Given the higher prevalence of depression among adults with chronic diseases, a number of clinical groups have developed recommendations for screening practices, for both the general population and disease-specific groups: diabetes, COPD, stroke, and CAD.

Research Question

In a chronic disease population, is a screen-and-treat strategy for depression associated with an improvement in chronic disease outcomes?

Included Studies

A literature search was performed on January 29, 2012, that included studies published between January 1, 2007, and January 29, 2012. A 5-year interval was chosen because of recent developments and enhancements in screening tools for depression, and because of the substantial body of literature on depression management. The search was limited to RCTs, systematic reviews, and meta-analyses. Additionally, studies were limited to those that used a validated screening tool to identify patients with depression and where patients were not currently receiving treatment for depression. One reviewer screened the database (1,588 citations, with duplicates removed); 9 studies (1 systematic review, 8 RCTs) were included in the final analysis.

Results

Table 6: Interventions to Screen and Treat for Depression in Chronic Disease Populations (Versus Placebo or Usual Care)

Outcome	Population	Measure	Studies	Result[a]	GRADE
Health service utilization	Not reported				
Mortality	HF population	Mortality rate	1 RCT	No significant difference	Moderate
	CAD population	Mortality rate	2 RCTs	No significant difference	Moderate
Clinical measures	Diabetes population	HbA1c	1 RCT	No significant difference	Low
	HF population	Cardiopulmonary performance	1 RCT	No significant difference	Low
		Cardiac event rate	1 RCT	No significant difference	Moderate
	CAD population	Change in LVEF	1 RCT	No significant difference	Moderate
		ECG findings	2 RCTs	No significant difference	Low
		MI rate	3 RCTs	No significant difference	Moderate
Functional status[b]	Not reported				
Nonclinical patient outcomes	Not reported				

Abbreviations: CAD, coronary artery disease; ECG, electrocardiogram; HbA1c, hemoglobin A1c; HF, heart failure; LVEF, left ventricular ejection fraction; MI, myocardial infarction; RCT, randomized controlled trial.
[a]Association with treatment arm.
[b]Quality of life outcomes were not included in this review, as quality of life could be directly affected by treatment for depression.

Cost-Effectiveness

An economic evaluation of the screening and management of depression was not conducted, because no significant clinical benefit was noted for the outcomes of interest.

Conclusions

- Based on low quality evidence, screening and medication management of mild depression in patients with diabetes did not significantly improve blood glucose control (HbA1c).
- Based on low to moderate quality evidence, screening and medication management of depression in patients with heart failure did not significantly affect (improve or worsen) cardiac event rates or mortality (moderate quality) and did not significantly change electrocardiogram (ECG) findings (low quality).
- Based on low to moderate quality evidence, screening and medication management of depression in patients with CAD did not significantly reduce the proportion of those with reduced left ventricular ejection fraction (moderate quality) and did not significantly change ECG findings (low quality).
- Based on moderate quality evidence, screening and medication management of depression in patients with CAD appeared to have a potentially protective effect on MI rates and mortality, but the difference was not statistically significant.

6. Self-Management Support Interventions

Objective of Analysis

The objective of this analysis was to systematically assess the clinical effectiveness of self-management support interventions for persons with chronic diseases.

Intervention

In simplest terms, *self-management* describes what a person does to manage his/her disease, and *self-management support* describes what health care professionals, health care practices, and the health care system provide to assist patients in their self-management. For the purpose of this review, *self-management support* is defined in accordance with the Institute of Medicine as "the systematic provision of education and supportive interventions by health care staff to increase patients' skills and confidence in managing their health problems, including regular assessment of progress and problems, goal setting, and problem-solving support." (50)

Self-management support is more than education. One of the goals of these programs is changes in self-efficacy (i.e., an individual's confidence in managing his/her condition); changes in health care behaviour are secondary. It is believed that changes in self-efficacy directly influence health status, which in turn affects health care utilization. (51)

The Stanford Chronic Disease Self-Management Program

The Stanford Chronic Disease Self-Management Program (CDSMP) is a community-based self-management support program first described by Lorig. (51) It is based on Bandura's self-efficacy theory, a social cognitive theory that states that successful behaviour change requires confidence in one's ability to carry out an action (i.e., self-efficacy) and the expectation that a specific goal will be achieved (i.e., outcome expectancy). The CDSMP incorporates strategies suggested by Bandura to enhance self-efficacy.

The exact methodology of the CDSMP differs depending on how it is implemented, but the program typically consists of 6 weekly sessions of 2.5 hours each. Sessions involve groups of 10 to 15 participants and are often conducted in community settings such as churches, senior's centres, libraries, or hospitals. Sessions are led by 2 trained volunteer laypersons (typically with chronic diseases themselves) who act more as facilitators rather than as lecturers. Rather than prescribing specific behaviour changes, leaders assist participants in making their own disease management choices to reach self-selected goals. (51)

Topics covered in the CDSMP include exercise; use of cognitive symptom management (cognitive stress/pain-reduction techniques such as positive thinking or progressive muscle relaxation); use of community resources; use of medications; dealing with emotions of fear, anger, and depression; communication with others, including health professionals; problem-solving; and decision-making. (51) Exact content, however, may vary depending on how the CDSMP is implemented or adapted. Licensing and training are required in order for external organizations to implement the CDSMP.

Research Question

What is the effectiveness of self-management support interventions for persons with chronic disease compared to usual care?

Included Studies

A literature search was performed on January 15, 2012, that included studies published between January 1, 2000, and January 15, 2012. A January 1, 2000, start date was used because the concept of non–disease-specific/general chronic disease self-management was refined and first published only in 1999. The search was limited to RCTs, systematic reviews, and meta-analyses. Additionally, because of the wide range of literature on disease-specific self-management programs, this review was limited to the general chronic disease population and patients with multiple chronic conditions (assessed subjectively). One reviewer screened the database (6,147 citations, with duplicates removed); 20 studies (1 systematic review, 10 primary RCTs, and 9 secondary analyses of RCTs) were included in the final analysis.

Results

Table 7: Interventions to Improve Self-Management (Versus Usual Care)

Outcome	Population	Measure	Studies	Result[a]	GRADE
Health service utilization	General chronic disease population	Hospitalizations	2 RCTs	Nonsignificant reduction	Very low
		ED visits	4 RCTs	Nonsignificant reduction	Very low
		Days in hospital	5 RCTs	Nonsignificant reduction	Very low
		GP visits	6 RCTs	Nonsignificant reduction	Very low
Mortality		Not reported			
Clinical measures		Pain, disability, fatigue, depression, health distress, self-rated health	4–6 RCTs (depending on outcome)	Significant improvements	Low
		Dyspnea	4 (RCTs)	Nonsignificant reduction	Very low
QOL/functional status		HRQOL	2 RCTs	Significant improvement	Moderate
Nonclinical patient outcomes		Self-efficacy	6 RCTs	Significant improvement	Low
		Health behaviours	3–6 RCTs (depending on outcome)	Significant improvements in exercise tolerance, cognitive symptom management, and communication with health professionals	Low

Abbreviations: ED, emergency department; GP, general practitioner; HRQOL, health-related quality of life; QOL, quality of life; RCT, randomized controlled trial.
[a]Association with treatment arm.

Cost-Effectiveness

An economic evaluation of self-management support interventions was not conducted, because the intervention was evaluated in a multimorbid population and not in 1 of the cohorts for which economic models were developed.

Conclusions

- Based on low quality evidence, the Stanford CDSMP led to statistically significant, albeit clinically minimal, short-term (median 6 months) improvements across a number of health status measures, in healthy behaviours, and self-efficacy compared to usual care.
- Based on very low quality evidence, there was no significant difference between the CDSMP and usual care in short-term (median 6 months) health care utilization and across some HRQOL scales.
- Based on moderate quality evidence, the Stanford CDSMP led to statistically significant, albeit clinically minimal, short-term (median 6 months) improvement in EQ-5D score compared to usual care.
- More research is needed to explore the long-term (12 months and greater) effect of self-management support interventions across outcomes and to explore the impact of self-management support interventions on clinical outcomes.
- Exploratory evidence suggests that some subgroups of persons with chronic conditions may respond better to the CDSMP; however, there is considerable uncertainty, and more research is needed to better identify responders and nonresponders.

7. Specialized Nursing Practice

Objective of Analysis

The objective of this review was to determine the effectiveness of specialized nurses who have a clinical role in patient care in optimizing chronic disease management among adults in the primary health care setting.

Intervention

There is considerable variation between and within countries regarding the specific job title, education, and experience of nurses. For the purposes of this review, *specialized nursing practice* is used to define nurses with enhanced training, experience, and/or scope of clinical practice, or nurses with a primary clinical role in the care of patients with chronic disease. This includes advanced practice nurses, nurse diabetes educators, respiratory nurse specialists, cardiac nurse specialists, or geriatric nurse specialists.

In Ontario, registered nurses receive training at the baccalaureate level. (52) The Canadian Nursing Association defines specialization in nursing as "a focus on 1 field of nursing practice or health care that encompasses a level of knowledge and skill in a particular aspect of nursing greater than that acquired during basic nursing education." (53) Additionally, there are 2 types of advanced practice nurses—clinical nurse specialists and nurse practitioners—who have an advanced level of clinical nursing practice based on graduate education preparation, as well as in-depth knowledge and expertise in meeting the health care needs of individuals, families, groups, communities, and populations. (54) Clinical nurse specialists are registered nurses who receive additional training with a Master's in a clinical nursing speciality. Nurse practitioners are defined as "registered nurses with additional educational preparation and experience who possess and demonstrate the competencies to autonomously diagnose, order and interpret diagnostic tests, prescribe pharmaceuticals, and perform specific procedures within their legislated scope of practice."

Specialized nurses can supplement or substitute aspects of care provided by physicians in the primary health care setting. When substituting care, specialized nurses provide the same services as physicians, with the intent of reducing physician workload and improving health care efficiency. Supplementation refers to specialized nurses providing services that may extend or complement care provided by the physicians, thereby improving patient quality of care and outcomes.

This review of specialized nursing looked at 2 models of nursing care. Model 1 compared the effectiveness of specialized nurses working independently (alone) versus primary care physicians. This model was evaluated based on comparable outcomes between nurses and physicians (usual care); it aims to improve efficiency by directly substituting a specialized nurse in the role of the physician. In Model 2, specialized nurses worked in teams with physicians compared to physicians alone or usual care. This model was evaluated based on increased effectiveness or improved health care efficiency with the addition of specialized nurses to the primary care team.

Research Question

What is the effectiveness of specialized nursing practice in comparison to usual care in improving patient outcomes and health system efficiencies for chronic disease management in the primary health care setting?

Included Studies

A literature search was performed on May 3, 2012, that included studies published up to May 3, 2012. The search was limited to RCTs and systematic reviews. Additionally, studies were limited to those that evaluated specialized nurses performing a clinical role in patient care in community-based primary care settings. One reviewer screened the database (3,252 citations, with duplicates removed); 8 studies (7 RCTs and 1 sub-group analysis of an RCT) were included in the final analysis.

Results

Table 8: Specialized Nursing Care, Model 1 (Versus Physician Care)

Outcome	Population	Measure	Studies	Result	GRADE
Health service utilization	General population	Hospitalizations, ED visits, specialist visits, primary care visits	1 RCT	No significant differences between arms	Moderate
	Diabetes population (subgroup of above study)	Hospitalizations, ED visits, specialist visits, primary care visits	1 RCT (subgroup)	No significant differences between arms	Very low
Mortality	Not reported				
Clinical measures	General population	BP, peak flow (oxygen)	1 RCT	No significant difference in peak flow or SBP; significant reduction in DBP	Very low
	Diabetes population (subgroup of above study)	HbA1c	1 RCT (subgroup)	No significant difference between arms	Very low
QOL/functional status	General population	SF-36	1 RCT	No significant difference between arms	Moderate
	Diabetes population (subgroup of above study)	SF-36	1 RCT (subgroup)	No significant difference between arms	Very low
Nonclinical patient outcomes	Not reported				

Abbreviations: BP, blood pressure; DBP, diastolic blood pressure; ED, emergency department; HbA1c, hemoglobin A1c; QOL, quality of life; RCT, randomized controlled trial; SBP, systolic blood pressure; SF-36, Short-Form (36) Health Survey.

Table 9: Specialized Nursing Care Plus Physician Care, Model 2 (Versus Physician Care Alone or Usual Care)

Outcome	Population	Measure	Studies	Result[a]	GRADE
Health service utilization	Diabetes population	Number of visits	1 RCT	Significant increase	Low
	CAD population	Hospitalizations (all-cause)	1 RCT	Significant decrease	Low
		LOS	1 RCT	No difference	Low
Mortality	Not reported				
Clinical measures	Diabetes population	HbA1c	1 RCT	Significant decrease	Moderate
		% of patients below target (HbA1c, BP, cholesterol)	2 RCTs	No difference	Low
	CAD population	% of patients below target (BP, cholesterol)	1 RCT	Significant increase	Moderate
		% of patients with improved lifestyle control (physical activity, low-fat diet)	1 RCT	Significant increase	Low
		% of patients who stopped smoking	1 RCT	No difference	Low
QOL/functional status	Diabetes population	HRQOL	2 RCTs	Inconclusive; inconsistent findings across studies	Low
	CAD population	HRQOL	2 RCTs	Inconclusive; inconsistent findings across studies, but significant improvement in a number of subscales	Moderate
Nonclinical patient outcomes	Diabetes population	Patient satisfaction	1 RCT	Significant increase	Moderate

Abbreviations: BP, blood pressure; CAD, coronary artery disease; HbA1c, hemoglobin A1c; HRQOL, health-related quality of life; LOS, length of stay; QOL, quality of life; RCT, randomized controlled trial.
[a]Association with nursing arm.

The report also included a summary of the effect of specialized nursing care (Models 1 and 2) on processes of care; there was little to no impact (positive or negative) on efficiency.

Cost-Effectiveness

The review of specialized nursing alone (Model 1) found the intervention to be associated with significant clinical benefit in patients with diabetes. An evaluation of the cost-effectiveness of the intervention in a diabetes cohort found that specialized nursing alone (Model 1) for chronic disease management was dominant compared to usual care.

The review of specialized nursing plus physicians (Model 2) found the intervention to be associated with significant clinical benefit in patients with diabetes and CAD. An evaluation of the cost-effectiveness of the intervention found that specialized nursing plus physicians (Model 2) for chronic disease management was dominant compared to usual care.

Conclusions

Model 1: Specialized Nursing Care Versus Physician Care

- Based on moderate quality evidence, there was no significant difference among patients receiving primary health care from nurse practitioners (NPs) in comparison to physicians alone for health resource utilization, including hospitalizations, ED or urgent care visits, specialist visits, or primary care visits.
- Based on moderate quality evidence, there was no significant difference among patients receiving primary health care from NPs in comparison to physicians alone for HRQOL (SF-36) or patient satisfaction.
- Based on very low quality evidence, there was no significant difference among diabetes patients receiving primary health care from NPs in comparison to physicians alone for health resource utilization, including hospitalizations, ED or urgent care visits, specialist visits, or primary care visits.
- Based on very low quality evidence, there was no significant difference among diabetes patients receiving primary health care from NPs in comparison to physicians alone for blood glucose control (HbA1c).
- Results from the EBA found specialized nurses providing autonomous patient care to a primary health care population oversampled with chronic disease demonstrated comparable outcomes to physician care alone. Outcomes were similarly comparable among the subgroup of patients with diabetes. Specialized nurses in this model most closely resemble NPs in the Ontario context.

Model 2: Specialized Nursing Care Plus Physician Care Versus Physician Care Alone

- Based on low quality evidence in a diabetes population, specialized nurses plus physicians in comparison to usual care were associated with a significant increase in the number of visits to primary health care.
- Based on low quality evidence in a CAD population, specialized nurses plus physicians in comparison to usual care were associated with a significant reduction in all-cause hospitalizations, but no difference in length of hospital stay.
- Based on moderate quality evidence, specialized nurses plus physicians in comparison to usual care were associated with a significantly higher proportion of patients achieving threshold blood pressure and/or cholesterol levels (CAD/CVD population) and significantly lower HbA1c (diabetes population).
- Based on moderate quality evidence in a CAD or congestive heart failure population, specialized nurses plus physicians in comparison to usual care were associated with a significantly higher proportion of patients with appropriate blood pressure and/or cholesterol management as well as a significant increase in the number of clinical examinations for blood pressure, body mass index and smoking status, but no difference in cholesterol examinations. There was also a significant increase in the number of echocardiography assessments for confirmation of heart failure among unconfirmed cases and a significant increase in the number of MI patients who were prescribed beta blockers but no difference in the number of prescriptions for angiotensin-converting enzyme inhibitors.
- Based on low quality evidence, CAD patients receiving care in Model 2 versus usual care were also significantly more likely to achieve lifestyle control related to physical activity and a low-fat diet, but there was no difference between the intervention and control arms in the proportion of patients who were nonsmokers.
- Based on moderate quality evidence in a diabetes population, specialized nurses plus physicians in comparison to usual care were associated with a significantly higher proportion of patients

receiving foot examinations and intensification of drug therapy among patients with uncontrolled HbA1c or uncontrolled blood pressure, but no difference in intensification of therapy for patients with uncontrolled cholesterol levels.

- Based on moderate quality evidence in a diabetes population, specialized nurses plus physicians in comparison to usual care were associated with significantly greater patient satisfaction.
- Based on low quality evidence, there was no difference between specialized nurses plus physicians and usual care for number of physician consultations or objective and subjective physician workload.
- Based on moderate to low quality evidence, for most QOL measures and populations, the findings were inconsistent or indeterminate when comparing specialized nurses plus physicians and usual care.

8. Electronic Tools for Health Information Exchange

Objective of Analysis

The objective of this analysis was to examine the impact of eTools for health information exchange in the context of care coordination for individuals with chronic disease in the community.

Intervention

Care coordination is increasingly being conducted using computer-based programs to facilitate information transfer and shared care. (55) There are a number of perceived potential benefits to this approach, including improved provider communication and coordination as a result of standardized documentation, and speed of availability. (56;57) However, some health care providers are hesitant to adopt computer-assisted management; reasons for concern include security and privacy issues, depersonalization of care, and the up-front costs of incorporating an electronic system. (58)

The use of eTools for health information exchange ranges from a single point of information exchange between 2 health care providers to real-time complete sharing of patient electronic medical records between everyone involved in a patient's care. The benefit of this kind of use of eTools is that it allows for information to be shared in an accurate and timely manner with laboratories, pharmacies, and health care providers as patients transition between providers and care settings. Electronic tools can improve informational continuity and facilitate care coordination.

The adoption of electronic medical and health records has been steadily on the rise. One study of use in general practices across 10 countries (8 European nations, Australia, and New Zealand) found that nearly all physicians in these countries had computers (90% to 100%). Overall, the most common application was medication prescribing and monitoring, whether or not it was a mandated component of government regulations. (59)

Research Questions

What is the impact of eTools for health information exchange on patient outcomes and health services utilization when used to improve the care coordination of adults with chronic disease? What specifications of eTools contribute to their effectiveness?

Included Studies

A literature search was performed on April 26, 2012, that included studies published before this date. The search excluded studies where eTools facilitated communication between providers and patients or patient self-monitoring devices and studies that focused on eTools to facilitate improved management of care within a single-provider practice. One reviewer screened the database (2,723 citations, with duplicates removed); 11 studies (4 RCTs and 7 observational studies) were included in the final analysis.

Results

Table 10: eTools to Improve Health Information Exchange (Versus Usual Care)

Outcome	Population	Measure	Studies	Result	GRADE
Health service utilization	Diabetes population	Hospitalizations	1 RCT	Significant reduction	Moderate
		ED visits	1 RCT	Significant reduction	Moderate
		LOS, days	1 RCT	Significant reduction	Moderate
	General population (discharged from hospital)	Rate of readmission	1 RCT	No difference	High
Mortality	Not reported				
Clinical measures	Diabetes population	Change in HbA1c	1 RCT, 1 observational study	No difference	Low to very low
		BP	1 RCT	No difference	Low
		Lipid levels	2 RCTs	No difference	Low
	General population (discharged from hospital)	Adverse event rate	1 RCT	No difference	High
QOL/functional status	Not reported				
Nonclinical patient outcomes	Not reported				

Abbreviations: BP, blood pressure; ED, emergency department; eTool, electronic tool; HbA1c, hemoglobin A1c; LOS, length of stay; QOL, quality of life; RCT, randomized controlled trial.

All process-of-care measures reported were related to the frequency with which certain tests or examinations were conducted (or recorded). Results for this group of outcomes were inconclusive, and in general the quality of the evidence was very low. Additionally, there was no observed trend of an impact based on the disease-specific groupings of patients, the care coordination aspect targeted, or the technology applied.

With respect to measures of efficiency, there was evidence that electronic discharge summaries were received in as timely a manner as paper-based discharge summaries (i.e., electronic communication did not affect the time to receipt). While there were some significant increases in time spent with patients and communication from consultants to general practitioners, the interpretation of these effects was unclear. Overall, the evidence did not demonstrate improved efficiency; generally the quality of evidence was very low, although a few outcomes were associated with moderate to high quality evidence.

Cost-Effectiveness

The review of electronic tools for health information exchange found the intervention to be associated with significant clinical benefit in patients with diabetes. An evaluation of the cost-effectiveness of the intervention in a diabetes cohort found it to be dominant compared to usual care.

Conclusions

- Based on moderate quality evidence, when an automated laboratory results report with clinical alerts mapped to guidelines was shared with primary care, there was evidence of a significant reduction in hospitalization rates, ED visits, and hospital LOS.
- Based on high to very low quality evidence, the implementation of eTools for health information exchange did not result in improvements in clinical measures, including adverse event rates (high quality evidence), blood pressure levels (low quality evidence), lipid levels (low quality evidence), or HbA1c levels (very low quality evidence). The evidence was inconclusive about the impact of eTools on achievement of threshold levels for clinical measures such as body mass index, lipids, HbA1c, and smoking status.
- Based on low to very low quality evidence, eTools for health information exchange had a variable impact on process-of-care measures. There was no trend for any specific disease, technology, or care coordination aspect examined.
  - There was low to very low quality evidence of a significant improvement in number of foot examinations, fructosamine tests, weight and height measurements, blood pressure examinations, vaccinations and immunizations, eye examinations, and medication management of beta-blockers.
  - There was moderate to very low quality evidence of no difference in changes in statin prescriptions, blood glucose tests, lipid tests, or medication management of a variety of cardiac drugs.
  - There was inconclusive evidence (low to very low quality) of an impact on kidney management, behavioural interventions, and composite outcomes of processes of care.
- Based on high to very low quality evidence, there was no improved efficiency for care providers following the implementation of eTools for health information exchange, including no difference in the proportion of primary care physicians receiving discharge summaries using electronic transfer versus paper transfer (high quality evidence) and no evidence of increased efficiencies related to time or communication (moderate to very low quality evidence).
- The findings from this EBA call into question the ability of eTools to independently improve the quality of outpatient care coordination. Although automation is intended to facilitate consistency in application and measurement, eTools may not be able to overcome underlying process inefficiencies.

9. Health Technologies

Objective of Analysis

The purpose of this review was to identify health technologies evaluated by the Medical Advisory Secretariat between 2006 and 2011 that can effectively improve the management of chronic disease in the community.

Selection of Evidence-Based Analyses

Inclusion Criteria

A review was conducted of *Ontario Health Technology Assessment Series* reports published between January 1, 2006, and December 31, 2011. (60) Field evaluations conducted by the Programs for Assessment of Technologies in Health and the Toronto Health Economics and Technology Assessment Collaborative were also reviewed. (61;61) EBAs were independently reviewed to identify health technologies that aligned with the objective of improving chronic disease management, with a focus on those in the 7 areas of interest (type 2 diabetes, CAD, atrial fibrillation, COPD, congestive heart failure, stroke, and chronic wounds).

EBAs were initially selected based on information in the title and executive summary. The full texts of potentially relevant analyses were then reviewed. Analyses of technologies that led to statistically or clinically significant improvement on chronic disease management (with moderate to high quality evidence for at least 1 of the primary outcomes based on the reported GRADE), or that were cost-effective, were included.

Exclusion Criteria

Analyses related to the screening or monitoring of disease were excluded. Analyses related to multidisciplinary care, rehabilitation programs, and self-management were excluded, because they are discussed as part of the Optimizing Chronic Disease Management in the Community (Outpatient) Setting mega-analysis or other recently completed mega-analyses (specialized community-based care and COPD).

Included Studies

The search yielded 97 publications completed between January 1, 2006, and December 31, 2011. A total of 9 health technologies were identified for review. Additionally, 1 health technology assessment evaluating photoselective vaporization of the prostate was included based on the results of an ongoing field evaluation, which demonstrated a significant reduction in hospitalizations and associated cost savings. As well, 1 EBA evaluating implantable cardioverter defibrillators from 2005 was included due to ongoing data collection resulting from an OHTAC recommendation.

Results

The review of previous EBAs identified a number of technologies that can be incorporated into chronic disease management to prevent, cure, and treat chronic diseases (see Table 11).

Table 11: Summary of Results from Evidence-Based Analyses

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
Technologies for the *Cure* of Disease							
Diabetes	Bariatric surgery for people with diabetes and morbid obesity	—	—	—	—	Resolution of diabetes (76.8%; 95% CI 70.7–82.9) *GRADE: Moderate* Clinically significant reduction in HbA1c (–2.7%; range –5.0 to –0.70) *GRADE: Moderate*	ICER: $15,697/QALY *Complications avoided* Heart disease: 2,757 MI: 13,839 HF: 31,137 Stroke: 8,957 Amputation: 2,997 Blindness: 4,179 Renal failure: 17
Atrial Fibrillation	First-line treatment of ablation for AF of flutter (vs. drug therapy)	—	—	—	Significant improvement *GRADE: NR*	Significant freedom from arrhythmia (RR 0.24; 95% CI 0.09–0.59) *GRADE: Moderate*	Annual cost savings per patient starting from 4.5 years post-ablation forward
	Ablation for drug-refractory AF when no other heart surgery required (vs. drug therapy)	—	—	—	Significant improvement ($P < 0.05$) *GRADE: NR*	Significant freedom from arrhythmia (RR 0.32; 95% CI 0.21–0.43) *GRADE: Moderate*	—
	Ablation for drug-refractory AF when additional heart surgery required (vs. heart surgery alone)	—	—	—	No difference *GRADE: NR*	Significant freedom from arrhythmia (range RR 0.13–0.53) *GRADE: Moderate–High*	—
Technologies for the *Prevention* of Disease							
Chronic Wounds	Alternative foam mattresses (vs. standard mattresses)	—	—	—	—	Significant prevention of pressure ulcers (RR 0.31; 95% CI 0.21–0.46) *GRADE: Moderate*	ICER: $6,328/QALY (in LTC) Annual pressure ulcer–related cost savings: $17.3 million Pressure ulcer cases averted: 2,984
	Repositioning every 4 hours plus a alternative foam mattress (vs. 2–3 h)	—	—	—	—	Significant prevention of pressure ulcers (RR 0.70; 95% CI 0.52–0.93) *GRADE: Low*	ICER: $5,234/QALY (in LTC) (Dominant when also assuming a reduction in personal support worker time) Annual pressure ulcer–related cost savings: $19.7 million Pressure ulcer cases averted: 3,381 Projected 47% reduction in pressure ulcer–related deaths over 5 years

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
	Dry vesico-elastic polymer pad (gel pad) (vs. standard mattress)	—	—	—	—	Significant prevention of pressure ulcers for surgeries > 90 minutes (RR 0.53; 95% CI 0.33–0.85) *GRADE: Low*	ICER: Dominant (in operating room) Annual pressure ulcer–related cost savings: $26 million–$29 million Pressure ulcer cases avoided: 4,233-4,868 Projected no change in absolute life expectancy
Technologies for the *Management* of Disease							
Coronary Artery Disease	Primary PCI (vs. in-hospital thrombolysis)	No difference (OR 0.87; 95% CI 0.61–1.24) *GRADE: Moderate*	—	—	—	Significant reduction in composite outcome of mortality, reinfarction, and stroke (OR 0.56; 95% CI 0.42–0.75) *GRADE: Moderate*	Cost savings per capita: $2,820–$5,259
	Routine early PCI (vs. thrombolysis and rescue PCI as needed)	No difference (OR 0.73; 95% CI 0.47–1.14) *GRADE: Moderate*	—	—	—	Significant reduction in composite outcome of mortality, reinfarction, and stroke (OR 0.64; 95% CI 0.49–0.83) *GRADE: Moderate*	—
Chronic Obstructive Pulmonary Disease	Influenza vaccination[b] (vs. no vaccination)	—	—	No difference (RR 0.41; 95% CI 0.08–2.02) *GRADE: Low*	—	Significant reduction in ARI (RR 0.2; 95% CI 0.06–0.70) *GRADE: High* No difference in mechanical ventilation (RR 0.15; 95% CI 0.01–2.75) *GRADE: Low*	—
	Pneumococcal vaccination[b] (vs. no vaccination)	No difference *GRADE: NR*	No difference (P = 0.16) *GRADE: NR*	No difference (P = 0.59) *GRADE: Low*	—	Significant 1.7% reduction in pneumococcal pneumonia (P = 0.025) *GRADE: High* Significant reduction in CAP among < 65 years (RR 0.24; 95% CI 0.07–0.80) *GRADE: NR*	—
	Smoking cessation[b] strategies, including a combination of counselling, NRT, and antidepressants (vs. usual care or placebo)	—	—	—	—	Significant improvement in prolonged smoking abstinence (range RR 2.01–7.70, depending on intervention) *GRADE: Moderate*	ICER: Dominant for all cessation strategies modelled Budget impact for Ontario to fund NRT: $10.4 million

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
	NPPV + usual care (vs. usual care)	Significant reduction (RR 0.53; 95% CI 0.35–0.81) *GRADE: Moderate*	Significant reduction (WMD –2.68; 95% CI –4.41 to –0.94) *GRADE: Moderate*	—	No significant difference in quality of sleep and general well-being *GRADE: NR*	Significant reduction in endotracheal intubation (RR 0.38 (95% CI 0.28–0.50) *GRADE: Moderate* Fewer complications *GRADE: Low*	ICER: Dominant Cost savings to Ontario from hospital perspective: $42 million
	Weaning from IMV using NPPV (vs. IMV)	Significant reduction (RR 0.47; 95% CI 0.23–0.97) *GRADE: Moderate*	No difference (WMD –5.21; 95% CI –11.60 to 1.18) *GRADE: Low*	—	Poor sleep quality in NPPV group *GRADE: NR*	No difference in duration of mechanical ventilation (WMD –3.55; 95% CI –8.55 to 1.44) *GRADE: Low* Significant reduction in weaning failure *GRADE: Moderate* Significant reduction in nosocomial pneumonia (RR 0.14; 95% CI 0.03–0.71) *GRADE: Moderate*	ICER: Dominant Cost savings to Ontario from hospital perspective: $12 million
Congestive Heart Failure	ICD (vs. conventional therapy)	Significant reduction (range HR 0.46–0.77) *GRADE: Low–Moderate*	—	—	—	—	ICER: $34,000/QALY–$70,200/QALY (US) Total cost: $156 million–$770 million
Stroke	CIMT (vs. usual care)	—	—	—	No difference in HRQOL *GRADE: Very low* No difference in functional status *GRADE: Low* Significantly improved perceived arm motor function, quality of use (MD 0.97; 95% CI 0.7–1.3) and amount of use (MD 1.1; 95% CI 0.6–1.7) *GRADE: Low*	Significant improvement in measured arm motor function (ARAT MD 13.6; 95% CI 8.7–18.6) and decreased impairment (FMA MD 6.5; 95% CI 2.3–10.7) *GRADE: Low–Moderate*	Average annual implementation cost: $0.46 million–$0.97 million
Chronic Wounds	NPWT (vs. usual care)	—	Significant reduction of 3.5 days among patients with a skin graft (P = 0.01) *GRADE: NR*	—	First week: lower (P = 0.031) End of study: no difference *GRADE: NR*	Significantly greater proportion of complete wound closure (P < 0.05) *GRADE: Moderate* Significantly greater graft survival (P = 0.01) and less graft loss (P < 0.001) *GRADE: NR*	Annual cost savings: $1,571 (US) —$12,852 (US), per patient

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
Benign Prostatic Hyperplasia	PVP (vs. TURP)	—	Significant reduction (PVP 2 days, TURP 2.5 days)	Significant reduction (PVP 7.1%, TURP 100%)	No difference	No difference	ICER: dominant Annual cost savings: $6 million Hospitalizations avoided: 4,644 hospital admissions, 11,790 bed days

Abbreviations: AF, atrial fibrillation; ARAT, action research arm test; ARI, acute respiratory illness; CAP, community-acquired pneumonia; CI, confidence interval; CIMT, constraint-induced movement therapy; COPD, chronic obstructive pulmonary disease; FMA, Fugl-Meyer motor assessment; HR, hazard ratio; HbA1c, hemoglobin A1c; HF, heart failure; HRQOL, health-related quality of life; ICD, implantable cardioverter defibrillator; ICER, incremental cost-effectiveness ratio; IMV, invasive mechanical ventilation; LOS, length of stay; LTC, long-term care; MD, mean difference; MI, myocardial infarction; NPPV, noninvasive positive pressure ventilation; NPWT, negative pressure wound therapy; NR, not reported; NRT, nicotine replacement therapy; OR, odds ratio; PCI, percutaneous coronary intervention; PVP, photoselective vaporization of the prostate; QALY, quality-adjusted life-year; RR, relative risk; TURP, transurethral resection of the prostate; WMD, weighted mean difference.
[a]All costs in Canadian dollars unless otherwise stated.
[b]Manages COPD by preventing potentially complex adverse events.

Conclusions

- The impact of new health technologies used in chronic disease management to optimize patient outcomes and hospitalization rates is often overlooked. Based on high to moderate quality evidence, this analysis demonstrates that health technologies can:
  - reduce the burden of illness and improve patient outcomes
  - reduce resource utilization intensity, and are often cost-effective
  - be a viable contributing factor to chronic disease management in the community

10. Aging in the Community

Early on, a gap in the evidence reviews was identified: the lack of evidence for interventions that could reduce admissions to LTC facilities. The Medical Advisory Secretariat completed a review in 2008 titled *Aging in the Community* that addressed this gap. (62)

Objective of the Review

To identify interventions (e.g., devices and programs) that are effective at enabling seniors to live healthfully and independently in the community.

Research Questions

What are the main *modifiable* predictors of admission to an LTC home in Ontario? What interventions (e.g., devices and programs) are effective at targeting these predictors, and thus potentially delaying the transition from community-based living to LTC home admission?

Methods

Based on a literature review of the predictors of LTC admission as well as consultations with experts, 4 key predictors were identified for further research:

- falls and fall-related injuries
- urinary incontinence
- dementia
- social isolation

Interventions to address each predictor were evaluated to identify effective means of addressing these factors. Table 12 provides a summary of the results and the GRADE quality of evidence.

Table 12: Summary of Results from Aging in the Community Review

Intervention	Target Population[a] (Ontario)	Risk Estimate (95% CI)	Staffing Requirement	GRADE
Falls and fall-related injuries Community exercise programs—untargeted, long duration	Mobile seniors N = 476,992	RR = 0.76 (0.64–0.91)	PT	Moderate
Social isolation Community exercise and education programs	Mobile seniors N = 476,992	Mean loneliness score change = 0.3 ($P < 0.01$) Activity change score = 2.0 ($P < 0.01$)	RT, OT, or PT	Moderate
Urinary incontinence Patient-directed behavioural techniques (PFMT only) (home and clinic)	Seniors with urinary incontinence N = 196,011	Number of incontinent episodes per week: WMD = 10.50 (4.30–16.70)	PT	Moderate
Dementia Patient-directed exercise program (in-home visit)	Seniors with mild/moderate dementia N = 38,696	Effect size = 0.62 (0.55–0.70)	OT, PT, PSW, or RT	Moderate
Falls and fall-related injuries Environmental modifications (high-risk elderly)	High-risk elderly N = 271,980	RR = 0.66 (0.54–0.81)	OT	High
Falls and fall-related injuries Vitamin D + calcium supplementation	Women at risk for osteopenia N = 477,662	RR = 0.83 (0.73–0.95)	None	Moderate
Urinary incontinence Patient-directed multicomponent behavioural techniques[b]	Mobile, motivated seniors with urinary incontinence N = 196,011	Number of incontinent episodes per week: WMD = 3.63 (2.07–5.19)	NCA	Moderate
Dementia Caregiver-directed behavioural techniques	Caregivers of seniors with dementia N = 56,629	Not estimable	OT or nurse	Moderate
Dementia Caregiver- and patient-directed behavioural techniques	Seniors with dementia and their caregivers N = 56,629	Caregiver burden: NNT = 2.5 (2.3–2.7) Patient (motor/process skills): NNT = 1.3 (1.2–1.4) Patient (deterioration in ADLs): NNT = 1.5 (1.4–1.6)	OT or nurse	Moderate

Abbreviations: ADL, activity of daily living; OT, occupational therapist; PT, physiotherapist; NCA, nurse continence advisor; NNT, number needed to treat; PFMT, pelvic floor muscle training; PSW, personal support worker; RR, relative risk; RT, recreational therapist; WMD, weighted mean difference.
[a]Population adjusted for percentage willing to participate as derived in individual systematic reviews.
[b]Includes a combination of bladder training techniques, pelvic floor muscle training (± biofeedback), education on bladder control strategies, self-monitoring.

Conclusions

- Based on moderate to high quality evidence, interventions that treat or reduce the risk of falls, urinary incontinence, dementia, or social isolation can improve health outcomes in the community-dwelling elderly.
- Based on moderate to high quality evidence, regular exercise can significantly improve health outcomes in the community-dwelling elderly through the primary or secondary prevention of falls, urinary incontinence (using pelvic floor muscle training), dementia, and social isolation.

OHTAC Recommendations

General Recommendations

Exercise Interventions

- The province should engage in high-profile health promotion activities to encourage regular exercise for the community-dwelling elderly.
- The province should build on existing strategies and adopt new innovative strategies that promote ease of access to exercise/exercise programs for the community-dwelling elderly.

Caregiver-Directed Programs

- Given the key role that caregivers play in sustaining elderly living in the community, education, support, and relief programs for caregivers should be a priority.

Falls and Fall-Related Injuries

- In addition to exercise, the following interventions should be made available to or promoted for use by the community-dwelling elderly:
  - environmental modifications in high-risk populations
  - vitamin D + calcium supplementation in women
  - use of gait-stabilizing devices outdoors in the mobile elderly

Urinary Incontinence

- The province should consider increasing access to nurse continence advisors, possibly through multimodal community-based clinics that offer multicomponent (including pelvic floor muscle training) behavioural interventions.

Dementia

In addition to exercise for the primary and secondary prevention of dementia, the following interventions should be made available for community-dwelling elderly and their caregivers:

- behavioural management interventions: interventions designed to help the caregiver manage the behavioural and psychological symptoms of dementia (i.e., agitation, depression, anxiety, sleep disorders
- multicomponent interventions: interventions encompassing ≥ 2 supportive interventions that address the complex needs of caregivers (i.e., education + counselling + behavioural management)

Social Isolation

- Community-based exercise programs combined with informal opportunities to share information should be made available for the community-dwelling elderly.

Qualitative Meta-Syntheses

Four qualitative reports focused on patient-centredness and vulnerability provided additional context to the reviews and synthesis. This section provides a summary of the findings for each report. For complete descriptions of methods and results, please refer to the individual reports.

How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease

This report synthesized the qualitative evidence on the diet modification challenges faced by patients with diabetes and/or heart disease. It also compared the challenges faced by patients who are members of vulnerable and nonvulnerable groups. The review included 65 primary qualitative studies.

Five challenges were identified that are common to all patients making dietary modifications: self-discipline, knowledge, coping with every day stress, negotiating with family members, and managing the social significance of food. In vulnerable populations (e.g., ethnic minorities, those who do not speak English as a first language, those with less educational attainment or lower incomes, and patients from underserviced or rural areas), such challenges are often magnified by other issues, such as difficulty reading or understanding labelling, limited access to healthy foods, or cultural expectations related to food.

This review has implications for the analysis of self-management support interventions and the implementation of self-management programs. It suggests that for programs to be effective, they should take into consideration the challenges faced by specific subpopulations and offer flexible solutions for these groups.

Chronic Disease Patients' Experiences With Accessing Health Care in Rural and Remote Areas

This report synthesized qualitative research on the advantages and disadvantage rural patients with chronic diseases face when accessing both rural and distant health care. The review included 12 primary qualitative studies.

Three major themes emerged: geography, availability of health care providers, and rural culture. Geography was associated with barriers to access such as distance, isolation, weather, and transportation. The studies suggest that rurally located services can mitigate these issues and improve access to health care professionals. A lack of access to locally situated primary and specialty services can leave patients feeling powerless. Additional cultural or educational barriers can exacerbate these feelings; for patients who have to travel for care, the attitudes of urban providers may leave them feeling like "country bumpkins," increasing patients' reluctance to seek distant care. Rural patients appreciated long-term relationships with health care providers that were personalized by familiarity; this was more consistent with locally provided care. A culture of self-reliance and community belonging in rural areas meant patients were further inclined to go without care.

This review has implications for the analyses of continuity of care, advanced access, and specialized nursing practice. The primary implications stem from rural patients' perspectives on the health system, identification of health system structural problems (such as referral processes), and cultural aspects of health care access in both rural and urban settings.

Patient Experiences of Depression and Anxiety With Chronic Disease

This review examined the empirical qualitative research on the experiences of patients with chronic disease and comorbid depression or anxiety and highlighted the implications of screening on the management of anxiety and/or depression. The review included 20 primary qualitative studies.

Patients experience chronic disease and anxiety or depression as either 2 coincidental, but independent issues, or as interrelated conditions (either the chronic condition led to depression, or vice versa, or both). The overlap of symptoms has implications for identifying depression/anxiety and management, either by clinicians or by patients. This sometimes has the perverse effect of "normalizing" the depression symptoms by making them part of the chronic disease (e.g., sleeplessness, lack of appetite). Additionally, patients can experience uncertainty and anxiety about the future, loss of self, feelings of social isolation, and loss of relationships as a result of a chronic disease diagnosis, which may precipitate at least a temporary depression. Some patients also feel a sense of guilt for behaviours that may have led to the development of a chronic disease (e.g., lack of activity or smoking). For some chronic diseases, the relationship with depression/anxiety is cyclical; for example, patients with COPD who experience acute exacerbations may also have associated exacerbations of anxiety or depression with the fear of worsening disease.

This review has implications for the analysis of depression screening and supports the recommendation that physicians should maintain a higher level of suspicion for depression in patients with chronic diseases, but that mental health issues should not be addressed in isolation. This recommendation also has potential implications for physician education; patient context is important.

Experiences of Patient-Centredness With Specialized Community-Based Care

This review synthesized the qualitative research on patient and provider experiences of specialized community-based care (SCBC) interventions and health care delivery models, using the lens of patient-centredeness. The review included 29 primary qualitative studies.

Three main themes emerged: patients' health beliefs affect their participation in SCBC interventions; patients' experiences with community-based care differ from their experiences with hospital-based care; and patients and providers value the role of nurses differently in community-based chronic disease care. Patients who participated in SCBC interventions valued the education and self-management that they gained from it, but the information that was provided had to be provided in a meaningful, appropriate way. Patients were happy to develop longer and stronger relationships with their SCBC providers, in contrast to hospital settings, where care was often more disease-focused than patient-focused. SCBC programs often had the advantage of creating communities and relationships with other patients; this helped in some cases address issues of social isolation.

This review has implications specifically for the review on specialized community based care (63) and some community interventions, such as rehabilitation and self-management programs. Much of what is reported applies to how these programs are developed and implemented and the considerations for staffing, location, and content.

Contextualization

An expert panel was engaged to provide guidance and frame the context of the EBA and synthesis findings. The panel met 4 times over 1 year to comment on the scope of the work, the findings of the individual EBAs, the synthesis, and opportunities for follow-up. The panel's input can be categorized as scope of work, challenges, opportunities, and recommendations.

Scope of Work

One of the concerns raised in the panel's initial meetings was limitations to the scope of work. The focus of the meta-analysis was chronic disease care in an adult population, and this automatically excluded other populations (e.g., pediatrics) and other types of conditions (e.g., infections, cancers). The focus on patients with existing chronic diseases also excluded community-based primary prevention of chronic disease. The panel felt that the focus on a preselected group of chronic diseases (derived via mandate rather than consultation) could miss opportunities to improve overall community-based chronic disease care. The conditions that the panel specifically noted as missing included cognitive conditions (e.g., dementias) and musculoskeletal conditions (e.g., arthritis and osteoporosis), both of which affect patients' functional status. Within the reviews, the panel also stressed the importance of considering variation in effectiveness by subpopulation, such as those living in rural areas, marginalized groups, or different patient demographics. For such subpopulations, the panel noted that acknowledgement of barriers and opportunities would be important for recommendations and implementation considerations.

Challenges

The panel identified a number of challenges related to the body of work. One of the main challenges to interpretation and recommendations was the complexity of interventions and variability in findings. The risk is that inconsistent evidence reflects not variability in effectiveness, but fidelity in implementation. To be useful, recommendations would need to be specific enough to provide direction, but flexible enough to allow tailoring to different populations and settings. Recommendations should provide guidance while still allowing for novel methods of delivery.

The panel also noted that the "messaging" of findings would be important. For interventions that appeared not to work, findings may have been related more to limitations of the underlying studies than to the interventions themselves. For interventions that were expected to affect processes (e.g., eTools) or intermediate outcomes such as patient engagement (e.g., self-management), outcomes of interest and adequacy of follow-up were important for evaluating effectiveness.

Finally, the panel commented on a recurring issue related to the drafting of policy with limited evidence: "There is a push for ideas and not a lot of available evidence or not strong enough evidence to proceed with confidence [with an intervention]." The panel noted that it would be important to provide thoughtful, useful recommendations on questionable interventions where there was already substantial policy support (e.g., advanced access). Such situations may provide opportunities to suggest restructuring or refocusing interventions to be more effective.

Opportunities

The reviews and synthesis present an opportunity to identify effective interventions and models of care that apply to multiple conditions, and importantly, to multimorbid populations. This work can move the health system away from the current structure of "boutique" systems of care based on single conditions to one that is patient-centred. The opportunity to make policy recommendations allows the work to draw on a range of levers from the provider, structural, and governance levels, among others.

The panel also recognized that where the evidence was of low quality and findings were inconsistent, there was an opportunity to recommend local (Ontario) evaluations. While there may be a hesitancy to deny services if additional evidence of effectiveness is needed, there is good rationale to at least delay wider service delivery until an intervention is more comprehensively tested.

Recommendations

There were a number of instances where the results were not clear or where better-quality research was needed. Governments and other groups need to create more opportunities to fund studies exploring these gaps; 1 such opportunity is work around postdischarge support to improve care transitions. Gaps should also be catalogued to allow areas of research need to be identified and prioritized. It is likely that it will be possible to gain reasonable answers in a timely fashion and with a reasonable amount of resources for only a subset of gaps. Focused calls for evaluation are necessary under these circumstances.

Similarly, there should be a plan to evaluate what is recommended and implemented in a short time frame. If interventions are found not to work in an Ontario setting, implementation may identify a need to reassess or even drop ineffective programs. Alternatively, programs that are shown to be effective on a small scale in a local setting could be scaled up rapidly. Some smaller questions could be tested in "living labs," intended to encourage creativity and idea generation through field evaluations, targeted calls, and/or through collaborations with other programs (e.g., BRIDGES). Project failure should be seen not as money wasted but as money saved, since ineffective programs would not be broadly implemented. The plan should be to "fail cheaply and quickly."

Gaps and Limitations

The objective of this report series was to compile an evidence base and economic analysis to optimize chronic disease management in the outpatient setting, but it is equally important to identify the limitations and gaps of this synthesis.

One of the major gaps was that no interventions had been identified that could reduce admissions to LTC facilities. However, HQO had conducted a synthesis of interventions that could assist older Ontarians to live longer and more healthfully in the community. The *Aging in the Community* (62) report series was an EBA intended to identify drivers and interventions that could help reduce or delay admissions to LTC facilities. The review focused on interventions to reduce falls and fall-related injuries; treat urinary incontinence and dementia; and address issues of social isolation. Despite the strength of the evidence and the potential economic impact of the interventions reviewed,[1] the report has so far had only limited traction in policy. As such, the findings and recommendations of the *Aging in the Community* series have been incorporated into the Optimizing Chronic Disease Management mega-analysis in an effort to highlight them.

Some of the general limitations that faced all EBAs stemmed from the complexity of the interventions themselves. Often, interventions could not always be described in detail because of variations in delivery, and this made it difficult to interpret findings and determine what was working. As well, because of the breadth of work in many areas, reviews had to be limited either by population (e.g., self-management support interventions), scope of intervention (e.g., in-home care), or setting of care (e.g., specialized nursing practice). In other cases, the quality of the evidence limited the ability to make strong recommendations (e.g., advanced access).

Some interventions identified in the initial scoping were not prioritized for review, but aside from these, there were other gaps in the evidence. A number of interventions were not applied to all conditions or did not evaluate the effectiveness of the interventions for all outcomes of interest; this was a limitation of the available evidence. Tables 13 and 14 describe these gaps.

[1]Exercise interventions for community-dwelling elderly, support programs for caregivers, environmental modifications for high-risk populations, vitamin D and calcium supplementation in women, multicomponent interventions for urinary incontinence, behavioural management and/or multicomponent interventions for dementia.

Table 13: Gaps in the EBAs—Disease Cohorts for Which Data Were Not Available

EBA	Cohorts for Which Data Were Available								
	Diabetes	CAD	AF	Stroke	HF	COPD	Chronic Wounds	General CD	Multi-morbid
Discharge planning	No	No	No	No	Yes	No	No	Yes	Yes
In-home care	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes
Continuity of care	Yes	Yes	No	No	No	Yes	No	Yes	Yes
Advanced (open) access scheduling	Yes	Yes	No	No	No	No	No	Yes	Yes
Screening and management of depression	Yes	Yes	No	No	Yes	No	No	No	No
Self-management support	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes
Specialized nursing practice	Yes	Yes	No	No	Yes	No	No	Yes	No
Electronic tools	Yes	Yes	No	No	Yes	No	No	Yes	Yes
Previous EBAs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No

Abbreviations: AF, atrial fibrillation; CAD, coronary artery disease; CD, chronic disease; COPD, chronic obstructive pulmonary disease; EBA, evidence-based analysis; HF, heart failure.

Table 14: Gaps in the EBAs—Outcomes for Which Data Were Not Available

EBA	Outcomes for Which Data Were Available									
	Admits	Readmits	LOS	ED Visits	LTC Admission	Mortality	Disease-Specific Measures	HRQOL	Functional Status	Patient Satisf'n
Discharge planning	No	Yes	Yes	No	No	Yes	No	Yes	No	Yes
In-home care	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Continuity of care	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes
Advanced (open) access scheduling	Yes	No	Yes	Yes	No	No	Yes	No	No	Yes
Screening and management of depression	No	No	No	No	No	Yes	Yes	NA	No	No
Self management support	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Specialized nursing practice	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Electronic tools	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No
Previous EBAs	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No

Abbreviations: EBA, evidence-based analysis; ED, emergency department; HRQOL, health-related quality of life; LTC, long-term care; LOS, length of stay.

Conclusions

A number of interventions in this analysis were effective and cost-effective at improving chronic disease management in the community. The results were classified into 3 groups: strategies that were clinically effective; strategies that showed some clinical effectiveness, but may require further review and assessment for the Ontario setting; and strategies that were not more effective than alternatives.

Strategies that were clinically effective (and should be considered for implementation/expansion in Ontario) were as follows:

- discharge planning (individualized predischarge planning)
- in-home care
- continuity of care
- specialized nursing practice
- a number of previously reviewed health technologies
- SCBC (intermediate care)

Strategies that showed some clinical effectiveness, but may require further review and assessment for Ontario setting were as follows:

- Stanford CDSMP
- eTools for health information exchange

Strategies that were not more effective than alternatives were as follows:

- addition of postdischarge support programs to predischarge planning
- advanced access scheduling
- screen-and-treat strategy for depression

> "The ideal health system would put more emphasis on preventing poor health. It would be patient-centric and would feature coordination along the complete continuum, of care the patient may require. Primary care would be the main point of patient contact, with a good part of the coordination across care taking place through the administration of hospitals or regional health authorities. There would be much less emphasis on patients being in hospital: they are expensive, expose people to contagious disease and yield poor patient satisfaction"
>
> — Don Drummond, 2011 (64)

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Appendices

Appendix 1: Summary of Results

Table A1: Summary of Results from Evidence-Based Analyses

Intervention	Comparator	Study Population	Number of Studies (N)	Findings	GRADE
TRANSITIONS FROM HOSPITAL TO COMMUNITY AND BACK					
Discharge Planning					
Research Question: What is the effectiveness of discharge planning bundles at reducing health resource utilization and improving patient outcomes compared to usual care alone?					
Individualized predischarge planning	Usual care	Chronic disease populations (including heart failure) who were admitted to hospital	11 (2,552)	Individualized predischarge planning is **more effective** at reducing **readmissions**	Moderate
			10 (1,765)	Individualized predischarge planning is **more effective** at reducing **initial hospital LOS**	Moderate
			4 (978)	Individualized predischarge planning is **not more effective** at reducing **mortality**	Moderate
			1 systematic review of RCTs	Individualized predischarge planning is **more effective** at improving **HRQOL**	Very low
			1 systematic review of RCTs	Individualized predischarge planning is **more effective** at improving **patient satisfaction**	Very low
Individualized predischarge planning plus postdischarge support	Usual care	Heart failure patients admitted to hospital (primarily limited to this condition)	17 studies (2,941) and additional 4 studies (882)	Individualized predischarge planning plus postdischarge support is **more effective** at reducing **readmissions**	Low
				Individualized predischarge planning plus postdischarge support is **not more effective** at reducing **initial hospital LOS**	Low
				Individualized predischarge planning plus postdischarge support planning is **not more effective** at reducing **mortality**	Low
				Individualized predischarge planning plus postdischarge support is **more effective** at improving **HRQOL**	Very low
				Individualized predischarge planning plus postdischarge support is **more effective** at improving **patient satisfaction**	Very low

In-Home Care					
Research Question: What is the effectiveness of care delivered in the home (i.e., in-home care) compared to no home care or usual care/care received outside of the home (e.g., a health care setting)?					
Patient education around condition	Usual care	Heart failure patients	1 (106)	There was **no significant difference** in **unplanned admissions and on ED visits**	Moderate
Components of home care included disease education, assessment of medication adherence, clinical exam	Usual care	Heart failure patients	2 (558)	There was **no significant difference** in **hospital LOS**	Moderate
Components of home care included disease education, assessment of medication adherence, clinical exam	Usual care	Heart failure patients	3 (859)	There was **a significant benefit** of in-home care on the **combined events of all cause mortality and hospitalization**	Moderate
OT/PT to assess home environment and assist with strength and exercise training (general CD population) HF interventions were multiple types	Usual care	Heart failure patients; chronic disease/ comorbid patients	Heart failure 5 (1,240); chronic disease/ comorbid 1 (319)	There was **no significant difference** in **all-cause mortality**	Moderate High (CD population only)
Components of home care included disease education, assessment of medication adherence, clinical exam	Usual care	Heart failure patients	2 (562)	There was **no significant difference** in **CVD-specific mortality**	Moderate
				There was **no significant difference** in **heart failure-specific mortality**	Moderate
OT/PT to assess home environment and assist with strength and exercise training (general CD population)	Usual care	Chronic disease/ comorbid patients	1 (300)	There was a **significant benefit** of in-home care for **activities of daily living** (showed improvement). However, there was **no difference** in **instrumental activities of daily living** or **mobility**	Moderate
Patient education around condition	Usual care	Heart failure patients	1 (106)	There was a **significant benefit** of home care for the **physical component summary of the SF-36** (showed improvement). However, there was **no difference** for the **mental component summary of the SF-36**	Low
Components of home care included disease education, assessment of medication adherence, clinical exam	Usual care	Heart failure patients	2 (672)	There was a **beneficial effect** of nurse-led in-home care on **heart failure–specific HRQOL**	Low
Patient education, medication, lifestyle changes, signs and symptoms	Usual care	Heart failure patients	1 (158)	There was **no difference** between pharmacist-led in-home care and usual care for **heart failure–specific QOL**	Low

COMMUNITY-OPTIMIZED CARE					
Continuity of Care					
Research Question: Is higher continuity of care effective at reducing health resource utilization and improving patient outcomes?					
Continuity of care (not an intervention—it is an outcome or characteristic of relationships; as such, the comparison is between low and high continuity		General population; patients with diabetes; patients with COPD	9 (622,573) (general population 3, diabetes 5, COPD 1)	Despite heterogeneity in the measurement of continuity, higher continuity of care appeared to **decrease** **hospital admission rates** consistently in all studies and with a gradient shown in most studies that measured multiple levels of continuity	Low
		General population; patients with diabetes; patients with COPD	7 (1,218,200) (general population 3, diabetes 3, COPD 1)	Despite heterogeneity in the measurement of continuity, higher continuity of care appeared to **decrease** **ED visits**	Low
		Diabetes population	2 (11,400)	Higher continuity appeared to **improve** **HbA1c** levels in patients with diabetes	Low
		CAD population	1 (7,000)	There is **insufficient evidence** (no difference in 1 study) to comment on the relationship of continuity of care on **other disease-specific measures**	Very low
		General population	3 systematic reviews	There appeared to be a **positive association** between high continuity and **patient satisfaction**, particularly among those with chronic conditions	Low
Advanced (Open) Access Scheduling					
Research Question: What is the effectiveness and cost-effectiveness of advanced access scheduling compared to traditional scheduling for the management of chronic diseases in Ontario adults?					
Advanced access scheduling	Traditional scheduling	Diabetes population	2 studies (1st study, 4,060; 2nd study 6,741 [pre]; 7,238 [post])	Both studies reported **no (significant) reduction** in **hospitalization rates** for patients with diabetes after advanced access scheduling	Low
			1 study (4,060)	There was **no significant reduction** in **ED visit** rates between the pre and post period of advanced access scheduling	Very low
			2 studies (1st study, 4,060; 2nd study 6,741 [pre]; 7,238 [post])	There were **inconsistent findings** with 1 study showing a small but nonsignificant decrease in **ED/urgent care visits** and 1 study showing a significant decline in these visits (from 41% to 37.6%; *P*<0.001)	Very low
			1 study (6,741 [pre]; 7,238 [post])	There was a **significant reduction** in the percentage of patients with a **LOS >3 days**	Very low
			3 studies (1st study, 4,060; 2nd study 6,741 [pre]; 7,238 [post]; 3rd study 156)	There were **inconsistent findings** related to the impact of advanced access on clinical measures, including **HbA1c, cholesterol, and BP**.	Very low
		CAD population	1 study (3,555 [pre]; 3,802 [post])	There was a **significant reduction** in **hospitalization rates** (percent of patients hospitalized at least once in a 1-year period) from 58.4% (pre) to 57.3%	Very low

			1 study (3,555 [pre]; 3,802 [post])	There was **no significant change** in **ED visit rates** between the pre and post periods	Very low
			1 study (3,555 [pre]; 3,802 [post])	There was a **significant reduction** in the percent of patients with a **LOS >3 days**	Very low
			2 studies (1st study 3,555 [pre], 3,802 [post]; 2nd study 77)	There were **inconsistent findings** related to the impact of advanced access on **clinical measures, including HbA1c, cholesterol, and BP**	Very low
		Geriatric population	No sample size provided	**Unable to draw a conclusion** on **patient satisfaction,** as there was only 1 study and it did not conduct a statistical analysis	Very low
Screening and Management of Depression					
Research Question: In a chronic disease population, is a screen-and-treat strategy for depression associated with an improvement in chronic disease outcomes?					
Paroxetine	Placebo	Patients with diabetes and mild depression	1 (48)	Medication management of depression **did not significantly improve** clinical measures of diabetes (**HbA1c**)	Low
Citalopram	Placebo	Heart failure population	1 (37)	For patients with heart failure and depression (including mild depression), medication management of depression **did not significantly affect (improve or worsen) cardiopulmonary performance**	Low
Sertraline	Placebo		1 (469)	For patients with heart failure and depression (including mild depression), medication management of depression **did not significantly affect (improve or worsen) cardiac event rates or mortality**	Moderate
Citalopram (Esperance) or mirtazapine (Honig)	Placebo	CAD population	2 (375)	For patients with CAD and depression (including mild depression), medication management of depression **did not significantly affect** (improve or worsen) **ECG findings**	Low
Sertraline	Placebo		1 (369)	For patients with CAD and depression (including mild depression), medication management of depression **did not significantly affect (improve or worsen)** the percentage of patients with **reduced LVEF (<30%)**	Moderate
CBT (ENRICHD), citalopram (Lesperance); sertraline (Glassman)	Placebo		3 (3,134)	For patients with CAD and depression (including mild depression), management of depression appeared to have a **potentially protective, but not statistically significant** effect on **MI rates**	Moderate
CBT (ENRICHD), sertraline (Glassman)	Placebo		2 (2,850)	For patients with CAD and depression (including mild depression), management of depression appeared to have **a potentially protective, but not statistically significant** effect on **mortality**	Moderate

Self-Management Support Interventions					
Research Question: What is the effectiveness of self-management support interventions for persons with chronic diseases compared to usual care?					
Stanford CDSMP	Usual care	Population with chronic diseases	2–6 studies (1,730–3,901) patients	There was **no significant difference** in **health care utilization** (median follow-up 6 months) between patients who received the Stanford CDSMP and usual care, including: **visits with GPs, ED visits, hospitalizations** or **number of days in hospital**	Very low
			4–6 studies (2,742–3,854 patients)	The Stanford CDSMP led to **statistically significant (albeit clinically minimal) short-term (median 6 months) improvements** across a number of health status measures, including: reduction in **pain, dyspnea disability, fatigue, depression, health distress,** and an improvement in **self-rated health**	Low
			3–6 studies (2,084–3,818 patients)	The Stanford CDSMP led to **statistically significant short-term (median 6 months) improvements** across a number of **healthy behaviours,** including: **aerobic exercise, cognitive symptom management, communication with health professionals**	Low
			6 studies (3,119)	The Stanford CDSMP led to **significant improvement**s in **self-efficacy**	Low
			2 studies (905)	The Stanford CDSMP led to **statistically significant (albeit clinically minimal) short-term improvements** in **EQ-5D scores**	Moderate
Specialized Nursing Practice					
Research Question: What is the effectiveness of specialized nursing practice in comparison to usual care in improving patient outcomes and health system efficiencies for chronic disease management in the primary health care setting?					
Specialized nurse alone (Model 1) (equivalence)	Physician alone (usual care)	Primary care population with oversampling of chronic disease populations	1 (1,981)	There was **no significant difference** in **health service utilization** (hospitalizations, ED visits, specialist visits, or primary care visits)	Moderate
				There was **no significant difference** in **some clinical measures** (SBP, peak flow) but a significant decrease in DBP	Very low
				There was **no significant difference** in **QOL (SF-36)**	Moderate
		Diabetes subpopulation (substudy of the above)	1 (214)	There was **no significant difference** in **health service utilization** (hospitalizations, ED visits, specialist visits, or primary care visits)	Very low
				There was **no significant difference** in **HbA1c**	Very low
				There was either **no difference** or **a significant increase** in **patient education or monitoring of clinical measures**	Very low
				There was **no significant difference** in **QOL (SF-36)**	Very low

Specialized nurse plus physician (Model 2)	Physician alone (usual care)	Diabetes	1 (206)	There was a **significant increase** in the **number of primary care visits**	Low
			1 (157) absolute HbA1c 2 (363)	There was a **significant decrease** in **HbA1c**, but no difference in **the percent of patients reaching target levels (HbA1c, BP, or cholesterol)**	Moderate (absolute value for HbA1c); low (achievement of threshold)
			2 (1 study included 2 scales) (363)	There was **inconclusive evidence** on the effect of the intervention on **HRQOL**	Low
			1 (157)	There was a **significant increase** in **patient satisfaction**	Moderate
			2 (maximum 363, but variable)	There was a trend towards improvement in **process of care indicators;** most but not all showed **significant improvement**	Low to moderate
		CAD/CHD	1 (1,058)	There was a **significant decrease** in number of **hospitalizations** and **LOS** for intervention patients	Low
			2 (variable Ns depending on measure)	There was a **significant increase** in **the percent of patients achieving target levels** (BP, cholesterol, lifestyle measures, and management of BP and cholesterol)	Low to moderate
			2	There was **inconclusive evidence** on the effect of the intervention on **HRQOL**	Moderate
			1 (maximum 1,059)	There was a trend towards improvement in **process-of-care indicators;** most but not all showed **significant improvement**	Low to moderate
			1 (maximum 1,173)	There was **no significant difference** in number of **physician consultations** in the 2 models	Low
		Chronic disease population	1 (maximum 30 GP practices)	There was **no significant difference** in **total clinic hours** or **out of office hours**; but a **significant increase** in **COPD/asthma hours** and **no difference** in **subjective physician workload**	Low
INTERVENTIONS ACROSS THE SYSTEM					
Electronic Tools for Health Information Exchange					
Research Question: What is the impact of electronic tools (eTools) for health information exchange on patient outcomes and health services utilization when used to improve the care coordination of adults with chronic disease? What specifications of eTools contribute to their effectiveness?					
Automated laboratory results report with clinical alerts mapped to guidelines	Usual care	Adult patients with diabetes	1 (7,368)	There was evidence of a **significant reduction** in **acute health service utilization** (hospitalizations, ED visits, and LOS)	Moderate
Automatically generated personalized discharge	Paper-based summaries	Population discharged from hospital and with	1 (631)	There was evidence of **no difference** in the proportion of patients who experienced a **readmission**	High

summaries		an increased likelihood of readmission			
Electronic data interchange tool (facilitates communication between providers; including specialists)	Physicians not using EDI tool Pre/post comparison	Patients with diabetes (and primary care providers treating these patients)	1 study (32 GPs; 275 patients) 1 (607)	There was evidence of **no difference** in **HbA1c levels** in diabetes patients	Very low to low
DEMS	Before use of DEMS	Patients with diabetes (and primary care providers treating these patients)	1 (607)	There was evidence of **no difference** in **blood pressure** (SBP or DBP) in diabetes patients	Low
DEMS Electronic system that identifies high-risk patients and emails information on decision supports, as well as integration into EHR	Before use of DEMS, standard EHR	Patients with diabetes patients with CAD or CAD risk	1 (607) 1 (163)	There was evidence of **no difference** in **lipid levels**	Low
Automatically generated personalized discharge summaries	Paper-based summaries	Population discharged from hospital and with an increased likelihood of readmission	1 (631)	There was evidence of **no difference** in the proportion of patients identified as having an **adverse event within 1 month of discharge**	High
eTools for health information exchange (variety of tools)	Usual care	Variety of chronic disease populations and general population	Various	The **evidence does not demonstrate that eTools had an overall positive impact** on **process-of-care measures** (based on a number of measures; some showed an increase in the number of tests/assessment, some showed a decrease, and some showed no difference or had inconclusive findings)	Very low to low
Automatically generated personalized discharge summaries DEMS; EDI tool (diabetes) Electronic system that identifies high-risk patients and emails information on decision supports, as well as integration into EHR	Paper-based summaries, standard EHR Pre-DEMS physicians not using EDI	Population discharged from hospital and with an increased likelihood of readmission; patients with diabetes; patients with CAD or CAD risk	1 (631) 1 (607); 1 (32 GPs; 275 patients) 1 (235)	The **evidence does not demonstrate improved efficiency** for care providers	Very low to high

Abbreviations: BP, blood pressure; CAD, coronary artery disease; CBT, cognitive behavioural therapy; CD, chronic disease; CDSMP, Chronic Disease Self-Management Program; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; DBP, diastolic blood pressure; DEMS, diabetes electronic management system; ECG, electrocardiogram; ED, emergency department; EDI, electronic data interchange; EHR, electronic health record; eTool, electronic tool; GP, general practitioner; HbA1c, hemoglobin A1c; HF, heart failure; HRQOL, health-related quality of life; LOS, length of stay; LVEF, left ventricular ejection fraction; MI, myocardial infarction; OT, occupational therapist; PT, physiotherapist; RCT, randomized controlled trial; SBP, systolic blood pressure; SF-36, Short Form (36) Health Survey.

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About Health Quality Ontario

Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the *Ontario Health Technology Advisory Committee* and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

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Abstract

Background

Chronically ill people experience frequent changes in health status accompanied by multiple transitions between care settings and care providers. Discharge planning provides support services, follow-up activities, and other interventions that span pre-hospital discharge to post-hospital settings.

Objective

To determine if discharge planning is effective at reducing health resource utilization and improving patient outcomes compared with standard care alone.

Data Sources

A standard systematic literature search was conducted for studies published from January 1, 2004, until December 13, 2011.

Review Methods

Reports, randomized controlled trials, systematic reviews, and meta-analyses with 1 month or more of follow-up and limited to specified chronic conditions were examined. Outcomes included mortality/survival, readmissions and emergency department (ED) visits, hospital length of stay (LOS), health-related quality of life (HRQOL), and patient satisfaction.

Results

One meta-analysis compared individualized discharge planning to usual care and found a significant reduction in readmissions favouring individualized discharge planning.

A second meta-analysis compared comprehensive discharge planning with postdischarge support to usual care. There was a significant reduction in readmissions favouring discharge planning with postdischarge support. However, there was significant statistical heterogeneity.

For both meta-analyses there was a nonsignificant reduction in mortality between the study arms.

Limitations

There was difficulty in distinguishing the relative contribution of each element within the terms "discharge planning" and "postdischarge support." For most studies, "usual care" was not explicitly described.

Conclusions

Compared with usual care, there was moderate quality evidence that individualized discharge planning is more effective at reducing readmissions or hospital LOS but not mortality, and very low quality evidence that it is more effective at improving HRQOL or patient satisfaction.

Compared with usual care, there was low quality evidence that the discharge planning plus postdischarge support is more effective at reducing readmissions but not more effective at reducing hospital LOS or mortality. There was very low quality evidence that it is more effective at improving HRQOL or patient satisfaction.

Plain Language Summary

Chronically ill people experience frequent changes in their health status and multiple transitions between care settings and care providers (e.g., hospital to home). Discharge planning provides support services, follow-up activities and other interventions that span pre-hospital discharge to post-hospital settings.

A review of the effects of different discharge plans was conducted. After searching for relevant studies, 11 studies were found that compared discharge planning with routine discharge care.

This review indicates that:

- Individualized discharge planning reduces initial hospital length of stay and subsequent readmission to hospital but does not reduce mortality. The effect on health-related quality of life (HRQOL) or patient satisfaction is uncertain.

- Discharge planning plus postdischarge support reduces readmissions but does not reduce the initial hospital length of stay or mortality after discharge. The effect on HRQOL or patient satisfaction is uncertain.

List of Abbreviations

6MWT	6-minute walking test
APN	Advanced practice nurse
CAD	Coronary artery disease
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
EPOC	Effective Practice and Organization of Care Group
HQO	Health Quality Ontario
HRQOL	Health-related quality of life
LOS	Length of stay
RCT	Randomized controlled trial
RR	Relative risk
SD	Standard deviation

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this analysis was to determine if discharge planning bundles (e.g., support services, follow-up activities, and other interventions that span pre-hospital discharge to the home setting) are effective at reducing health resource utilization and improving patient outcomes compared with usual care alone.

Clinical Need and Target Population

Chronically Ill People and Transitions Between Care Settings

Chronically ill people experience frequent changes in health status accompanied by multiple transitions between care settings and care providers. (1) It is during these transitions that mistakes frequently occur, for example, information about medication that a patient was prescribed while in hospital may not be accurately communicated to the family physician. Transitions may also give rise to adverse clinical events, patients' serious needs not being met, and poor satisfaction with care. (1)

Transitions have also been reported to be associated with increased rates of potentially avoidable hospitalizations. (1) Innovative solutions that aim to improve integration and continuity across episodes of care discourage patterns of frequent use of health care services among the chronically ill and address the negative effects on quality and costs. Such solutions are referred to as "discharge planning."

Discharge Planning

The few definitions of hospital discharge planning indicate that this is a process that takes place between hospital admission and the discharge event. (2) Pre-hospital discharge and communication is important as a start to the discharge planning process: it provides an opportunity to summarize the visit, teach patients how to safely care for themselves at home, and address any remaining questions or concerns. Discharge planning helps patients communicate with caregivers and primary care providers about how best to manage their chronic needs after leaving the hospital.
(3)

The emphasis on discharge planning varies between countries. (4) Discharge planning is mandatory in the United States in hospitals that participate in the Medicare and Medicaid programmes. In the United Kingdom, the Department of Health has published guidelines on discharge practice for health and social care. However, procedures vary between specialities in the same hospital, and discharge planning may be embedded in another intervention, such as specialized assessment units. (4) These differences make it difficult to interpret data on the effectiveness of discharge planning.

Ontario Context

There is a process for discharge planning in approximately 80%–90% of hospitals in Ontario. However, this practice is not standardized throughout the province. It is likely more of an organic process with varying elements tailored to suit the needs of the community(e.g., some hospitals may have discharge planners and some may use the services of Community Care Access Centres in order to try and bridge the care a patient receives from the hospital to that from their health care provider).

Evidence-Based Analysis

Research Questions

What is the effectiveness of discharge planning bundles at reducing health resource utilization and improving patient outcomes compared to usual care alone?

Research Methods

Literature Search

Search Strategy

A literature search was performed on December 13, 2011, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database for studies published from January 1, 2004, until December 13, 2011. Studies published from 2004 onwards were of interest because a meta-analysis of discharge planning for patients with heart failure was published in that year. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

English language full-text reports

- published between January 1, 2004, and December 13, 2011
- randomized controlled trials (RCTs), systematic reviews, and meta-analyses
- enrolled adult patients
- ≥ 1 month follow-up
- limited to identified chronic conditions
  - chronic obstructive pulmonary disease (COPD)
  - coronary artery disease (CAD)
  - congestive heart failure
  - atrial fibrillation
  - diabetes
  - stroke
  - chronic wounds
- also included general terms
  - chronic conditions
  - multiple chronic conditions/multi-morbidity
- explicitly described bundles of services to ensure transition from inpatient to community (outpatient) care (e.g., discharge planning, support services, follow-up activities, monitoring and/or other interventions that span pre-hospital discharge to the home setting)

Exclusion Criteria

- studies where discrete results on discharge planning cannot be extracted
- studies that examined pediatric patients
- observational studies

Outcomes of Interest

- mortality/survival
- acute hospital admissions (readmissions)
- emergency department (ED) visits
- hospital length of stay (LOS)
- health-related quality of life (HRQOL)
- functional status
- disease-specific clinical measures
- patient satisfaction

Quality of Evidence

The quality of the body of evidence for each outcome is examined according to the GRADE Working Group criteria. (5) The overall quality is determined to be very low, low, moderate or high using a step-wise, structural methodology.

Study design is the first consideration; the starting assumption is that RCTs are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision and publication bias—are then taken into account. Limitations or serious limitations in these areas result in downgrading the quality of evidence. Finally, 4 factors are considered which may raise the quality of evidence: large magnitude of effect, dose response gradient and accounting for all residual confounding. (5) For more detailed information, please refer to the latest series of GRADE articles. (5)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to that of the estimate of the effect
Moderate	Moderately confident in the effect estimate – the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited – the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate – the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

The database search yielded 2,707 citations published between January 1, 2004, and December13, 2011 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded in the analysis.

Eleven studies (7 systematic reviews and 4 RCTs) met the inclusion criteria.

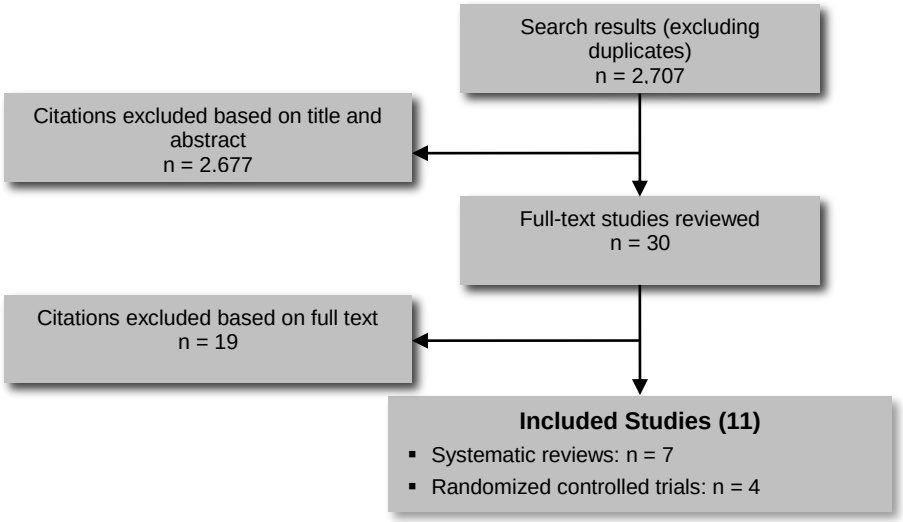

Figure 1: Citation Flow Chart

For each included study, the study design was identified. These are summarized in Table 1, which is a modified version of a hierarchy of study design by Goodman. (6)

Table 1: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	7
Large RCT	4
Small RCT	
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	11

Abbreviation: RCT, randomized controlled trial

Systematic Reviews

Table 2 includes a summary of the results and limitations for the 7 systematic reviews. (1;4;7-11) Four of these (1;8-10) were of low quality for a number of reasons including a lack of reported literature search cut-off dates; a lack of critical assessments of the studies in the narrative reviews; an unbalanced focus on studies that showed positive effects of discharge planning; the inclusion of numerous studies written by the lead author of the systematic review; the inclusion of grey literature; and uncritical narrative review of systematic reviews.

Table 2: Summary of Systematic Reviews

Author, Year, Country	Purpose	Inclusion Criteria	Results	Conclusion	Limitations
Hansen et al, 2011 (7) United States Literature search up to January 2011	Describe interventions evaluated in studies aimed at reducing rehospitalization within 30 days of discharge	RCTs (the authors also included observational studies, but HQO did not examine them in this analysis) Adults Interventions did not require disease-specific approaches (e.g., measurement of brain natriuretic peptide before HF discharge)	43 studies (16 RCTs) identified and divided into: -predischarge interventions; -patient education, medication reconciliation, discharge planning, and scheduling of follow-up appointments before discharge; -postdischarge interventions; -follow-up telephone calls, patient-activated hotlines, timely communication with ambulatory providers, timely ambulatory provider follow-up, and postdischarge home visits; -bridging interventions; and -transition coaches, physician continuity across the inpatient and outpatient setting, and patient-centred discharge instruction. 5 of 16 RCTs documented statistically significant improvement in rehospitalization outcomes within 30 days. Of these 5 trials, 1 consisted of a single intervention in which high-risk patients received early discharge planning or usual care; the treatment group experienced an absolute 11 percentage point reduction in 30-day rehospitalization. The remaining 4 RCTs tested multicomponent discharge bundles. However, 1 RCT did not report results for 30-day readmission but for 2 weeks, and 1 RCT combined readmission and ED visits. The 2 remaining RCTs demonstrated absolute reductions in 30-day readmission of between 3.6 and 6.0 percentage points. The patient-centred discharge instructions and postdischarge telephone call were included in all 4 RCTs showing significantly effective discharge bundles.	No single intervention implemented alone was regularly associated with reduced risk for 30-day rehospitalization.	Inadequate description of individual studies' interventions precluded meta-analysis of effects. Many studies were single-institution assessments of quality improvement activities rather than those with experimental designs. Several interventions have not been studied outside of multicomponent "discharge bundles."

Author, Year, Country	Purpose	Inclusion Criteria	Results	Conclusion	Limitations
Naylor et al, 2011 (1) United States Literature search cut-off date not reported	To identify and synthesize available evidence regarding discharge planning for adult, chronically ill populations	RCTs conducted in the United States Adults	21 RCTs identified. Naylor et al focused on 9 studies (3 of which were by the lead author) demonstrating positive effects of discharge planning on readmissions. "Because a key aim of the *Affordable Care Act* is to reduce avoidable hospital readmissions, we were particularly interested in the 9 interventions that reported a statistically significant positive effect on at least one measure of readmissions..." All but 1 of the 9 studies reported reductions in all-cause readmissions through at least 30 days after discharge. Of the remaining 8 interventions, 3 found positive, long-term effects in all-cause readmissions through 6 or 12 months following the index hospital discharge. These included 2 comprehensive discharge planning and follow-up interventions with home visits that were conducted by the lead author of the systematic review. The third intervention was a telehealth-facilitated intervention in which HF patients received either a videophone or telephone postdischarge support program. The study reported reduced all-cause readmissions through 12 months only when the 2 interventions groups were combined. There were no differences between the intervention group and the control group at 3 or 6 months. Discharge planning was not examined in this study.	"Our evidence review reveals nearly a dozen interventions that have demonstrated some positive effect on hospital readmissions."	No overall systematic assessment of the 21 RCTs. Authors focused solely on the 9 studies that demonstrated positive effects of discharge planning on readmissions. Seven of the 21 studies focused on discharge management plus follow-up. Meta-analysis was not conducted due to heterogeneity of study design. "The nature and practice of transitional care is evolving, and a standardized definition has not yet been established. The *Affordable Care Act*'s interpretation of transitional care is broad, so we chose to be inclusive in our search. Thus the interventions retained in our synthesis are diverse and in some cases could reasonably be categorized in other ways (for example, as telehealth and case management interventions)."

Author, Year, Country	Purpose	Inclusion Criteria	Results	Conclusion	Limitations
Shepperd et al, 2010 (4) United Kingdom Literature search up to March 2009	To determine the effectiveness of planning the discharge of patients moving from hospital	RCTs that compared an individualized discharge plan with routine discharge care that was not tailored to the individual patient	21 RCTs (7,234 patients). Follow-up ranged from 2 weeks to 9 months. Readmission to hospital was significantly reduced for patients allocated to discharge planning (readmission rates RR, 0.85; 95% CI, 0.74–0.97, 11 trials). For elderly patients with a medical condition (usually HF), there was insufficient evidence for a difference in mortality (RR, 1.04; 95% CI, 0.74–1.46, 4 trials). In 3 trials, patients allocated to discharge planning reported increased satisfaction.	A structured discharge plan tailored to the individual patient probably brings about small reductions in readmission rates for older people admitted to hospital with a medical condition. The impact of discharge planning on mortality and health outcomes remains uncertain.	Key issue in interpreting the evidence is the definition of the intervention and the subsequent understanding of the relative contribution of each element. It was not possible to assess how some components of the process compared between trials. Inclusion of the caregiver or family was mentioned by some of the trials, but the degree to which this was done was not always apparent or reported. Monitoring of patient discharge planning differed (e.g., telephone or visiting primary care clinics). Three trials examined the effectiveness of a pharmacy discharge plan. The context in which an intervention such as discharge planning is delivered may also play a role, not only in the way the intervention is delivered, but in the way services are configured for the control group. Orientation of primary care services differs between countries, which may affect communication between services. Different perceptions of care by professionals of alternative care settings and country-specific funding arrangements may also influence discharge. Two studies reported discharge planning commencing from the time a patient was admitted to hospital, and another reported that discharge planning was implemented 3 days prior to discharge. The timing of delivery of discharge planning, which depends on other services, will have some bearing on how quickly these services can begin providing care. The patient population may also impact outcome (e.g., patients experiencing major complications from their chronic disease combined with an intervention designed to increase the intensity of primary care services may explain the observed increase in readmission days for those receiving the intervention.) Shepperd et al excluded RCTs evaluating interventions where discharge planning was not the main focus of a multifaceted package of care.

Author, Year, Country	Purpose	Inclusion Criteria	Results	Conclusion	Limitations
Scott, 2010 (8) Australia Literature search up to March 2009	To determine the relative efficacy of peridischarge interventions categorized into 2 groups: -single component interventions (sole or predominant) implemented either before or after discharge -integrated multicomponent interventions that have pre- and postdischarge elements	Controlled trials or systematic reviews that reported data on interventions targeting hospitalized patients and measured readmission rates	7 systematic reviews were key sources of data for analysis. Studies (not all RCTs) summarized as a narrative review. Formal meta-analysis not applied due to considerable study heterogeneity in design and outcome measures. Single component interventions that reduced readmissions: -intense self-management -transition coaching of high-risk patients -nurse home visits Telephone support of patients with HF Multicomponent interventions that reduced readmissions: -early assessment of discharge needs -enhanced patient and caregiver education and counselling -early postdischarge follow-up of high-risk patients	Peridischarge interventions are highly heterogeneous and reported outcomes show considerable variation. Multicomponent interventions targeted at high-risk populations that include pre- and postdischarge elements seem to be more effective in reducing readmissions than most single component interventions that do not span the hospital-community interface.	No critical review of single studies within the systematic review was undertaken Non-RCTs included in some of the systematic reviews "It is not an exhaustive systematic review of all individual trials of clinical interventions that relate to discharge processes in some way."
Kumar and Grimmer-Somers, 2007 (9) Australia Literature search cut-off dates not reported	To systematically evaluate the secondary literature on hospital avoidance and discharge programs using a framework of best practice principles in health care (safety, effectiveness, timeliness, equity, efficiency, and patient-centredness)	Systematic reviews and grey literature reflecting the descriptive reviews of published and unpublished literature Patients of any age and with any condition who had been discharged from hospital to home RCTs and observational studies	48 publications "Overall, the health outcome, hospital LOS, and readmission rates associated with community/home-based care were no worse than those derived from hospital-based care. However, patients and caregivers mostly preferred care provided out of hospital, and this was often reflected in positive functional change and improved satisfaction scores."	"While there was evidence for improved patient-centred outcomes, the evidence for safety, effectiveness, and efficiency of hospital avoidance and discharge programs was equivocal."	Lack of description in many of the publications of "standard hospital care" as a comparator

Author, Year, Country	Purpose	Inclusion Criteria	Results	Conclusion	Limitations
Mistiaen et al, 2007 (10) Netherlands Literature search up to November 2006	To systematically examine reviews of the effectiveness of interventions aimed at reducing postdischarge problems in adults discharged home from an acute general care hospital	Systematic reviews Adult patients hospitalized primarily for a physical problem. Outcomes measured include patient status at discharge, patient functioning within 3 months of discharge, or health care service use and costs after discharge	15 systematic reviews All reviews dealt with considerable heterogeneity in interventions, populations and outcomes making synthesizing and pooling difficult. Although a statistically significant effect was occasionally found, most review authors reached no firm conclusions about the effectiveness of the discharge interventions. Limited evidence that some interventions may improve patients' knowledge, may help in keeping patients at home, or may reduce readmissions to hospital Interventions that combine discharge planning and discharge support tend to lead to the greatest effects. There is little evidence that discharge interventions have an impact on hospital LOS, discharge destination, or dependency at discharge. No evidence that discharge interventions have a positive impact on the physical status of patients after discharge or on health care use after discharge.	Based on 15 high quality systematic reviews, there is some evidence that some interventions, particularly those with educational components and those that combine predischarge and postdischarge interventions, may have a positive impact. However, on the whole there is limited summarized evidence that discharge planning and discharge support interventions have a positive impact on patient status at hospital discharge, on patient functioning after discharge, or on health care use after discharge and costs.	"The umbrella concept of 'discharge interventions' is too broad to endeavour synthesizing by means of a review of systematic reviews already dealing with vast heterogeneity." Poor description of interventions and control conditions
Phillips et al, 2004 (11) United States Literature search up to October 2003.	To evaluate the effect of comprehensive discharge planning plus postdischarge support on the rate of readmission, all-cause mortality, hospital LOS, and HRQOL	RCTs that described interventions to modify hospital discharge for older patients with HF compared with usual care Studies with clearly defined inpatient and outpatient components Studies that reported readmission as the primary outcome	18 RCTs (3,304 patients) Mean follow-up 8 months (range 3–12 months) Intervention vs. usual care: **Readmission** 555/1590 vs. 741/1714 RR, 0.75; 95% CI, 0.64–0.88 **All-cause mortality** RR, 0.87; 95% CI, 0.73–1.03; n = 14 studies **Percent improvement in HRQOL scores compared with baseline** 25.7% (95% CI, 11.0%–40.4%) vs. 13.5% (95% CI, 5.1%–22.0%), n = 6, *P* = 0.01	Comprehensive discharge planning plus postdischarge support for older patients with HF significantly reduced readmission rates and may improve health outcomes such as survival and HRQOL.	For most studies, usual care was not explicitly described. No studies evaluated the efficacy of comprehensive discharge planning without components for postdischarge support for patients with HF. The duration of components for postdischarge support was not consistently reported and varied by study. Components for postdischarge support varied by study. Unable to ascertain whether events that occurred distant from the index discharge were related to the initial DRG or new problems for patients who were readmitted or those who died.

Abbreviations: CI, confidence interval; DRG, diagnosis related group; ED, emergency department; HF, heart failure; HQO, Health Quality Ontario; HRQOL, health-related quality of life; LOS, length of stay; RCT, randomized controlled trial; RR, relative risk.

Overall General Results of Published Meta-Analyses

Of the 3 high quality systematic reviews, 2 included a meta-analysis. (4;11) Hansen et al (7) did not conduct a meta-analysis because "inadequate description of individual studies' interventions precluded meta-analysis of effects."

Table 3 shows a comparison of the summary statistics reported in the meta-analyses. Shepperd et al (4) compared individualized discharge planning with usual care, and Phillips et al (11) compared comprehensive discharge planning plus postdischarge support to usual care. There was a significant reduction in readmissions favouring individualized discharge planning compared with usual care (with no significant statistical heterogeneity). There was also significant reduction in readmissions favouring discharge planning with postdischarge support compared with usual care, though in this case heterogeneity was significant (despite that Phillips et al (11) removed a large study from the meta-analysis due to significant heterogeneity).

For both meta-analyses, there was a nonsignificant reduction in mortality between the study arms.

Shepperd et al (4) found a significant difference in the hospital LOS favouring individualized discharge planning. Conversely, Phillips et al (11) did not find a significant difference in LOS between discharge planning with postdischarge support compared with usual care.

Table 3: Results of Two Meta-Analyses – Comparison of Individualized Discharge Planning Versus Usual Care and Comprehensive Discharge Planning With Postdischarge Support Versus Usual Care

Intervention/Author	Summary Statistic RR (95% CI)	Number of RCTs	N	Heterogeneity *P* Value
Readmission to Hospital				
Individualized discharge planning Shepperd et al, 2009[a] (4)	0.85 (0.74–0.97) (Follow-up from 2 weeks to 9 months)	11	2,552	0.47
Individualized discharge planning WITH postdischarge support Phillips et al, 2004[b] (11)	0.74 (0.67–0.81) (Follow-up from 3–12 months; mean, 8 months)	17	2,941	0.04 (significant heterogeneity remained even after a large study was removed due to considerable significant heterogeneity [$P < 0.001$] in 18 studies)
Mortality				
Individualized discharge planning Shepperd et al, 2009 [a] (4)	1.04 (0.74–1.46)	4	978	0.44
Individualized discharge planning WITH postdischarge support Phillips et al, 2004 (11)	0.87 (0.73–1.03)	14	2,847	0.06
Length of Stay				
Individualized discharge planning Shepperd et al[b], 2009 (4)	Mean difference −0.91 (−1.55 to −0.27)	10	1,765	0.50
Individualized discharge planning WITH postdischarge support Phillips et al, 2004 (11)	Mean difference −0.37 (−0.15 to 0.60)	10	1,682	Not reported

Abbreviations: CI, confidence interval; RCT, randomized controlled trials; RR, relative risk.

[a] This systematic review specifically focused on discharge planning. Studies were excluded if it was not possible to separate the effects of discharge planning from the other components of the intervention, if discharge planning appeared to be a minor part of a multifaceted intervention, or if the focus was on the provision of care after discharge from hospital. The control group had to receive standard care with no structured discharge planning.

[b] Included studies specifically addressed congestive heart failure, described components for inpatient care *plus* postdischarge support, compared the effects with usual care, and reported readmission rates as the primary outcome.

Detailed Results of Published Systematic Reviews

Systematic Review of Interventions Aimed at Reducing 30-Day Rehospitalization

The objective of the most recent systematic review identified in the literature search was to describe interventions evaluated in studies aimed at reducing rehospitalization within 30 days of discharge. (7) Hansen et al. (7) identified 16 RCTs (12-27) from a literature search that spanned from January 1975 to January 2011. Because of the overlapping nature of intervention components and the heterogeneity of interventions in these included studies, meta-analysis of interventions was not feasible and the authors reported a narrative synthesis.

The authors developed a taxonomy for categorizing individual components of interventions into 3 groups:

- Predischarge interventions
- Postdischarge interventions
- Interventions active both before and after discharge as a "bridge" across care settings. These "bridge interventions" provided a longitudinal service with activity spanning the pre- and postdischarge periods.

Table 4 shows a listing of interventions in each of the 3 categories.

Of the 16 RCTs Hansen et al. (7) identified, 5 documented a statistically significant improvement in rehospitalization outcomes within 30 days. (14;17;20;21;24) One of the 5 trials consisted of a single intervention in which high-risk patients received early discharge planning or usual care; the treatment group experienced an absolute 11 percentage point reduction in 30-day rehospitalization. (17) Hansen et al (7) stated that isolated interventions may have small effects, but bundled interventions may have an additive effect or additional value through change in cultural or organizational factors.

The remaining 4 RCTs tested multicomponent discharge bundles. However, Naylor et al (24) did not report results for 30-day readmission (results were reported at 2 weeks), and Koehler et al (21) combined readmission and ED visits. The 2 remaining RCTs (14;20) demonstrated absolute reductions in 30-day readmission of between 3.6 and 6.0 percentage points. Interventions common to these 4 RCTs were the postdischarge telephone call (either by a hospital, or more usually, a nurse from the primary provider's office) and patient-centred discharge instructions. However, 2 separate RCTs (12;25) that included these 2 interventions with others in a bundle did not show significant reductions in rehospitalization within 30 days, and 2 RCTs that tested them in isolation found no effect. (13;15) This difference, along with the higher frequency of bundled interventions in RCTs showing effect, may suggest limited efficacy of isolated interventions.

Eleven RCTs identified in the review by Hansen et al (7) did not show a significant effect of isolated *or* bundled interventions. These included negative studies of *isolated* application of discharge planning (18), patient education (26), home visits (16;27), and postdischarge telephone calls. (13;15)

Limitations to the systematic review included the following:

- Diverse interventions or scant details which made it difficult to analyze the relative efficacy of individual interventions. Staffing and scope of intervention components or the population targeted for intervention varied between studies, and in particular for patient education and discharge planning.
- A paucity of high quality RCTs. The 2 highest quality studies (25;26), which scored 7 out of 9 on the Cochrane Collaboration's Effective Practice and Organization of Care (EPOC) Group Risk of Bias Criteria used by the authors, did not demonstrate a significantly reduced 30-day rehospitalization in the intervention groups. Details about the quality of the studies are shown in Appendix 2, Table A2-1.

- The RCTs examining the effectiveness of discharge planning care predominantly focused on the academic health care environment, and the results may not transfer to non-academic sites of care. (7) The importance of organizational context to organizational change raises concerns that many hospitals may be frustrated if they seek improvement by replicating the processes reviewed. (7)

Table 4: Summary of Interventions Tested in Randomized Controlled Trials Included in Systematic Review

Author, Year, Size, Country	Population	Interventions												EPOC Quality Criteria Satisfied (9 possible), n	Absolute Risk Reduction, percentage points
		Predischarge Interventions				Postdischarge Interventions				Interventions Bridging the Transition					
		Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity		
Balaban et al, 2008 (12) N = 96 United States	Community hospital					X		X				X		5	−0.3
Braun et al, 2009 (13) N = 309 Israel	General medicine ward							X						5	0.5
Coleman et al, 2006 (14) N = 750 United Sates	Geriatric							X		X	X	X		5	3.6[a]
Dudas et al, 2001 (15) N = 221 United States	General medicine ward							X						4	10
Dunn et al, 1994 (16) N = 59 United Kingdom	Geriatric									X				4	−2
Evans et al, 1993 (17) N = 835 United States	Veterans Affairs; **high risk**		X											4	11.0[a]
Forster et al, 2005 (18) N = 620 Canada	General medicine ward		X											5	−7.8 (readmission or death)
Jaarsma et al, 1999 N = 179 Netherlands	HF	X						X	X	X	X			5	2
Jack et al, 2009 N = 738 United States	Medical/ surgical ward	X	X	X		X		X				X		6	6.0[a]
Koehler et al, 2009 (21) N = 41 United States	Geriatric, high risk	X	X	X		X		X			X	X		6	28.1[a] (readmission or ED visit)
Kwok et al, 2004 (22) N = 149 Hong Kong	Chronic lung disease, geriatric								X	X				6	−10
McDonald et al, 2001 (23) N = 70 Ireland	HF, geriatric	X						X						4	0
Naylor et al, 1994 (24) N = 142 United States	Cardiac (medical/ surgical), geriatric	X	X					X	X		X	X		5	12.0[a] (2 weeks, medical); 4 (surgical)

Author, Year, Size, Country	Population	Interventions												EPOC Quality Criteria Satisfied (9 possible), n	Absolute Risk Reduction, percentage points
		Predischarge Interventions					Postdischarge Interventions				Interventions Bridging the Transition				
		Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity		
Parry et al, 2009 N = 98 (25) United States	Geriatric	X		X			X	X		X	X	X		7	9.9
Rainville, 1999 (26) N = 34 United States	HF	X												7	7.1
Wong et al, 2008 (27) N = 332 Hong Kong	General medicine ward									X				5	2.4

Abbreviations: ED, emergency department; EPOC, Effective Practice and Organization of Care Group; HF, heart failure; PCP, primary care provider.

[a]Statistically significant improvement in rehospitalization outcomes within 30 days.

Source: Hansen et al, 2011 (7)

Systematic Review of Discharge Planning From Hospital to Home

Shepperd et al (4) conducted a systematic review of RCTs to determine the effectiveness of planning patient discharge from hospital to home. The objectives were to determine the effectiveness of discharge planning on

- unscheduled readmission rates compared with usual care
- length of stay (LOS) in hospital compared with usual care
- incidence of complications related to the initial admission compared with usual care
- mortality rate compared with usual care
- patient health outcomes compared with usual care
- patients' and caregivers' satisfaction compared with usual care

The researchers defined discharge planning as the "development of an individualized discharge plan for a patient *prior* to them leaving hospital for home." (4) The discharge planning process was divided into the following steps:

1. preadmission assessment (where possible);
2. case finding on admission;
3. inpatient assessment and preparation of a discharge plan based on individual patient needs, e.g., multidisciplinary assessment involving the patient and their family and communication between relevant professionals within the hospital;
4. implementation of the discharge plan;
5. monitoring.

Shepperd et al excluded those studies

- that did not include an assessment and implementation phase of discharge planning;
- where it was not possible to separate the effects of discharge planning from the other components of the intervention or if discharge planning appeared to be a minor part of a multifaceted intervention; and/or
- if the focus was on the provision of care after discharge from hospital.

The control group had to receive standard care with no structured discharge planning. The literature search cut-off date was March 2009.

Shepperd et al (4) identified 21 RCTs (N = 7,234 patients), details of which are shown in Appendix 2, Tables A2-2 and A2-3. (12;17;20;24;28-44) Follow-up duration ranged from 2 weeks to 9 months. The trials evaluated a broadly similar intervention of discharge planning that included an assessment, planning, implementation and monitoring phase, although 6 trials (17;33;34;38;42;43) did not describe a monitoring phase. The interventions were implemented at different times during the patient's stay in hospital, from admission to 3 days prior to discharge. Three trials (28;36;42) evaluated a pharmacy discharge plan implemented by a hospital pharmacy. The patient's medication was rationalized, the family physician, community pharmacist, or both were sent a pharmacy discharge plan, and patients were given information about their medication.

The description of the type of care the control group received varied. One trial (31) did not describe the care received by the control group. Sixteen trials (12;17;20;24;29;30;32-35;37-41;44) described the control group as receiving usual care with some discharge planning but without a formal link through a co-ordinator to other departments and services although other services were available on request from nursing or medical staff. The control groups in the 3 trials (28;36;42) that evaluated the effectiveness of a pharmacy

discharge plan did not have access to a review and discharge plan by a pharmacist. The control group in one trial (43) received multidisciplinary care that was not defined in advance but was determined by the patients' progress.

Twelve RCTs reported adequate concealment of allocation. (20;29;31;34-36;38;39;41-44) All but 2 trials (12;37) collected data at baseline, and 15 trials reported blinded measurement of outcomes (mostly for objective outcomes such as hospital LOS and readmission). (12;17;20;30-38;40;41;44)

Results of discharge planning compared with usual care are shown in Table 5.

Table 5: Results of Discharge Planning Compared with Usual Care

Outcome	Summary Statistic (95% CI)	Number of Trials	N
Readmission within 3 months of discharge from hospital	RR, 0.85 (0.74–0.97)	11	2,552
Hospital LOS (days)	Mean difference, −0.91 (−1.55 to −0.27)	10	1,765
Mortality at 6–9 months	RR, 1.04 (0.74–1.46)	4	978

Abbreviations: CI, confidence interval; LOS, length of stay; RCT, randomized controlled trial; RR, relative risk.
Source: Shepperd et al, 2009 (4)

Patients' and caregivers' satisfaction were reported in 3 studies. (33;36;44) Overall, results were inconsistent. Moher et al (33) reported on a subgroup of 40 patients; 18 in the treatment group and 21 in the control group responded. The difference in terms of their satisfaction was significantly in favour of the treatment group (89% vs. 62%; mean difference, 27%; 95% CI, 2% – 52%, $P < 0.05$) on day 4 of their hospital stay. Nazareth et al (36) reported results from a client satisfaction questionnaire, but found no significant difference between the treatment and control groups at 3- or 6-months' follow-up. Weinberger et al (44) measured patient satisfaction at 1 and 6 months and found the intervention group significantly more satisfied than the control group ($P < 0.001$ at both time points).

Ten trials (17;24;29;31;36;37;39;41;43;44) measured patient outcomes including functional status, mental well-being, perception of health, self-esteem, and affect. Of these, 3 (24;31;44) did not report follow-up data, and 5 trials (17;29;36;37;39) observed no significant difference between study arms. Rich et al (41) reported a significant improvement on the total score for the Chronic Heart Failure Questionnaire (mean [SD] difference = 22.1 [20.8]); $P < 0.01$). Sulch et al (43) recruited patients recovering from a stroke and reported a significant functional improvement between 4 and 12 weeks' follow-up for the control group using the Barthel score (median within-group change of 6 points for the control group vs. 2 points for the treatment group; $P < 0.01$). However, between-group differences of the Barthel score were not statistically significant. HRQOL measured using the EuroQol showed significant between-group differences at 26 weeks' follow-up in favour of the control group (control group 72 points vs. treatment group 63 points; $P < 0.005$) but no differences were reported between groups for the Rankin score and the Hospital Anxiety and Depression Scale.

The systematic review by Shepperd et al (4) had a number of limitations:

- The reporting of different outcomes restricted the ability to pool data.
- A key issue in interpreting the evidence was the definition of the intervention and the subsequent understanding of the relative contribution of each element.
  - Authors of the trials did describe the interventions, but it was not possible to assess how some components of the process compared between trials. For example, the trial by Naylor et al (24) formalized the inclusion of the patient's caregiver into the assessment process and the

development of the discharge plan. Inclusion of the caregiver or family was mentioned by some of the other trials (17;30-32;35), but the degree to which this was done was not always apparent.

  - In terms of the discharge planning, one trial included a predischarge home visit by an occupational therapist and rehabilitation doctor, (37) another trial had hospital and community nurses working together on the discharge plan, (29) and 2 trials used an assessment tool to find cases eligible for discharge planning. (17;38)

- The majority of trials included a patient education component within the discharge planning process.
- The monitoring of discharge planning differed among trials. For example, one trial (24) did this primarily by telephone, while in another, (44) patients were given appointments to attend a primary care clinic.
- Three trials evaluated the effectiveness of a pharmacy discharge plan. (28;36;42)
- Assessing the extent to which contamination between the intervention and control groups occurred was difficult.
- The context in which discharge planning is delivered may play a role not only for the intervention but in the way services are configured for the control group.
  - Studies in the review were based in the United States, United Kingdom, Canada, Australia, Denmark, and France. In each country the orientation of primary care services differs in a way that may affect communication between services.
  - Different perceptions of care by professionals of alternative care settings and country-specific funding arrangements may also influence discharge.
- The point when discharge planning was implemented also varied across studies. For example, 2 trials (38;43) commenced discharge planning when patients were admitted to hospital, while another (44) implemented discharge planning 3 days prior to discharge.
- The patient population may also affect outcome. For example, 99 patients in the trial by Weinberger et al (44) had major complications related to their chronic disease. This, together with an intervention designed to increase the intensity of primary care services, may explain the observed increase in readmission days for those receiving the intervention.

Systematic Review of Comprehensive Discharge Planning with Postdischarge Support for Older Patients with Congestive Heart Failure

Phillips et al (11) evaluated the effect of comprehensive discharge planning plus postdischarge support for patients with congestive heart failure. Outcomes of interest included:

- rate of readmission
- all-cause mortality
- hospital LOS
- HRQOL

Inclusion criteria consisted of RCTs that

- described interventions to identify hospital discharge for older patients with congestive heart failure,
- delineated clearly defined inpatient and outpatient components,
- compared efficacy with usual care, and
- reported readmission as the primary outcome.

The literature search cut-off date was October 2003.

The analysis included 18 RCTs. (19;24;26;29;32;40;41;44-55) Characteristics of these are shown in Appendix 2, Tables A2-4 and A2-5.

Studies were assessed for quality using the Jadad scale. The most common reason for point deduction was the absence of double blinding, which was impossible due to the nature of the interventions. Of the 18 studies, 16 received a Jadad score of 4 out of 5, whereas 2 (26;51) received a score of 3 because they did not report data for loss to follow-up and blinding. However, most studies reported blinded assessment of outcomes. The pooled attrition rate due to nonresponse, withdrawals, or loss to follow-up was less than 5%, except for 1 study (32) with a rate of 8%.

Overall, fewer patients in the intervention group had to be readmitted compared with usual care (RR, 0.75; 95% CI, 0.64–0.88; *P* for heterogeneity < 0.001). Most of the heterogeneity was accounted for by results from a single large study. When this was omitted from the analysis, heterogeneity was reduced but nevertheless remained significant (RR, 0.74; 95% CI, 0.67–0.81; *P* for heterogeneity = 0.04). Results for the studies are shown in Table 6.

The evidence did not support the implicit assumption of incremental efficacy with more intensive postdischarge interventions. Comparable benefit resulted from a home visit, home visits and/or frequent telephone follow-up, and extended home care services. Increased clinic visits and/or frequent telephone contact did not result in a significant decrease in readmission rates. Day hospital visits, of which there was only 1 study, yielded a significant reduction in readmissions compared with usual care.

The authors found no significant difference in baseline use of angiotensin-converting enzyme (ACE) inhibitors in 14 trials ($P = 0.40$). Only 3 studies assessed the use of ACE inhibitors during follow-up (32;44;47;48), and the data did not show a significantly higher rate of ACE inhibitor use among the intervention groups, although these studies also showed no overall effect of the intervention on readmission rates.

Table 6: Readmission Rates with Comprehensive Discharge Planning Plus Postdischarge Support Compared with Usual Care

Author, Year	Intervention Events/Patients (%)	Control Events/Patients (%)	Absolute Risk Reduction, %	Relative Risk Reduction (95% CI)	*P* Value for Heterogeneity	Single or Combination (for "and/or" interventions)
Single Home Visit						
Stewart et al, 1998 (45)	24/49 (49)	31/48 (65)	16	0.76 (0.53–1.08)		NA
Stewart et al, 1999 (46)	40/100 (40)	51/100 (51)	11	0.78 (0.58–1.07)		NA
Jaarsma et al, 1999 (19)	31/84 (37)	47/95 (49)	12	0.75 (0.53–1.05)		NA
Subtotal	**95/233 (41)**	**129/243 (53)**	**12**	**0.76 (0.63–0.93)**	**0.97**	
Increased Clinic Follow-up and/or Frequent Telephone Contact						
Cline et al, 1998 (47)	22/80 (28)	43/110 (39)	13	0.70 (0.46–1.08)		Clinic only
Rainville, 1999 (26)	4/17 (24)	10/17 (59)	35	0.40 (0.16–1.03)		Telephone only
Oddone et al, 1999 and Weinberger et al. 1996 (44;48)	124/222 (56)	97/221 (44)	12+	1.27 (1.05–1.54)		Combination
McDonald et al, 2002 (49)	1/51 (2)	11/47 (23)	21	0.08 (0.01–0.62)		Telephone only
Subtotal	**151/370 (41)**	**161/395 (41)**	**0**	**0.64 (0.32–1.28)**	**< 0.001**	
Home Visits and/or Frequent Telephone Contact						
Naylor et al, 1994 (24)	16/72 (22)	23/70 (33)	11	0.68 (0.39–1.17)		Combination
Naylor et al, 1999 (50)	18/52 (35)	26/56 (46)	11	0.75 (0.47–1.19)		Combination
Serxner et al, 1998 (51)	15/55 (27)	27/54 (50)	23	0.55 (0.33–0.91)		Telephone only
Blue et al, 2001 (52)	47/84 (56)	49/81 (60)	4	0.92 (0.71–1.20)		Combination
Riegel et al, 2002 (53)	56/130 (43)	114/228 (50)	7	0.86 (0.68–1.09)		Telephone only
Krumholz et al, 2002 (54)	16/44 (36)	23/44 (52)	16	0.69 (0.43–1.13)		Telephone only
Subtotal	**168/437 (38)**	**262/533 (49)**	**11**	**0.79 (0.69–0.91)**	**0.59**	
Extended Home Care Services						
Rich et al, 1993 (40)	21/63 (33)	16/35 (46)	12	0.73 (0.44–1.02)		NA
Rich et al, 1995 (41)	41/142 (29)	59/140 (42)	13	0.69 (0.50–0.95)		NA
Harrison et al, 2002 (29)	21/92 (23)	31/100 (31)	8	0.74 (0.46–1.19)		NA
Laramee et al, 2003 (32)	49/141 (35)	46/146 (32)	3+	1.10 (0.79–1.53)		NA
Subtotal	**132/438 (30)**	**152/421 (36)**	**6**	**0.82 (0.68–1.00)**	**0.19**	
Day Hospital Services (with specialized HF unit)(49)						
Capomolla et al, 2002 (55)	9/112 (8)	37/122 (30	22	0.25 (0.15–0.44)		NA
Total	**555/1590 (35)**	**741/1714 (43)**	**8**	**0.75 (0.64–0.88)**	**< 0.001**	

Abbreviations: CI, confidence interval; HF, heart failure; RCT, randomized controlled trial; RR, relative risk; +, increased risk.
Source: Phillips et al, 2004 (11)

Data for all-cause mortality were reported in 14 studies. (19;26;29;32;41;44-48;52-55) There was no significant difference in all-cause mortality between the study arms (RR, 0.87; 95% CI, 0.73–1.03; *P* for heterogeneity = 0.06).

Ten studies (19;24;26;29;32;44-46;48;50) reported data for initial hospital LOS. This was similar for intervention and control patients (mean [standard error] 8.4 [2.5] vs. 8.5 [2.2] days, $P = 0.60$). The difference in LOS favoured intervention patients, but this difference was not statistically significant (difference −0.37; 95% CI, −0.15 to 0.60). Heterogeneity was not reported by the authors.

Six studies (19;29;41;46-48) reported data for HRQOL. All except for 2 used different measurement scales to assess this outcome. During 8 months of follow-up (range 3–12 months), HRQOL scores improved from baseline for patients in the intervention group (mean change, 25.7%; 95% CI, 11.0%–40.4%) and usual care group (mean change, 13.5%; 95% CI, 5.1%–22.0%), but the HRQOL scores of intervention patients improved significantly more than for the usual care patients (difference in mean change of scores, 12.2% [95% CI, 3.8%–20.6%], $P = 0.01$). Heterogeneity was not reported by the authors.

Limitations to the study by Phillips et al (11) included the following:

- There was significant heterogeneity among studies.
- Most studies did not explicitly describe usual care.
- 4 studies (26;40;41;52) did not report explicit data for the intervention duration.
- The duration of components for postdischarge support varied by study and was not consistently reported.
- For those studies that did not show a significant difference in readmission rates between comprehensive discharge planning with postdischarge support versus usual care, patients may already have been receiving optimal care, thereby minimizing the difference in effects of additional treatment.
- Several of the studies did not collect or report information about secondary outcomes such as hospital LOS or HRQOL scores.
- The optimal arrangement of components for individualized comprehensive discharge and postdischarge support was not determined.
- Inability to ascertain whether events that occurred distant from the index hospitalization were related to the initial admission or were new problems for patients who were readmitted or who died.

Recent Studies Not Included in Systematic Reviews

Four identified RCTs were not included in the systematic reviews. (56-59) A summary of results for the 4 studies is shown in Table 7.

Table 7: Summary of Recent Studies Not Included in Systematic Reviews

Author, Year, Country	Intervention	Control	Results	Limitations
Atienza et al, 2004 (59) Spain	n = 164 Patients and families received a predischarge formal education about disease from cardiac nurse Visit with primary care physician scheduled within 2 weeks of discharge Regular follow-up visits at the outpatient Heart Failure Clinic scheduled for every 3 months 24-hour phone contact number available to patients from discharge to end of study if patients experienced worsening symptoms	n = 174 Discharge planning according to the routine protocol of the study hospitals	Event-free survival Reduction of 47 events per 100 patients (95% CI, 29–65), P < 0.001 per year of observation in intervention patients Readmissions Reduction of 16% (95% CI, 4%–28%), P = 0.004 in rate of readmitted patients for any cause in intervention group Reduction of 37 all-cause readmissions per 100 patients (95% CI, 21–53), P < 0.001 per year of observation for intervention group Reduction of 19% (95% CI, 0.09–0.29), P < 0.001 in rate of readmitted patients for HF in intervention group Mortality Reduction of 10 deaths per 100 patients (95% CI, 0.02–0.18), P = 0.006 per observation year for intervention patients HRQOL at 1 year (Minnesota Quality of Life Score) Significantly higher improvement in intervention group (P = 0.01)	Unable to identify which elements of the intervention are responsible beneficial results
Naylor et al, 2004 (56) United States	n = 118 Comprehensive discharge planning and home follow-up directed by APNs APN visited at least daily during index hospitalization At least 8 APN home visits (one within 24 hours of discharge) Weekly visits during the first month (with one visit coinciding with the initial follow-up visit to the patient's physician); bimonthly visits during the second and third months. Additional APN visits based on patients' needs APN available by telephone 7 days/week	n = 121 Usual care for the control group included site-specific HF-patient management and discharge planning critical paths, and if referred, standard home agency care consisting of comprehensive skilled home health services 7 days a week.	**Time to first rehospitalization or death** Longer in intervention patients (log rank χ^2 = 5.0, *P* = 0.03) **Rehospitalization or death at 52 weeks** Intervention (n = 118 patients) vs. control (n = 121 patients) 56 (48%) vs. 74 patients (61%), *P* = 0.01 **Patients rehospitalized (1 time)** Intervention (n = 118 patients) vs. control (n = 121 patients) 53 (44.9%) vs. 67 (55.4%), *P* = 0.12; RR, 1.24 (95% CI, 0.95–1.60) **Rehospitalizations at 1 year** Intervention (n = 104 rehospitalizations) vs. control (n = 162 rehospitalizations) Index related: 40 vs. 72, *P* = 0.18 Comorbidity related: 23 vs. 50, *P* = 0.01 New health problem: 41 vs. 40, *P* = 0.88 **HRQOL** At 12 weeks, intervention group reported greater overall HRQOL (*P* < 0.05) No significant difference observed at other time points **Functional status** No significant difference observed at any time point **Satisfaction with care** Greater in intervention patients at 2 and 6 weeks (*P* < 0.001) No other time periods reported	Significantly more patients with hypertension in the control group than the treatment group, 71/121 (59%) vs. 54/121 (45%); *P* = 0.04 The primary outcome was time to first event (a combination of any cause readmission or death). There may not have been sufficient statistical power for assessment of some secondary outcomes e.g., patients rehospitalized or index-related rehospitalization at 1 year
Kwok et al, 2008 (57) China	n = 49 Community nurse visited before discharge, within 7 days of discharge, weekly for 4 weeks, then monthly Community nurses worked closely with designated hospital geriatricians or cardiologists; counselled patients on drug compliance and diet; encouraged patients to contact nurse via telephone hotline during office hours if symptoms developed	n = 56 Patients received usual care and follow-up in hospital outpatient clinics by same group of designated geriatricians or cardiologists used by intervention patients	**6-month readmission rate** No significant difference between intervention and control groups (46% and 57%, respectively, *P* = 0.23) Authors reported no significant difference for primary causes of readmission (no statistical test reported) **Unplanned readmissions** No significant difference (intervention: median 0 [quartile range 0, 1] vs. control: median 1 [quartile range 0, 2], *P* = 0.06) **Functional status (6MWT)** No significant difference between study groups **London Handicap Scale (6 domains)** Compared with controls, intervention group became significantly less limited in independence (median change in independence domain score 0 vs. 0.5, *P* < 0.005). No significant difference observed in other 5 domains	Intent-to-treat analysis not reported At baseline, more patients in intervention group receiving social security assistance than control group (23/49 [47%] vs. 14/56 [25%], respectively) Statistical comparisons not reported for baseline characteristics

Author, Year, Country	Intervention	Control	Results	Limitations
Zhao et al, 2009 (58) China	n = 100 A hospital nurse was responsible for the predischarge phase and 2 nurses in a community hospital were responsible for the postdischarge phase Key areas addressed were patients' understanding of and adherence to diet, medications, exercise, and health-related lifestyle Based on referral report from the hospital nurse, community nurses continued to follow-up the patients for 4 weeks via 2 home visits and 2 telephone calls.	n = 100 Physician talked to patients about special points that needed attention on returning home Free educational pamphlets on maintaining healthy eating and lifestyles were made available to patients	Endpoints measured at 2 days, 4 weeks, and 12 weeks postdischarge Patients in study group had significantly better understanding of diet, medications, and health-related lifestyle behaviour at 2 days, 4 weeks, and 12 weeks postdischarge and better understanding of exercise at weeks 4 and 12 Significant differences favouring intervention group in adherence to diet and health-related lifestyle at day 2, 4 weeks, and 12 weeks, medication at 4 and 12 weeks, and exercise at week 12 No significant difference between study groups for hospital readmission 82% of intervention patients considered community nursing follow-up very helpful, and 80% expressed high satisfaction with service Patient satisfaction not reported for control group	Instruments used to measure patient understanding, adherence and satisfaction were not standardized, validated measurement scales Outcome measures relied on self-reporting by patients. Data regarding extent of cardiovascular risk for the patients were not reported (e.g., weight, blood pressure, diabetes, etc.).

Abbreviations: χ^2, chi-square; 6MWT, 6-minute walking test**;** APN, Advanced Practice Nurses; CI, confidence interval; HF, heart failure; HRQOL, health-related quality of life; RR, relative risk.

Although the multicentre RCT by Naylor et al (56) was published in 2004, Hansen et al (7) excluded it from their systematic review because it did not report a 30-day readmission outcome. Similarly, the study by Naylor et al was excluded by Shepperd et al (4) from their systematic review because "the intervention was a complex package of care where the main emphasis was not on discharge planning." The RCT by Atienza et al, (59) also published in 2004, was excluded from the systematic review by Hansen et al (7) because it did not report a 30-day readmission outcome; however, it is unclear why it was excluded from the review by Shepperd et al. (4)

Atienza et al (59) evaluated the effectiveness of a discharge and outpatient management program in patients hospitalized for heart failure. Patients were randomized to usual care (n = 174) or an intervention (n = 164) consisting of a comprehensive hospital discharge planning and close follow-up at a heart failure clinic.

The intervention consisted of the following:

- patients and families received formal education about heart failure from a cardiac nurse before discharge;
- a visit with the patient's primary care physician was scheduled within 2 weeks of discharge;
- regular follow-up visits at the outpatient Heart Failure Clinic were scheduled every 3 months; and a 24-hour phone contact number was made available from discharge to the end of the study for patients to use if they experienced worsening symptoms.

The control group received discharge planning according to the routine protocol of the study hospitals.

The primary outcome was event-free survival defined on the basis of time to first event (any cause readmission or death) at 1 year. Secondary endpoints included rate of all-cause and heart failure readmissions per observation year, rate of death per observation year, and HRQOL.

Median follow-up was 509 days (interquartile range 365–649 days). Results are shown in Table 8.

Table 8: Summary of Results

Event-Free Survival	Readmissions	Mortality	HRQOL at 1 year (Minnesota Quality of Life Score)
Reduction of 47 events per 100 patients (95% CI, 29–65), *P* < 0.001 per year of observation in intervention patients. Intervention: 156 events (30 deaths and 126 all-cause readmissions) Control: 250 events (51 deaths 199 all-cause readmissions)	Reduction of 16% (95% CI, 4%–28%), *P* = 0.004 in the rate of ***readmitted patients for any cause*** in intervention group. Intervention: 68/164 patients Control: 101/174 patients Reduction of 37 ***all-cause readmissions*** per 100 patients (95% CI, 21–53), *P* < 0.001 per year of observation for intervention group. Intervention: 126 all-cause readmissions Control: 199 all-cause readmissions Reduction of 19% (95% CI, 0.09–0.29), P < 0.001 in the rate of ***readmitted patients for HF*** in the intervention group Intervention: 39/164 patients readmitted for HF Control: 79/174 patients readmitted for HF	Death rates per observation year were: Intervention: 0.14 Control: 0.24 Difference in rate of death per observation year: 0.10 (95% CI: 0.02–0.18), *P* = 0.006 Intervention: 30/164 deaths at end of follow-up Control: 51/174 deaths at end of follow-up	220 of 257 surviving patients completed questionnaire Significantly higher improvement in intervention group (*P* = 0.01) Intervention: baseline score 51.6; 1 year score 28.9 Control: baseline score 51.9; 1 year score 35.5

Abbreviations: CI, confidence interval; HF, heart failure; HRQOL health-related quality of life.
Source: Atienza et al, 2004 (59)

Limitations to the study by Atienza et al (59) included the following:

- The intervention elements that are responsible for beneficial results cannot be identified.
- This study had an additional component of postdischarge follow-up that the other studies in the systematic review by Phillips et al (11) did not have, namely patients were required to attend a heart failure clinic.

Naylor et al (56) examined the effect of a 3-month comprehensive discharge planning and home follow-up intervention directed by advanced practice nurses (APNs) compared with usual care for elders (aged 65 years or older) hospitalized with heart failure. The intervention consisted of the following:

- an initial APN visit within 24 hours of index hospital admission;
- APN visits at least daily during index hospitalization;
- at least 8 APN home visits (one visit within 24 hours of discharge);
- weekly visits during the first month (with one of these visits coinciding with the initial follow-up visit to the patient's physician);
- bimonthly visits during the second and third months;
- additional APN visits based on patients' needs; and
- APN telephone availability 7 days per week (8 AM to 8 PM on weekdays; 8 AM to noon on weekends).

A major focus of the APN's intervention during the hospitalization phase was collaboration with physicians and other providers to optimize the patient's health status at discharge, design the discharge plan, and arrange for needed home care services. Special emphasis was placed on preventing functional decline and streamlining medication regimens. After patients were discharged to their homes, APNs conducted assessments to identify changes in patients' health status and collaborated with each patient's physician regarding adjustments in medications and other therapies.

Usual care for the control group included site-specific heart failure-patient management and discharge planning critical paths and, if referred, standard home agency care consisting of comprehensive skilled home health services 7 days a week. The attending physician was responsible for determining the discharge date, and the primary nurse, discharge planner and physician collaborated in the design and implementation of the discharge plan. Standards and processes of care for the primary home care sites included use of liaison nurses to facilitate referrals to home care; availability of comprehensive intermittent skilled home care services in patients' residences 7 days per week and on-call registered nurse availability 24 hours per day. Of the control group, 58% (71/121) received referrals for skilled nursing or physical therapy after the index hospital discharge.

Patient telephone interviews were conducted at 2, 6, 12, 26, and 52 weeks after the index discharge to obtain information about rehospitalizations and unscheduled acute care visits to physicians, clinics, and EDs, HRQOL and functional status. The primary endpoint was time to first rehospitalization or death.

Results for the RCT by Naylor et al (56) are shown in Table 9.

Table 9: Results of Discharge Planning Compared with Usual Care

Outcome	Result
Time to first rehospitalization or death	Longer in intervention patients (log rank χ^2 = 5.0, *P* = 0.03) **Control vs. intervention** Incidence density ratio 1.65 (1.13–2.40), *P* = 0.001
Rehospitalization or death at 52 weeks	**Intervention (n = 118 patients) vs. control (n = 121 patients)** 56 (48%) vs. 74 patients (61%), *P* = 0.01
Patients rehospitalized	**Intervention (n = 118 patients) vs. control (n = 121 patients)**
1 time	53 (44.9%) vs. 67 (55.4%), *P* = 0.12; RR, 1.24 (95% CI, 0.95–1.60)
2 times	34 (28.8) vs. 44 (36.4%), *P* = 0.22; RR, 1.20 (95% CI, 0.89–1.60)
Rehospitalizations at 1 year	**Intervention (n = 104 rehospitalizations) vs. control (n = 162 rehospitalizations)** Index related: 40 vs. 72, *P* = 0.18 Comorbidity related: 23 vs. 50, *P* = 0.01 New health problem: 41 vs. 40, *P* = 0.88
HRQOL	At 12 weeks, intervention group reported greater overall HRQOL (*P* < 0.05) No significant difference observed at other time points
Functional status	No significant difference observed at any time point
Patient satisfaction	Satisfaction with care greater in intervention patients at 2 and 6 weeks (*P* < 0.001) No other time periods reported

Abbreviations: χ^2, chi-square; CI, confidence interval; RCT, randomized controlled trial; RR, relative risk
Source: Naylor et al, 2004 (56)

A limitation to the study by Naylor et al (56) was that the control group had significantly more patients with hypertension at baseline than the treatment group (71/121 [59%] versus 54/121 [45%]; $P = 0.04$, respectively.

Kwok et al (57) conducted an RCT to evaluate the effectiveness of a postdischarge community nursing program in older patients (aged 60 years or older) with chronic heart failure who had at least one hospital admission for heart failure in the 12 months prior to the index admission.

Patients in the intervention group (n = 49) received community nurse visits before discharge, within 7 days of discharge, weekly for 4 weeks, and then monthly. Community nurses worked closely with designated hospital geriatricians or cardiologists and counselled patients on drug compliance and diet. They also encouraged patients to contact the nurse via a telephone hotline during office hours when they developed symptoms.

Patients in the control group (n = 56) received usual care and were followed up in the hospital outpatient clinics by the same group of designated geriatricians or cardiologists.

The primary outcome was the rate of unplanned readmissions at 6 months postdischarge from hospital. Secondary outcomes included the number of unplanned readmission, the 6-minute walking test (6MWT) and London Handicap Scale domain scores. The 6 domains of handicap in this scale were mobility, independence, occupation, social, orientation, and economic.

Baseline characteristics were similar between the study groups except that more patients in the intervention group were receiving social security assistance than the control group (23/49 [47%] vs. 14/56 [25%], respectively). Statistical comparisons were not reported for baseline characteristics.

There was no significant difference in the 6-month readmission rate between the intervention and control groups (46% and 57% respectively, $P = 0.23$). The authors reported no significant difference between the groups in terms of primary causes of readmission (no statistical test reported).

There was no significant difference in the median number of unplanned readmissions between the study groups (intervention: median 0 [quartile range 0, 1] vs. control: median 1 [quartile range 0, 2], $P = 0.06$).

No significant difference was observed between the intervention and control group for change in functional status using 6MWT.

For the London Handicap Scale, there was a significant difference between the groups for the independence domain. Compared with the control group, patients in the intervention arm became significantly less limited in independence (median change in independence domain score 0 vs. 0.5, $P < 0.005$). No significant difference was observed in the other 5 domains.

Limitations to the RCT by Kwok et al (57) included:

- Small sample size. The authors conducted a sample size analysis that required 50 patients per group to have an 80% chance of detecting a 40% relative reduction in readmission rate at a confidence interval of 95%. There were 44/49 intervention patients and 46/56 control group patients who completed the study. Intent-to-treat analysis was not reported by the authors.
- A significant difference in economic status between the study arms at baseline.

Zhao et al (58) conducted an RCT (N = 200) to determine the effectiveness of a discharge planning program among patients with newly diagnosed coronary heart disease. Patients in the intervention arm (n = 100) received a discharge planning program consisting of 2 phases. A nurse from the hospital was responsible for the predischarge phase, and 2 nurses in a community hospital were responsible for the postdischarge phase. Key areas addressed by all nurses were patients' understanding of and adherence to diet, medications, exercise, and health-related lifestyle such as getting enough rest and quitting smoking. Based on the instructions in the hospital nurse's referral report, the community nurses continued to follow the patients for 4 weeks via 2 home visits and 2 telephone calls.

Patients in the control group (n = 100) received routine care, which involved a physician talking to them about special points that needed attention on returning home. Patients were given educational pamphlets on maintaining healthy eating habits and lifestyles.

Outcome measures were:

- patient understanding (ranked high, moderate or low) of diet, medications, exercise, and HRQOL;
- patient adherence (ranked high, moderate, or low) to diet, medications, exercise, and health-related lifestyle;
- health care utilization; and
- satisfaction with care.

The authors did not report a primary outcome. Endpoints were measured at 2 days, 4 weeks, and 12 weeks postdischarge.

Results of the RCT are shown in Table 10. Overall, patients in the study group had a significantly better understanding of diet, their medications, and health-related lifestyle behaviour at 2 days, 4 weeks, and 12 weeks postdischarge and a better understanding of exercise at weeks 4 and 12. In addition, there were significant differences favouring the intervention group in adherence to diet and health-related lifestyle at 2 days, 4 weeks, and 12 weeks; medication at 4 weeks and 12 weeks; and exercise at week 12.

There was no significant difference between the study groups for hospital readmission at 12 weeks postdischarge, $P = 0.83$.

Of the intervention patients, 82% considered the community nursing follow-up to be very helpful, and 80% expressed high satisfaction with the service. Patient satisfaction was not reported for the control group.

Table 10: Results of Discharge Planning Compared with Usual Care

Outcome	Result (Intervention Compared With Control)
Understanding of diet, medications, exercise, and HRQOL	
Diet	Intervention patients had a significantly better understanding of diet at all endpoints 2 days: $P = 0.00$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.00$
Medications	Intervention patients had a significantly better understanding of medications at all endpoints 2 days: $P = 0.00$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.00$
Exercise	Intervention patients had a significantly better understanding of exercise at 4 and 12 weeks 2 days: $P = 0.06$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.00$
Health-related lifestyle	Intervention patients had a significantly better understanding of health-related lifestyle at all endpoints 2 days: $P = 0.00$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.00$
Adherence to diet, medications, exercise, and health-related lifestyle	
Diet	Intervention patients had significantly better adherence to diet at all endpoints 2 days: $P = 0.00$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.02$
Medications	Intervention patients had significantly better adherence to medications at 4 and 12 weeks 2 days: $P = 0.68$; 4 weeks: $P = 0.01$; 12 weeks: $P = 0.00$
Exercise	Intervention patients had significantly better adherence to exercise at 12 weeks 2 days: $P = 0.92$; 4 weeks: $P = 0.17$; 12 weeks: $P = 0.00$
Health-related lifestyle	Intervention patients had significantly better adherence to health-related lifestyle at all endpoints 2 days: $P = 0.03$; 4 weeks: $P = 0.00$; 12 weeks: $P = 0.00$
Health care utilization	
Readmission related to CHD	No significant difference between intervention and control patients at 12 weeks, $P = 0.83$
Readmission related to other diseases	No significant difference between intervention and control patients at 12 weeks, $P = 0.25$
Satisfaction with care	
Patient satisfaction	82% of intervention patients considered postdischarge community nursing very helpful 80% of intervention patients expressed high satisfaction with postdischarge community nursing

Abbreviations: CHD, coronary heart disease; HRQOL, health-related quality of life.
Source: Zhao et al, 2009 (58)

Limitations to the study by Zhao et al (58) included the following:

- The study took place in an affluent city in China, therefore generalizability to other cities is limited.
- The instruments used to measure patient understanding, adherence, and satisfaction were not standardized, validated measurement scales.
- The outcome measures (including health care utilization) relied on patient self-reports.
- Data regarding the extent of cardiovascular risk for the patients were not reported (e.g., weight, blood pressure, diabetes, etc.).

Conclusions

Conclusions for this evidence-based analysis are shown in Table 11. Details about GRADE for each outcome are in Appendix 3.

Table 11: Conclusions of Evidence-Based Review

Outcome	Conclusion
Individualized Discharge Planning Compared With Usual Care	
Readmissions	Moderate quality evidence that individualized discharge planning is more effective at reducing readmissions
Hospital LOS	Moderate quality evidence that individualized discharge planning is more effective at reducing initial hospital LOS
Mortality	Moderate quality evidence that individualized discharge planning is not more effective at reducing mortality
HRQOL	Very low quality evidence that individualized discharge planning is more effective at improving HRQOL
Patient Satisfaction	Very low quality evidence that individualized discharge planning is more effective at improving patient satisfaction
Individualized Discharge Planning Plus Postdischarge Support Compared With Usual Care	
Readmissions	Low quality evidence that discharge planning plus postdischarge support is more effective at reducing readmissions
Hospital LOS	Low quality evidence that discharge planning plus postdischarge support is not more effective at reducing LOS
Mortality	Low quality evidence that discharge planning plus postdischarge support is not more effective at reducing mortality
HRQOL	Very low quality evidence that discharge planning plus postdischarge support is more effective at improving HRQOL
Patient Satisfaction	Very low quality evidence that discharge planning plus postdischarge support is more effective at improving patient satisfaction

Abbreviations: HRQOL, health-related quality of life; LOS, length of stay.

Overall limitations to the studies in this evidence-based analysis were as follows:

- It was difficult to distinguish the relative contribution of each element within the umbrella terms "discharge planning" and "postdischarge support."
- The context in which discharge planning is delivered may play a role not only for the intervention but in the way services are configured for the control group (i.e., for different countries, the orientation of primary care services differs, which may affect communication between services).
- The specific time point in a patient's hospital admission when discharge planning was implemented varied across studies (i.e., at time of admission vs. 3 days before discharge). The duration of components for postdischarge support also varied across studies.
- For most studies, "usual care" was not explicitly described.
- Some studies may have been underpowered to detect a statistically significant difference in outcomes (type 2 error).
- Many studies were unable to determine whether events that occurred distant from the index hospitalization were related to the initial admission or whether they were new problems for patients who were readmitted or died.

Acknowledgements

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: January 29th, 2012
Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination

Limits: 2004-current; English; MA/SR/HTA/RCT filter

Database: Ovid MEDLINE(R) <1946 to January Week 3 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 27, 2012>, Embase <1980 to 2012 Week 04>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212075
2	exp Myocardial Infarction/ use mesz	133578
3	exp heart infarction/ use emez	216992
4	(coronary artery disease or cad or heart attack).ti.	44463
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149559
6	or/1-5	539975
7	exp Atrial Fibrillation/ use mesz	28093
8	exp heart atrium fibrillation/ use emez	55522
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73540
10	or/7-9	99451
11	exp heart failure/	300981
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234590
13	11 or 12	381953
14	exp Stroke/	178088
15	exp Ischemic Attack, Transient/ use mesz	16370
16	exp transient ischemic attack/ use emez	19680
17	exp stroke patient/ use emez	5637
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101006
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	281375
20	or/14-19	391798
21	exp Diabetes Mellitus, Type 2/ use mesz	68223
22	exp non insulin dependent diabetes mellitus/ use emez	101711
23	exp diabetic patient/ use emez	12920
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	765351
25	or/21-24	790292
26	exp Skin Ulcer/	72073
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28723
28	(decubitus or bedsore*).ti,ab.	8532
29	or/26-28	90816
30	exp Pulmonary Disease, Chronic Obstructive/ use mesz	17049
31	exp chronic obstructive lung disease/ use emez	54779

32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54491
33	(copd or coad).ti,ab.	45716
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37444
36	exp chronic bronchitis/ use emez	6985
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50848
38	or/30-37	159366
39	exp Chronic Disease/	340792
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	220217
41	39 or 40	506604
42	exp Comorbidity/	143585
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	203652
44	42 or 43	284365
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2823779
46	exp Patient Discharge/ use mesz	16001
47	exp hospital discharge/ use emez	48313
48	((post-discharge or postdischarge or post-hospital or posthospital or discharge) adj2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*)).ti,ab.	46581
49	exp Medication Reconciliation/ use mesz	85
50	exp Medication Errors/pc use mesz	3717
51	exp medication therapy management/ use emez	736
52	exp medication error/pc use emez	2159
53	((medication* or drug*) adj2 (reconcil* or manage*)).ti,ab.	9668
54	or/46-53	108369
55	45 and 54	27866
56	limit 55 to english language	25438
57	limit 56 to yr="2004 -Current"	16734
58	limit 57 to (controlled clinical trial or meta analysis or randomized controlled trial)	1072
59	exp Technology Assessment, Biomedical/ or exp Evidence-based Medicine/ use mesz	63494
60	exp Biomedical Technology Assessment/ or exp Evidence Based Medicine/ use emez	524160
61	(health technology adj2 assess*).ti,ab.	3066
62	exp Random Allocation/ or exp Double-Blind Method/ or exp Control Groups/ or exp Placebos/ use mesz	379985
63	Randomized Controlled Trial/ or exp Randomization/ or exp RANDOM SAMPLE/ or Double Blind Procedure/ or exp Triple Blind Procedure/ or exp Control Group/ or exp PLACEBO/ use emez	902695
64	(random* or RCT).ti,ab.	1256935
65	(placebo* or sham*).ti,ab.	414541
66	(control* adj2 clinical trial*).ti,ab.	35105
67	meta analysis/ use emez	58676
68	(meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab.	253317
69	or/59-68	2167232
70	(57 and 69) or 58	2889
71	remove duplicates from 70	2308

CINAHL

#	Query	Limiters/Expanders	Results
S45	S34 and S40 and S43	Limiters - Published Date from: 20040101-20121231; English Language; Exclude MEDLINE records Search modes - Boolean/Phrase	38
S44	S34 and S40 and S43	Search modes - Boolean/Phrase	369
S43	S41 or S42	Search modes - Boolean/Phrase	156355
S42	random* or sham*or rct* or health technology N2 assess* or meta analy* or metaanaly* or pooled analysis or (systematic* N2 review*) or published studies or medline or embase or data synthesis or data extraction or cochrane or control* N2 clinical trial*	Search modes - Boolean/Phrase	148276
S41	(MH "Random Assignment") or (MH "Random Sample+") or (MH "Meta Analysis") or (MH "Systematic Review") or (MH "Double-Blind Studies") or (MH "Single-Blind Studies") or (MH "Triple-Blind Studies") or (MH "Placebos") or (MH "Control (Research)")	Search modes - Boolean/Phrase	83647
S40	S35 or S36 or S37 or S38 or S39	Search modes - Boolean/Phrase	19853
S39	medication* N2 reconcil* or drug* N2 reconcil* or drug N2 manage* or medication N2 manage*	Search modes - Boolean/Phrase	1997
S38	(MH "Medication Errors/PC")	Search modes - Boolean/Phrase	3605
S37	(MH "Medication Reconciliation")	Search modes - Boolean/Phrase	241
S36	post-discharge or postdischarge or post-hospital or posthospital or discharge N2 plan* or discharge N2 summar* or discharge N2 co-ordinat* or discharge N2 coordinat* or discharge N2 manage*or discharge N2 service*	Search modes - Boolean/Phrase	5580
S35	(MH "Patient Discharge+")	Search modes - Boolean/Phrase	12852
S34	S5 OR S8 OR S11 OR S15 OR S19 OR S22 OR S27 OR S30 OR S33	Search modes - Boolean/Phrase	221088
S33	S31 OR S32	Search modes - Boolean/Phrase	28945
S32	comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* N1 patient*) OR "patient* with multiple" OR (multiple N2 (condition* OR disease*))	Search modes - Boolean/Phrase	28945
S31	(MH "Comorbidity")	Search modes - Boolean/Phrase	16646
S30	S28 OR S29	Search modes - Boolean/Phrase	43734
S29	(chronic* N2 disease*) OR (chronic* N2 ill*)	Search modes - Boolean/Phrase	43734
S28	(MH "Chronic Disease")	Search modes - Boolean/Phrase	23647
S27	S23 OR S24 OR S25 OR S26	Search modes - Boolean/Phrase	8774
S26	chronic N2 bronchitis OR emphysema	Search modes - Boolean/Phrase	1820
S25	(MH "Emphysema")	Search modes - Boolean/Phrase	885
S24	chronic obstructive N2 disease* OR chronic obstructive N2 disorder* OR copd OR coad	Search modes - Boolean/Phrase	7349
S23	(MH "Pulmonary Disease, Chronic Obstructive+")	Search modes - Boolean/Phrase	5342
S22	S20 OR S21	Search modes - Boolean/Phrase	16179
S21	pressure N1 ulcer* OR bedsore* OR bed N1 sore* OR skin N1 ulcer* OR pressure N1 wound* OR decubitus	Search modes - Boolean/Phrase	9574
S20	(MH "Skin Ulcer+")	Search modes - Boolean/Phrase	14845
S19	S16 OR S17 OR S18	Search modes - Boolean/Phrase	70185

S18	diabetes OR diabetic* OR niddm OR t2dm	Search modes - Boolean/Phrase	70185
S17	(MH "Diabetic Patients")	Search modes - Boolean/Phrase	3536
S16	(MH "Diabetes Mellitus, Type 2")	Search modes - Boolean/Phrase	18233
S15	S12 OR S13 OR S14	Search modes - Boolean/Phrase	38210
S14	stroke OR tia OR transient ischemic attack OR cerebrovascular apoplexy OR cerebrovascular accident OR cerebrovascular infarct* OR brain infarct* OR CVA	Search modes - Boolean/Phrase	37713
S13	(MH "Cerebral Ischemia, Transient")	Search modes - Boolean/Phrase	1903
S12	(MH "Stroke") OR (MH "Stroke Patients")	Search modes - Boolean/Phrase	25676
S11	S9 OR S10	Search modes - Boolean/Phrase	18862
S10	myocardi* failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation OR cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	Search modes - Boolean/Phrase	18850
S9	(MH "Heart Failure+")	Search modes - Boolean/Phrase	14393
S8	S6 OR S7	Search modes - Boolean/Phrase	8072
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	Search modes - Boolean/Phrase	8072
S6	(MH "Atrial Fibrillation")	Search modes - Boolean/Phrase	6490
S5	S1 OR S2 OR S3 OR S4	Search modes - Boolean/Phrase	30133
S4	TI myocardi* N2 infarct* OR TI heart N2 infarct* OR TI cardiac N2 infarct* OR TI coronary N2 infarct* OR TI arterioscleros* OR TI atheroscleros*	Search modes - Boolean/Phrase	9643
S3	coronary artery disease OR cad OR heart attack*	Search modes - Boolean/Phrase	7706
S2	(MH "Myocardial Infarction+")	Search modes - Boolean/Phrase	19219
S1	(MH "Coronary Arteriosclerosis")	Search modes - Boolean/Phrase	4646

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor Coronary Artery Disease explode all trees	2183
#2	MeSH descriptor Myocardial Infarction explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor Atrial Fibrillation explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor Heart Failure explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor Stroke explode all trees	3899
#9	MeSH descriptor Ischemic Attack, Transient explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor Diabetes Mellitus, Type 2 explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor Skin Ulcer explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor Pulmonary Disease, Chronic Obstructive explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor Emphysema explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	(Chronic Disease):ti	4464
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor Comorbidity explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	**(**#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	61123
#27	MeSH descriptor Patient Discharge explode all trees	863
#28	(post-discharge or postdischarge or post-hospital or posthospital or discharge) NEAR/2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*):ti	478
#29	MeSH descriptor Medication Reconciliation explode all trees	2
#30	MeSH descriptor Medication Errors explode all trees with qualifier: PC	103
#31	(medication* or drug*) NEAR/2 (reconcil* or manage*):ti	71
#32	(#27 OR #28 OR #29 OR #30 OR #31)	1285
#33	(#26 AND #32), from 2004 to 2012	131

Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	224
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	168
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	280
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	622
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1223
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	219
19	(copd or coad):TI	108
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	252
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	((comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*)))):TI	21
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4655

28	MeSH DESCRIPTOR Patient Discharge EXPLODE ALL TREES	146
29	(((post-discharge or postdischarge or post-hospital or posthospital or discharge) adj2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*))):TI	27
30	MeSH DESCRIPTOR Medication Errors EXPLODE ALL TREES WITH QUALIFIER PC	19
31	(((medication* or drug*) adj2 (reconcil* or manage*))):TI	20
32	#28 OR #29 OR #30 OR #31	189
33	#27 AND #32	32

Appendix 2: Results

Table A1: Quality (EPOC) of Randomized Controlled Trials[a]

Author, Year	Allocation Sequence Random	Allocation Concealed	Baseline Outcomes Similar	Baseline Characteristics Similar	Plan for Missing Data/ Incomplete Data for Primary Outcome	Blinding	No Contamination	Free of Selective Outcome Reporting Risk	No Other Bias	EPOC Group Risk of Bias Criteria (9 Maximum Score)
Balaban et al, 2008 (12)	1	Unclear	Unclear	1	1	1	0	1	0	5
Braun et al, 2009 (13)	0	1	Unclear	0	1	1	1	1	0	5
Coleman et al, 2006 (14)	1	1	Unclear	0	1	1	0	1	0	5
Dudas et al, 2001 (15)	1	Unclear	Unclear	1	Unclear	1	0	1	0	4
Dunn et al, 1994 (16)	1	Unclear	Unclear	0	0	1	1	1	0	4
Evans et al, 1993 (17)	1	Unclear	Unclear	1	Unclear	1	0	1	0	4
Forster et al, 2005 (18)	1	1	Unclear	1	Unclear	1	0	1	0	5
Jaarsma et al, 1999 (19)	1	1	Unclear	1	Unclear	1	0	1	0	5
Jack et al, 2009 (20)	1	1	Unclear	1	Unclear	1	1	1	0	6
Koehler et al, 2009 (21)	1	1	Unclear	1	Unclear	1	1	1	0	6
Kwok et al, 2004 (22)	1	1	Unclear	1	Unclear	1	1	1	0	6
McDonald et al, 2001 (23)	1	Unclear	Unclear	1	Unclear	1	1	Unclear	0	4
Naylor et al, 1994 (24)	1	0	Unclear	1	Unclear	1	1	1	0	5
Parry et al, 2009 (25)	1	1	Unclear	1	1	1	1	1	0	7
Rainville, 1999 (26)	1	1	Unclear	1	1	1	1	1	0	7
Wong et al, 2008 (27)	1	Unclear	Unclear	0	0	1	1	1	1	5

Abbreviations: EPOC, Effective Practice and Organization of Care Criteria.
[a]http://epoc.cochrane.org/epoc-author-resources.
Source: Hansen et al, 2011. (7)

Table A2: Randomized Controlled Trials

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
Balaban et al, 2008 (12) N = 96	A comprehensive patient discharge form was given to patients to identify any communication problems during transition of care (i.e., lack of knowledge about condition and gaps in outpatient follow-up care or test results). Discharge form electronically transferred to the RN at patients' primary care facility. RN contacted patient and reviewed form and medication included in the discharge plan. RN phoned patient to assess status, review form, assess patient concerns and confirm follow-up appointments. Form and telephone notes forwarded electronically to PCP who reviewed the form.	Patients admitted to a 100-bed community teaching hospital as an emergency Patients with diabetes, HF, COPD, depression	Hospital LOS and readmission rates Follow-up at 21 and 31 days	Adequate sequence generation? Unclear Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? No	122 randomized 24 excluded after randomization because discharged to another institution; 2 died during hospital admission
Bolas et al, 2004 (28) N = 243	Use of a comprehensive medication history service, provision of an intensive clinical pharmacy service including management of patients' own drugs brought to hospital, personalized drug record and patient counselling to explain changes at discharge. Discharge letter outlining complete drug history on admission and explanation of changes to medication during hospital and variances to discharge prescription faxed to GP and community pharmacist. Personalized drug card, counselling, labelling of dispensed drugs for follow-up. Drug helpline. Control intervention: standard clinical pharmacy services.	Patients admitted to district general hospital Aged ≥ 55 years and taking ≥ 3 regular drugs	Patient satisfaction Knowledge of drugs Hoarding of drugs	Adequate sequence generation? Yes Allocation concealment? Unclear Blinding? No Incomplete outcome data addressed? No Free of selective reporting? Unclear Baseline data? Yes	Follow-up of patients: 67% (162/243) Low response rate in survey of GPs (55%) and community pharmacists (56%) Unclear how standard clinical pharmacy services differ from intervention.
Evans et al, 1993 (17) N = 835	Patients screened for risk factors that may prolong hospital LOS, increase risk of readmission, or discharge to a nursing home. During discharge planning, information on support systems, living situation, finances, and areas of need were obtained from medical notes, interviews with the patient and family, and by consulting with the physician and nurse. Discharge planning initiated on day 3 of hospital admission, with patients referred to a social worker. Plans implemented with measureable goals using goal attainment scaling. Control intervention: discharge planning only if referred by medical staff and usually on the 9th day of hospital admission, or not at all.	Patients screened for risk factors that would prolong their LOS at a VA hospital Older patients with a medical condition, neurological condition, or recovering from surgery	Hospital LOS Readmission to hospital Discharge destination Health status Follow-up at 3 months	Adequate sequence generation? Unclear Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	Controls could receive discharge planning
Harrison et al, 2002 (29) N = 200	Patients' notes were flagged at admission as a signal to the primary nurse to follow a checklist for discharge planning. Hospital and community nurses working together for a smooth transition from hospital to home. A structured protocol was used for counselling and education for HF self-management. Home nursing visits were the same number as the control group. Telephone outreach within 24 hours of discharge. Control intervention: usual care for hospital to home transfer that involved completing a medical history, nursing assessment form, and a multidisciplinary plan. Discharge planning meetings took place weekly. Regional home care co-ordinator consulted with the hospital team as needed. Patients received the same number of home nurse visits as the intervention group.	Older, cognitively unimpaired people with HF who were expected to be discharged (from a large urban teaching hospital) with home nursing care	HRQOL Symptoms distress and functioning ED visits and readmissions at 12 weeks	Adequate sequence generation? Yes Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? No Free of selective reporting? Yes Baseline data? Yes	

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
Hendriksen et al, 1990 (30) N = 273	Patients had daily contact with the project nurse who discussed their illness and discharge arrangements with them. Liaison between hospital and primary care staff. Project nurse visited patients at home after discharge and could make one repeat visit. Control intervention: described as "usual care."	Elderly patients admitted to a suburban hospital	Hospital LOS Readmission to hospital Discharge destination	Adequate sequence generation? Unclear Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Unclear Free of selective reporting? Unclear Baseline data? Yes	Details of measures of outcome not provided Translated from Danish
Jack et al, 2009 (20) N = 749	At admission, the nurse discharge advocate completed the discharge intervention components. With information collected from the hospital team and patient, the discharge advocate created the after-hospital care plan that contained medical provider contact information, dates for appointments and tests, an appointment calendar, a colour-coded drug schedule, a list of tests with pending results at discharge, an illustrated description of the discharge diagnosis, and information about what to do if a problem arises. Information for the after-hospital care plan was manually entered into a Microsoft Word template, printed, and bound to produce an individualized booklet. Discharge advocate used scripts from the training manual to review contents of the after-hospital care plan with the patients. On day of discharge, the plan and discharge summary were faxed to the PCP. Pharmacist telephoned patients 2–4 days after the index discharge to reinforce the discharge plan by using a scripted interview. Pharmacist had access to the care plan and discharge summary and over several days made at least 3 attempts to reach each patient. Pharmacist asked patient to bring drugs to the phone, review them, and address any problems. Pharmacist communicated these issues to the PCP or discharge advocate.	Patients who were emergency admissions to the medical teaching service and who were going to be discharged home	Readmission Patient satisfaction	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Kennedy et al, 1987 (31) N = 80	Discharge planning emphasized communication with the patient and family. A primary nurse assessed patients' postdischarge needs. A comprehensive discharge planning protocol was developed that included an assessment of health status, orientation level, knowledge and perception of health status, pattern of resource use, functional status, skill level, motivation, and sociodemographic data. Implementation of the discharge plan by the primary nurse and other members of the health care team. Follow-up visit made to assess discharge placement. Control intervention: not described.	Elderly acute care medical patients in a non-profit teaching hospital	Hospital LOS Readmission to hospital Discharge destination Health status	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	Not clear when intervention implemented
Laramee et al, 2003 (32) N = 287	Early discharge planning and co-ordination of care and individualized and comprehensive patient and family education. Case manager assisted in the co-ordination of care by facilitating the discharge plan and obtaining needed consultations from social services, dietary services, and physical/occupation therapy. If needed, arrangements were made for additional services or support once the patient had returned home. Case manager also facilitated communication in the hospital among patient and family, attending physician, cardiology team, and other practitioners by participating in	Patients admitted to an academic medical centre with confirmed HF who were at risk for early readmission	Readmissions Mortality Hospital bed days Resource use Patient satisfaction Follow-up at 3 months	Adequate sequence generation? Unclear Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting?	

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
	daily rounds, documenting patient needs in the medical record, submitting progress reports to the primary care physician, involving the patient and family in developing the plan of care, collaborating with the home health agencies, and providing informational and emotional support to the patient and family. 12 weeks of enhanced telephone follow-up and surveillance. Control intervention: social services evaluation (25% for usual care group), dietary consultation (15% usual care), physiotherapy/occupational therapy (17% usual care), drug and HF education by staff nurses and any other hospital services. Home care (44%).			Unclear Baseline data? Yes	
Moher et al, 1992 (33) N = 267	A nurse employed as a team co-ordinator acted as a liaison between members of the medical team and collected patient information. The nurse facilitated discharge planning. Control intervention: standard medical care.	Elderly medical patients admitted to a teaching hospital	Hospital LOS Readmission to hospital Discharge destination Patient satisfaction	Adequate sequence generation? Yes Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	Baseline data recorded only on age, sex, diagnosis Not clear when intervention implemented
Naji et al, 1999 (34) N = 343	Psychiatrist telephoned GP to discuss patient and make an appointment for the patient to see the GP within 1 week following discharge. A copy of the discharge summary was given to the patient to hand deliver to the GP. Control intervention: standard care. Patients advised to make an appointment to see their GP and were given a copy of the discharge summary to hand deliver to the GP.	Acute psychiatric admissions	Readmission Mental health status Discharge process Follow-up at 1 month for patient assessed outcomes 6 months for readmissions	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Unclear Free of selective reporting? Unclear Baseline data? Yes	Psychiatric patients
Naughton et al, 1994 (35) N = 111	A geriatric evaluation and management team assessed the patient's mental and physical health status and psychosocial condition to determine level of rehabilitation required and social needs. A geriatrician and social worker were the core team members. Team meetings with the team and nurse specialist and physical therapist took place twice a week to discuss patients' medical condition, living situation, family and social supports and patient and family's understanding of the patient's condition. Social worker responsible for identifying and co-ordinating community resources and ensuring the posthospital treatment place was in place at the time of discharge and 2 weeks later. Nurse specialist co-ordinated the transfer to home health care. Patients who did not have a primary care provider received outpatient care at the hospital. Control intervention: received "usual care" by medical house staff and an attending physician. Social workers and discharge planners were available on request.	Elderly medical patients admitted from ED in a non-profit academic medical centre	Hospital LOS Discharge destination	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	Intervention implemented at time of admission
Naylor et al, 1994 (24)	Discharge plan included a comprehensive assessment of the needs of the elderly patient and their caregiver, an education component for the patient and family, and interdisciplinary communication regarding	Elderly medical and cardiac surgery patients in an academic medical	Hospital LOS Readmission to hospital	Adequate sequence generation? Unclear	Intervention implemented at time of admission

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
N = 276	discharge status. Implemented by geriatric nurse specialist and extended from admission to 2 weeks postdischarge with ongoing evaluation of the effectiveness of the discharge plan. Control intervention: routine discharge planning available in the hospital.	centre	Health status	Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Nazareth et al, 2001 (36) N = 362	Hospital pharmacist assessed and rationalized the patients' drug treatment, provided information, and liaised with caregiver and community professionals. Aim was to optimize communication between secondary and primary care professionals. Follow-up visit by community hospital 7–14 days after discharge to check drug and intervene if necessary. Subsequent visits arranged if appropriate. Copy of discharge plan given to the patient, caregiver, community pharmacist, and GP. Follow-up in the community by a pharmacist. Control intervention: discharge from hospital following standard procedures, which included a letter of discharge to the GP. Pharmacist did not provide a review of drugs or follow-up in the community.	Elderly patients on ≥ 4 drugs who were discharged from 3 acute wards and 1 long-stay ward	Hospital readmission Mortality HRQOL Client satisfaction Knowledge and adherence to prescribed drugs Consultation with GP	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Pardessus et al, 2002 (37) N = 60	All admitted patients during the trial period were screened for inclusion and exclusion criteria. 2-hour home visit by occupational therapist and a physical medicine/rehabilitation doctor to evaluate patient abilities in home environment. Enabled observation of patient in their living conditions.. Social supports addressed by social worker. Modification of home hazards and safety advice in home situation, adaptation of recommendations and prescriptions particularly for physical therapy, speedy evaluation of necessary technical aids and social supports. Telephone follow-up was conducted by an occupational therapist to check if the home modifications were completed and assist if necessary. Control intervention: received physical therapy and were informed of home safety and social assistance if required. No home visit.	Patients aged ≥ 65 years who were hospitalized due to falls and able to return home	Functional status Falls Readmissions Mortality Residential care at 6 and 12 months	Adequate sequence generation? Yes Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Unclear	
Parfrey et al, 1994 (38) N = 841	Developed a questionnaire to identify patients requiring discharge planning. Assessment based on the questionnaire that covered the patient's social circumstances at home, if the admission was an emergency admission or a readmission, use of allied health and community services, mobility and activities of daily living, and medical or surgical condition. Referrals to allied health professionals following completion of the questionnaire for discharge planning. Control intervention: did not receive the questionnaire. Discharge planning occurred if the discharge planning nurses identified a patient or received a referral.	Medical and surgical patients	Hospital LOS at 6 and 12 months	Adequate sequence generation? Unclear Allocation concealment? Yes Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	Intervention implemented at time of admission

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
Preen et al, 2005 (39) N = 189	Discharge planning was based on the Australian Enhanced Primary Care Program and tailored to each patient. Discharge plan was developed 24–48 hours prior to discharge. Problems were identified from hospital notes and patient/caregiver consultation, goals were developed and agreed upon with the patient/caregiver based on personal circumstances and interventions, and community service providers who met patient needs and who were accessible and agreeable to the patient were identified. Discharge plan was faxed to the GP and consultation with the GP was scheduled within 7 days postdischarge. Copies faxed to all service providers identified on the care plan. Research nurse followed up if GP did not respond in 24 hours and the GP scheduled a consultation (within 7 days postdischarge) for patient review. Control intervention: patients were discharged under the hospitals' existing processes following standard practice in Western Australia where all patients have a discharge summary completed, which was copied to their general practitioner.	Patients with COPD, cardiovascular disease, or both in 2 tertiary hospitals	SF-12 Patient satisfaction and views of discharge process and GP views of the discharge planning process at 7 days postdischarge	Adequate sequence generation? Unclear Allocation concealment? Yes Blinding? No Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Rich et al, 1993 (40) N = 98	Intensive education about HF and its treatment during daily visits by cardiovascular research nurse to discuss diagnosis, symptoms, treatment, follow-up, and prognosis using a 15-page booklet. Dietary advice by dietician and study nurse. Assessment of medication with recommendations designed to improve compliance and reduce adverse effects. Drug card provided detailing the time, dose, and side effects of all drugs. Daily recording of weights emphasized and patients instructed to contact researchers for weight changes in excess of 3 to 5 pounds. Scales provided if needed. Early discharge planning. Patient seen by social worker and member of the home care team to facilitate discharge planning and ease the transition from the hospital to home. Economic, social, and transport problems identified and managed. Enhanced follow-up through home care and telephone contacts with additional assistance provided if needed. Patients visited at home within 48 hours of discharge and then 3 times in the first week and at regular intervals thereafter. At each visit, home care nurse reinforced the teaching materials, reviewed medications, diet and activity guidelines, physical assessment and cardiovascular examination plus assessed for additional problem areas. Study nurse contacted patients by phone and patients were encouraged to call researchers or personal physician with any new problems or questions. Control intervention: all conventional treatments as requested by the patient's attending physician. These included social service evaluation, dietary and medical teaching, home care, and all other available hospital services. Received study education materials and formal assessment of drugs.	Older people with HF in an academic medical centre	Hospital LOS Readmission to hospital Readmission days HRQOL	Adequate sequence generation? Yes Allocation concealment? Unclear Blinding? Yes Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Rich et al, 1995 (41) N = 282	Inpatient assessment included using a teaching booklet, individualized dietary assessment and instruction by dietician with reinforcement by the cardiovascular research nurse, consultation with social services, assessment of drugs by geriatric cardiologist, intensive follow-up after discharge through the hospital's home care services plus	Admitted to an academic medical centre with confirmed HF and at least one risk factor for readmission	Mortality Readmission to hospital HRQOL	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? Yes Incomplete outcome data	HRQOL data were collected from a subgroup of patients only (n = 126).

Author, Year, Size	Intervention	Patient Population	Outcomes	EPOC Risk of Bias	Limitations/Comments
	individualized home visits and telephone contact with the study team. Control intervention: received all standard treatment and services ordered by their primary physicians.			addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Shaw et al, 2000 (42) N = 97	Predischarge assessment with a pharmacy checklist that assessed patients' knowledge and identified particular problems such as therapeutic drug monitoring, compliance aid requirements, and side effects. Pharmacy discharge plan supplied to the patients' community pharmacist for the intervention group. Control intervention: not described.	Patients discharged from a psychiatric hospital or care of the elderly ward	Readmission to hospital Readmission due to noncompliance Drug problems after discharge	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? No Incomplete outcome data addressed? Unclear Free of selective reporting? Unclear Baseline data? Yes	Psychiatric patients
Sulch et al, 2000 (43) N = ?	Rehabilitation and discharge planning with regular review of discharge plan. Senior nurse implemented and integrated care pathway. Multidisciplinary training preceded implementation of the pathway. Pathway piloted for 3 months prior to recruitment to the trial. Control intervention: to avoid contamination, the multidisciplinary process of care received by the control group was reviewed with a 3-month run-in period to ensure implementation. Both groups received comparable amounts of physiotherapy and occupational therapy.	Patients recovering from stroke in a stroke rehabilitation unit at a teaching hospital	Hospital LOS Discharge destination Mortality at 26 weeks Mortality or institutionalization Activities of daily living HRQOL	Adequate sequence generation? Yes Allocation concealment? Yes Blinding? No Incomplete outcome data addressed? Yes Free of selective reporting? Unclear Baseline data? Yes	
Weinberger et al, 1996 (44) N = 1,396	3 days before discharge a primary nurse assessed the patient's postdischarge needs. 2 days before discharge the primary care physician visited the patient and discussed patient's discharge plan with the hospital physician and reviewed the patient. Primary nurse made an appointment for the patient to visit the primary care clinic within 1 week of discharge. Patient given educational materials and a card with the names and beeper numbers of the primary care nurse and physician. Primary care nurse telephoned the patient within 2 working days of discharge. Primary care physician and primary nurse reviewed and updated the treatment plan at the first postdischarge appointment. Control intervention: did not have access to the primary care nurse and received no supplementary education or assessment of needs beyond usual care.	Multicentre patients with diabetes, HF, and COPD	Readmission to hospital Health status Patient satisfaction Intensity of primary care		Discharge planning within 3 days of discharge 9 Veterans Administration hospitals participated in the trial

Abbreviations: COPD, Chronic Obstructive Pulmonary Disease; ED, emergency department; EPOC, Effective Practice and Organization of Care Group; HF, heart failure; HRQOL, health-related quality of life; LOS, length of stay; PCP, primary care provider; RN, registered nurse.

Source: Shepperd et al, 2009. (4).

Table A3: Summary of Interventions Tested in Randomized Controlled Trials

Author, Year, Sample Size, Country	Population	Interventions											
		Predischarge Interventions				Postdischarge Interventions					Interventions Bridging the Transition		
		Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity
Balaban et al, 2008 (12) N = 96 United States	Community hospital					X		X				X	X
Bolas et al, 2004 (28) N = 243 Ireland				X					X				X
Evans et al, 1993 (17) N = 835 United States	Veterans Affairs; **high risk**		X										
Harrison et al, 2002 (29) N = 200 Canada		X						X		X			X
Hendriksen et al, 1989 (30) N = 273 Denmark		X	X							X			X
Jack et al, 2009 (20) N = 738 United States	Medical/ surgical ward	X	X	X		X		X				X	
Kennedy et al, 1987 (31) N = 80 United States			X							X		X	
Laramee et al (32) 2003, N = 287 United States		X						X				X	
Moher et al, 1992 (33) N = 267 Canada			X										
Naji et al, 1999 (34) N = 343 Scotland					X	X	X						X
Naughton et al, 1994 (35) N = 111 United States					X		X					X	
Naylor et al, 1994 (24) N = 142 United States	Cardiac (medical/ surgical), geriatric	X	X					X	X		X	X	
Nazareth et al, 2001 (36) N = 362 United Kingdom				X		X	X						X

Author, Year, Sample Size, Country	Population	Interventions											
		Predischarge Interventions					Postdischarge Interventions				Interventions Bridging the Transition		
		Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity
Pardessus et al, 2002 (37) N = 60 France								X		X		X	
Parfrey et al, 1994 (38) N = 841 Canada			X									X	
Preen et al, 2005 (39) N = 189 Australia			X			X						X	X
Rich et al, 1993 (40) N = 98 United States		X	X	X				X		X		X	
Rich et al, 1995 (41) N = 282 United States		X						X		X			
Shaw et al, 2000 (42) N = 97 Scotland				X									X
Sulch et al, 2000 (43) N = 152 United Kingdom			X										
Weinberger et al, 1996 (44) N = 1,396 United States			X		X	X	X	X					X

Abbreviations: PCP, primary care provider.

Source: Shepperd et al, 2009. (4)

Table A4: Randomized Controlled Trials

Author, Year, Country	N	Comprehensive Discharge Plan Plus Postdischarge Support	Duration of Follow-up (months)
Single Home Visit			
Stewart et al, 1998 (45) Australia	97	Medication counselling and review by clinical pharmacist to promote medication adherence; home visit within 2 weeks of discharge	6
Stewart et al, 1999 (46) Australia	200	Medication review and counselling by clinical pharmacist to promote medication adherence; home visit within 2 weeks of discharge	6
Jaarsma et al, 1999 (19) Holland	179	Medication review and counselling; information card with advice about diet, sodium, and fluid restriction; psychosocial support; home visit within 10 days of discharge	9
Increased Clinic Follow-up and/or Frequent Telephone Contact			
Cline et al, 1998 (47) Sweden	190	7-day medication organizer; diary to record signs of worsening HF (e.g., body weight, ankle circumference, fatigue); diuretic adjustment; home visit within 2 weeks of discharge	12
Rainville, 1999 (26) United States	34	Medication review and counselling by clinical pharmacist; increased communication between providers; telephone follow-up	12
Oddone et al, 1999 (47) and Weinberger et al. 1996 (44;48) United States	443	Measurement of daily weights; diuretic adjustment, medication review; increased communication between providers; prescheduled clinic appointments in the 6 months after discharge	6
McDonald et al, 2002 (49) Ireland	98	Medication review and counselling; dietary counselling, salt restriction; measurement of daily weights; diuretic adjustment; telephone follow-up at 3 days, then weekly for 12 weeks after hospital discharge	3
Home Visits and/or Frequent Telephone Contact			
Naylor et al, 1994 (24) United States	142	Geriatric discharge protocol; co-ordination of home care; increased communication between providers, telephone follow-up, home visits over 2 weeks after discharge	3
Naylor et al, 1999 (50) United States	108	Geriatric discharge protocol; co-ordination of home care; increased communication between providers, telephone follow-up home visits over 4 weeks after discharge	6
Serxner et al, 1998 (51)	109	Reinforcement of medication adherence; daily weights; dietary restrictions; increased communication between providers; additional mailing of educational materials; telephone follow-up for 3 months after discharge	3

Author, Year, Country	N	Comprehensive Discharge Plan Plus Postdischarge Support	Duration of Follow-up (months)
United States			
Blue et al, 2001 (52) England	165	Dietary counselling; optimization of medications; increased communication between providers; home visits; telephone follow-up	12
Riegel et al, 2002 (53) United States	358	Computerized assessment of patient and caregiver support; telephonic case management; monitoring of weight gain and dyspnea; increased communication between providers; multiple telephone calls for 6 months after discharge	6
Krumholz et al, 2002 (54) United States	88	Nurse-recommended follow-up based on patients' reports of symptoms; telephone monitoring; follow-up for 12 months after discharge	12
Extended Home Care Services			
Rich et al, 1993 (40) United States	98	Dietary and social service consultation; medication review by geriatric cardiologist; increased communication between providers; intensive follow-up for 3 months after discharge	3
Rich et al, 1995 (41) United States	282	Dietary and social service consultation; mediation review by geriatric cardiologist; increased communication between providers; intensive follow-up for 3 months after discharge	12
Harrison et al, 2002 (29) Canada	192	Management of medications, diet, exercise, and stress through community nurse visits; increased communication between providers; telephone follow-up; home care for 2 weeks after discharge	3
Laramee et al, 2003 (32) United States	287	Guidance with medications, diet, fluid intake, and daily weights (e.g., home scales, pill boxes); increased communication between providers; telephone follow-up; home care for 12 weeks after discharge	3
Day Hospital Services			
Capomolla et al, 2002 (55) Italy	234	Exercise training; daily weight monitoring; fluid restriction; physical training; optimal medication regimen; increased communication between providers; available day hospital services for 12 months after discharge	12

Abbreviations: HF, heart failure.
Source: Phillips et al, 2004. (11)

Table A5: Summary of Interventions Tested in Randomized Controlled Trials

Author, Year, Size, Country	Interventions											
	Predischarge Interventions					Postdischarge Interventions				Interventions Bridging the Transition		
	Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity
Blue et al, 2001 (52) N = 165 United Kingdom	X		X		X		X		X			X
Capomolla et al, 2002 (55) N = 234 Italy	X		X		X	X					X	
Cline et al, 1998 (47) N = 190 Sweden	X	X		X					X			
Harrison et al, 2002 (29) N = 200 Canada	X						X		X			X
Jaarsma et al, 1999 (19) N = 179 Holland	X						X	X	X	X		
Krumholz et al, 2002 (54) N = 88 United States	X					X	X					
Laramee et al, 2003 (32) N = 287 United States	X				X		X		X		X	
McDonald et al, 2002 (49) N = 98 Ireland	X						X					
Naylor et al, 1994 (24) N = 142 United States	X	X					X	X		X	X	
Naylor et al, 1999 (50) N = 108 United States		X			X		X		X			X
Oddone et al, 1999 (48) and Weinberger et al. (44) N = 443 United States	X			X	X	X	X					X
Rainville, 1999 (26) N = 34 United States	X						X					
Rich et al, 1993 (40) N = 98 United States	X	X	X				X		X		X	
Rich et al, 1995 (41) N = 282 United States	X						X		X			
Riegel et al, 2002 (53) N = 358 United States	X				X		X					X
Serxner et al, 1998 (51) N = 109	X				X		X					X

Author, Year, Size, Country	Interventions											
	Predischarge Interventions					Postdischarge Interventions				Interventions Bridging the Transition		
	Patient Education	Discharge Planning	Medication Reconciliation	Appointment Scheduled Before Discharge	Timely PCP Communication	Timely Clinic Follow-up	Follow-up Telephone Call	Postdischarge Hotline	Home Visit	Transition Coach	Patient-Centred Discharge Instructions	Provider Continuity
United States												
Stewart et al, 1998 (45) N = 97 Australia	X		X						X			
Stewart et al, 1999 (46) N = 200 Australia	X		X						X			

Abbreviations: PCP, primary care provider.

Source: Phillips et al, 2004 (11).

Appendix 3: GRADE Tables

Table A6: GRADE Evidence Profile for Comparison of Predischarge Planning Care and Usual Care

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Readmissions							
2 systematic reviews of RCTs	Some serious limitations (-1) [a]	No serious limitations [b]	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
Length of Stay							
1 systematic review of RCTs	Some serious limitations (-1) [c]	No serious limitations [d]	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
Mortality/Survival							
1 systematic review of RCTs	Some serious limitations (-1) [e]	No serious limitations [f]	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
HRQOL							
1 systematic review of RCTs	Very serious limitations (-2) [g]	Some serious limitations (-1) [h]	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Patient Satisfaction							
1 systematic review of RCTs	Very serious limitations (-2)[i]	Some serious limitations (-1) [j]	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low

Abbreviations: EPOC, Effective Practice and Organization of Care Group; No., number; RCT, randomized controlled trial

[a]Average EPOC Risk of Bias score in studies included in systematic review by Hansen et al was 5 out of 9.

The systematic review by Shepperd et al focused on discharge planning and excluded RCTs evaluating interventions where discharge planning was not the main focus of a multifaceted package of care. It was not possible to assess how some components of the process compared between trials (e.g., inclusion of caregivers and the extent of their care). Adequate sequence generation and allocation concealment were reported in 14/21 and 12/21 trials respectively.

[b]Shepperd et al found a significant difference in readmission favouring discharge planning versus usual care. Hansen et al did not conduct a meta-analysis due to heterogeneity among the included studies and could not make a conclusion as to which comprehensive discharge bundle/package was most effective compared with usual care.

[c] The systematic review by Shepperd et al focused on discharge planning and excluded RCTs evaluating interventions where discharge planning was not the main focus of a multifaceted package of care. It was not possible to assess how some components of the process compared between trials (e.g., inclusion of caregivers and the extent of their care). Adequate sequence generation and allocation concealment were reported in 14/21 and 12/21 trials respectively.

[d]Shepperd et al found a significant difference in hospital LOS favouring discharge planning. Phillips et al (11) did not find a significant difference in hospital LOS between the comprehensive discharge planning and postdischarge follow-up and usual care. Not all studies in the systematic reviews reported on hospital LOS.

[e] The systematic review by Shepperd et al focused on discharge planning and excluded RCTs evaluating interventions where discharge planning was not the main focus of a multifaceted package of care. It was not possible to assess how some components of the process compared between trials (e.g., inclusion of caregivers and the extent of their care). Adequate sequence generation and allocation concealment were reported in 14/21 and 12/21 trials respectively.

[f] Shepperd et al did not find a significant difference in mortality between study arms. No significant heterogeneity in summary statistic.

[g] The systematic review by Shepperd et al focused on discharge planning and excluded RCTs evaluating interventions where discharge planning was not the main focus of a multifaceted package of care. It was not possible to assess how some components of the process compared between trials (e.g., inclusion of caregivers and the extent of their care). Adequate sequence generation and allocation concealment were reported in 14/21 and 12/21 trials respectively. HRQOL was a secondary endpoint in 3 studies that reported this outcome and measured using different scales in subgroups of patients.

[h] A meta-analysis was not conducted by Shepperd et al for the HRQOL outcome due to the heterogeneity and diverse measurement techniques used by the 3 individual studies. One study reported no significant difference between the study arms. Another study only provided HRQOL data for baseline measurements. A third study showed a significant difference between study arms at 26 weeks follow-up in favour of the control group.

[i] This outcome was reported in 3 studies in the systematic review by Shepperd et al and a meta-analysis was not conducted. Satisfaction was reported as a secondary outcome and performed on subgroups of patients using different measurement scales.

[j] Two studies reported a significant difference between study arms, one study did not.

Table A7: GRADE Evidence Profile for Comparison of Predischarge Planning Plus Postdischarge Support and Usual Care

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Readmissions							
2 systematic reviews of RCTs 4 recent RCTs	Some serious limitations (-1) [a]	Some serious limitations (-1) [b]	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Length of Stay							
1 systematic review of RCTs	Some serious limitations (-1) [c]	Some serious limitations (-1) [d]	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Mortality/Survival							
1 Systematic Review of RCTs 1 recent RCT	Some serious limitations (-1) [e]	Some serious limitations (-1) [f]	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
HRQOL							
1 systematic review of RCTs 2 recent RCTs	Very serious limitations (-2) [g]	Some serious limitations (-1) [h]	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Patient Satisfaction							
1 recent RCT	Very serious limitations (-2) [i]	Some serious limitations (-1) [j]	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low

Abbreviations: EPOC, Effective Practice and Organization of Care Group; HF, heart failure; No., number; RCT, randomized controlled trial

[a]Average EPOC Risk of Bias score in studies included in systematic review by Hansen et al was 5 out of 9.

The systematic review by Phillips et al (11) reported that 16/18 RCTs were assigned a Jadad score of 4 out of 5 and 2 studies reported a score of 3 out of 5. The overall summary estimate was significantly heterogeneous ($P < 0.001$). When a large study was removed from meta-analysis, heterogeneity was reduced but was still significant (P = 0.04)

Some significant differences in baseline characteristics between treatment arms in recent RCTs.

[b]Phillips et al (11) found a significant difference in readmissions favouring comprehensive discharge planning with postdischarge support, however, there was significant statistical heterogeneity. Hansen et al did not conduct a meta-analysis due to heterogeneity among the included studies and could not make a conclusion as to which comprehensive discharge bundle/package was most effective compared with usual care. Of the 4 recent RCTs that were not included in the previous systematic reviews, 1 found a significant difference in readmissions favouring comprehensive pre- and postdischarge care.

[c] The systematic review by Phillips et al (11) reported that 16/18 RCTs were assigned a Jadad score of 4 out of 5 and 2 studies reported a score of 3 out of 5. Hospital LOS was not reported in all studies included in the systematic reviews and of those that did, it was reported as a secondary outcome.

[d]Phillips et al (11) did not find a significant difference in hospital LOS between the comprehensive discharge planning and postdischarge follow-up and usual care. Not all studies in the systematic reviews reported on hospital LOS. None of the 4 recent RCTs reported on hospital LOS.

[e]The systematic review by Phillips et al (11) reported that 16/18 RCTs were assigned a Jadad score of 4 out of 5 and 2 studies reported a score of 3 out of 5. Mortality/survival was not reported in all studies included in the systematic reviews and of those that did, it was reported as a secondary outcome. One of the 4 recent RCTs reported a significant reduction in mortality for patients in the intervention group. (RCT incorporated an additional component to postdischarge follow-up [HF clinics]).

[f]Phillips et al (11) did not find a significant difference in mortality between study arms. One of the 4 recent RCTs reported mortality and found a significant difference favouring comprehensive discharge planning and follow-up (Unlike the studies included in Phillips et al, this RCT also incorporated HF clinic visits as part of the intervention.)

[g]The systematic review by Phillips et al reported that 16/18 RCTs were assigned a Jadad score of 4 out of 5 and 2 studies reported a score of 3 out of 5. HRQOL was not reported in all studies included in the systematic reviews and of those that did, it was assessed using different measurement tools and reported as a secondary outcome.
Two of the 4 recent RCTs reported HRQOL. One study had significant differences in baseline characteristics between study arms and the other RCT incorporated an additional component to postdischarge follow-up (HF clinics).

[h]Phillips et al (11) meta-analyzed data for this outcome and reported that HRQOL scores of intervention patients improved significantly more than usual care patients. (Statistical heterogeneity was not reported.) One of the 4 recent RCTs reported a significant improvement in HRQOL for patients receiving comprehensive discharge planning (this study also incorporated HF clinic visits in the postdischarge follow-up). One RCT reported a significant improvement in HRQOL at one time point during follow-up (12 weeks). No significant difference was found at any other time point (2, 6, 26, and 52 weeks).

[i] Significantly more patients with hypertension in the control group than the treatment group at baseline. This endpoint was a secondary outcome and performed on a subgroup of patients.

[j] Satisfaction with care was greater in intervention patients at 2 and 6 weeks, however, no other time points were reported in a study that lasted 12 weeks.

Table A8: Risk of Bias Among Randomized Controlled Trials for the Comparison of Predischarge Planning Plus Postdischarge Support to Usual Care

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Atienza et al, 2004 (59)	No limitations	Limitations[a]	No limitations	No limitations	No limitations
Naylor et al, 2004 (56)	No limitations	No limitations	No limitations	No limitations	Limitations[b]
Kwok et al, 2008 (57)	No limitations	Limitations[c]	Limitations[d]	No limitations	Limitations[e]
Zhao et al, 2009 (58)	No limitations	Limitations[f]	Limitations[g]	No limitations	Limitations[h]

[a]Blinding not discussed in paper.

[b] Significant difference in baseline hypertension between study arms.

[c] Patients knew their group assignment.

[d] Intent-to-treat analysis not performed.

[e] No statistical comparisons of baseline characteristics, yet differences noted. E.g., 47% (intervention) vs. 25% (control) on security assistance.

[f] Not reported.

[g] Intent-to-treat analysis not performed.

[h] Instruments used to measure patient understanding, adherence and satisfaction not standardized or validated. Data regarding extent of coronary heart disease in patient arms not reported (severity).

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Abstract

Background

The emerging attention on in-home care in Canada assumes that chronic disease management will be optimized if it takes place in the community as opposed to the health care setting. Both the patient and the health care system will benefit, the latter in terms of cost savings.

Objectives

To compare the effectiveness of care delivered in the home (i.e., in-home care) with no home care or with usual care/care received outside of the home (e.g., health care setting).

Data Sources

A literature search was performed on January 25, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2006, until January 25, 2012.

Review Methods

An evidence-based analysis examined whether there is a difference in mortality, hospital utilization, health-related quality of life (HRQOL), functional status, and disease-specific clinical measures for in-home care compared with no home care for heart failure, atrial fibrillation, coronary artery disease, stroke, chronic obstructive pulmonary disease, diabetes, chronic wounds, and chronic disease / multimorbidity. Data was abstracted and analyzed in a pooled analysis using Review Manager. When needed, subgroup analysis was performed to address heterogeneity. The quality of evidence was assessed by GRADE.

Results

The systematic literature search identified 1,277 citations from which 12 randomized controlled trials met the study criteria. Based on these, a 12% reduced risk for in-home care was shown for the outcome measure of combined events including all-cause mortality and hospitalizations (relative risk [RR]: 0.88; 95% CI: 0.80–0.97). Patients receiving in-home care had an average of 1 less unplanned hospitalization (mean difference [MD]: −1.03; 95% CI: −1.53 to −0.53) and an average of 1 less emergency department (ED) visit (MD: −1.32; 95% CI: −1.87 to −0.77). A beneficial effect of in-home care was also shown on activities of daily living (MD: −0.14; 95% CI: −0.27 to −0.01), including less difficulty dressing above the waist or below the waist, grooming, bathing/showering, toileting, and feeding. These results were based on moderate quality of evidence. Additional beneficial effects of in-home care were shown for HRQOL although this was based on low quality of evidence.

Limitations

Different characterization of outcome measures across studies prevented the inclusion of all eligible studies for analysis.

Conclusions

In summary, education-based in-home care is effective at improving outcomes of patients with a range of heart disease severity when delivered by nurses during a single home visit or on an ongoing basis. In-home visits by occupational therapists and physical therapists targeting modification of tasks and the home environment improved functional activities for community-living adults with chronic disease.

Plain Language Summary

It is assumed that patients with chronic disease will benefit if they are living at home and being looked after at home or in the community. In addition, there may be cost savings to the health care system when care is provided in the community or in the home instead of in hospitals and other health care settings.

This evidence-based analysis examined whether in-home care given by different health care professionals improved patient and health system outcomes. Patients included those with heart failure, atrial fibrillation, coronary artery disease, stroke, chronic obstructive pulmonary disease, diabetes, chronic wounds, and with more than one chronic disease. The results show that in-home care delivered by nurses has a beneficial effect on patients' health outcomes. Patient mortality and/or patient hospitalization were reduced. In-home care also improved patients' activities of daily living when delivered by occupational therapists and physical therapists. In addition, the results showed that in-home care delivered by nurses has a beneficial effect on health system outcomes, reducing the number of unplanned hospitalizations and emergency department visits.

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List of Abbreviations

CCAC	Community Care Access Centre
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
DBP	Diastolic blood pressure
ED	Emergency department
HbA1c	Hemoglobin A1c
HC	Home care
HQO	Health Quality Ontario
HRQOL	Health-related quality of life
LDL	Low density lipoprotein
LOS	Length of stay
MD	Mean difference
MLWHFQ	Minnesota Living With Heart Failure Questionnaire
NPHS	National Population Health Survey
OHTAC	Ontario Health Technology Advisory Committee
RCT	Randomized controlled trial
RR	Relative risk
SBP	Systolic blood pressure
SD	Standard deviation
SE	Standard error
SF-36	Medical Outcomes Study Short Form 36-Item Health Survey
SGRQ	St George's Respiratory Questionnaire
UC	Usual care

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this evidence-based health technology assessment was to determine the effectiveness of in-home care in optimizing chronic disease management in the community. The assumption is that there will be cost savings to the health care system when patient moves from the health care setting to the community or the home. (1)

Clinical Need and Target Population

Based on the 1994/95 National Population Health Survey (NPHS), 522,900 Canadians aged 18 years or older were receiving formal home care. (2) This number grew to 545,000 in 1996/97. (2) The largest group of individuals receiving home care were the elderly and the chronically ill. However, people with a range of health conditions may receive home care. (2)

In 1995, use of home care services in Ontario increased dramatically with age, from about 50 per 1,000 population in women 65 years and older to more than 250 per 1,000 population in women 85 years and older. Men displayed a similar age-related increase in the use of home care services. (1)

In 2010, 125,724 Ontario seniors aged 65 years or more who had been assessed by the Resident Assessment Instrument Home Care were receiving publicly funded home care on an ongoing basis (i.e., expecting to receive or receiving services for at least 60 days). The majority were female (66.9%), and about 40% were aged 75 years or more. Overall, 38% were married, indicating that about one-third may have the advantage of a spouse as a caregiver. Less than 5% of the clients who received home care were without a family caregiver. Multimorbidity was common, with diabetes (26.4%), Alzheimer disease/dementia (22.7%), stroke (18.4%), chronic obstructive pulmonary disease (COPD) (17.2%), cancer (13.7%), heart failure (12.9%), and psychiatric diseases (12.7%) the most prevalent. (3)

Canadian Context

Publicly funded home care in Canada is administered by the provincial or territorial government or by regional health authorities. The way home care works in Canada is as follows: a client is referred to receive home care services, at which point a case manager is assigned to the client. The case manager meets with the client and any potential caregiver to conduct an assessment, and then coordinates care, authorizes services, and provides ongoing monitoring and evaluation. Home care service providers typically are a personal support worker and/or a nurse, either public employees and/or agency employees. A personal support worker assists with basic daily living needs whereas a nurse provides clinical care. The home care team may also include occupational therapists, physiotherapists, pharmacists, nurse practitioners, social workers, dietitians, and physicians. A majority of clients (50%–69%) across Canada are receiving home care services provided by personal support workers. (3)

In Ontario, home care services may begin at the time of hospital discharge, with a care coordinator assessing patient need. Alternately, a rapid response nurse may provide an in-home visit within 24 hours of discharge and provide medication reviews and education on symptom and lifestyle management. (*Personal communication, Community Expert, December 3, 2012*).

Home care services are publicly funded in Ontario, Manitoba, Quebec, Prince Edward Island, and the 3 territories. Provincial plans in British Columbia, Alberta, Saskatchewan, New Brunswick, Nova Scotia, and Newfoundland and Labrador cover most services. However, additional fees may be required for some personal and community support services. Community support services include general house cleaning, meal preparation or delivery, or help with running errands. (3)

Ontario Context

In Ontario, formal home care services are either government-funded or privately paid for. The Community Care Access Centres (CCACs) administers the former, and the case manager determines the type and amount of service delivered. Among Ontarian adults aged 65 years and older, 8% of women and 6% of men received government-funded services. (4) In total, there are 14 CCACs in communities across Ontario that are funded by Local Health Integration Networks through the Ministry of Health and Long-Term Care. CCAC advice and services are covered by the Ontario Health Insurance Plan (OHIP). (5)

The top 5 ranked type of home care services delivered to Ontario residents in fiscal year 2011/2012 by the CCAC were, by number of services delivered

1. Combined personal support and homemaking services (n = 17,557,390)
2. Nursing visits (n = 6,058,730)
3. Case management (n = 2,100,812)
4. Personal services (n = 1,862,877)
5. Occupational therapy (512,784 sessions) (6)

The rank of the remaining type of home care services were as follows:

1. Physiotherapy (443,289 sessions)
2. Nursing shifts (n = 376,905)
3. Speech language therapy (252,038 sessions)
4. Respite (n = 112,596)
5. Homemaking services (n = 72,790)
6. Social work (n = 55,494)
7. Nutrition/dietetic (47,865 sessions)
8. Other services (n = 37,304)
9. Placement services (n = 2,376)
10. Psychology (n = 340)
11. Respiratory services (n=216) (6)

In-Home Care

The aim of in-home and continuing care is to provide care for acute or chronically ill individuals in the home, in the community, in supportive housing, or in long-term care facilities. In-home and continuing care, delivered to recovering, disabled, or chronically or terminally ill individuals, maintains or improves the health status of individuals in need. (2) Offered are a variety of health services including nursing, personal care, physiotherapy, occupational therapy, speech therapy, social work, dietician services, homemaking, respite care, day programs for Alzheimer disease, Meals on Wheels, and friendly visitor programs, which can maintain or improve the health status of individuals in need. (2)

For the purposes of this evidence-based analysis, in-home care is defined as care predominately in the patient's home. This includes ongoing in-home assessment, case management, and coordination of a range of services provided in the home or in the community that are curative, preventive, or supportive in nature and that aim to enable clients to live at home, thus preventing or delaying the need for long-term care or acute care. Palliative care and rehabilitation are not considered in this analysis. Supportive care includes personal care, meal preparation, and homemaking tasks. (2)

In-Home Care as a Component of Multidisciplinary Care

Multidisciplinary care may constitute an in-home care component. For example, a number of systematic reviews/meta-analyses have examined multidisciplinary care in relation to heart failure. (7-9) Multidisciplinary care was examined as a complex intervention, (8) as part of a disease management program, (9) or in subgroups based on the setting in which the intervention was delivered including the home. (7)

In a systematic review/meta-analysis that examined multidisciplinary care in heart failure by intervention setting including home visits, (7) 12 of the 30 included studies had a home visit component. The search strategy was current as of 2004. Included studies were published between 1993 and 2005. Multidisciplinary interventions were nurse-led programs, medication reviews, medication adherence interventions, patient education, or enhanced monitoring. Home visits were defined as one or more planned visits by a health care professional to educate or improve patient self-management, but excluded visits to take blood samples, set up physiological monitoring, or deliver wound care. Results showed a 20% reduction in all-cause admissions (relative risk [RR]: 0.80; 95% CI: 0.71–0.89), a 38% reduction in heart failure admissions (RR: 0.62; 95% CI: 0.51–0.74), and a nonsignificant 13% reduction in all-cause mortality (RR: 0.87; 95% CI: 0.72–1.06). (7)

Since multidisciplinary care tends to be used synonymously with disease management programs that focus on the continuum of care across health delivery systems, the systematic reviews / meta-analyses that examined multidisciplinary care were not considered for this evidence-based analysis.

Alternate In-Home Care Strategies

A number of health care strategies involve an in-home care component. However, many are out-of-scope and therefore are not part of this evidence-based analysis. They include the following:

- Early supported discharge. Patients after stroke conventionally receive much of their rehabilitation in hospital. Services have been developed that offer patients an early discharge from hospital with more rehabilitation at home. (10)
- Transitional care. Also known as integrated care or disease management programs, transitional care focuses on improving the experience of patients when they are discharged from acute hospital care to other types of care. Transitional care may include home visits as part of the coordinated service. It aims to address the needs of the 20% of patients who experience an adverse clinical event within 30 days of the discharge from hospital. (11)
- Hospital-at-home. Hospitalizations result in a high demand on hospital resources and high health care costs. Hospital-at-home is a safe alternative to hospitalization in, for example, acute exacerbation of COPD where patients admitted to hospital may be discharged on the fourth day of admission to receive care at home provided by specialized respiratory nurses. (12)
- Home-based rehabilitation as an alternative to hospital-based programs for pulmonary rehabilitation in patients with COPD, for example, expands the recognition, application, and accessibility of pulmonary rehabilitation for these patients. (13) Similar considerations exist for patients undergoing cardiac rehabilitation. Hospital-based cardiac rehabilitation attracts those who prefer supervision during exercise, need the camaraderie of a group, are willing to make travel arrangements, and believe they lack self-discipline. Home-based cardiac rehabilitation attracts the more self-disciplined patients who believe that rehabilitation should fit in with their lives rather than their lives fitting in with the rehabilitation. The patients who prefer home-based care also dislike group therapy and express practical concerns such as travel or transportation to group hospital therapy. (14)

Evidence-Based Analysis

Research Question

To compare the effectiveness of care delivered in the home (i.e., in-home care) with no home care or with usual care / care received outside of the home (e.g., a health care setting).

Literature Search

Search Strategy

A literature search was performed on January 25, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database for studies published from January 1, 2006, until January 25, 2012. The start date for the literature search was selected based on scoping of the literature and identification of a number of systematic reviews that had already been completed at that time (see Results). Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

English language full-text reports

- published between January 1, 2006, and January 25, 2012
- randomized controlled trials (RCTs), systematic reviews, meta-analyses, health technology assessments
- adults aged ≥ 18 years
- at least one in-home care visit had to have occurred
- in-home care provided by any type of health or medical professional or social assistance provider
- studies on multidisciplinary care when findings for home visits were presented separately

Exclusion Criteria

- studies using telemonitoring or telemedicine to deliver in-home care
- telephone-based follow-up service or patients using self-management strategies alone
- studies on hospice care, end-of-life care, or palliative care delivered in the home
- studies comparing different delivery models of in-home care
- studies on the effectiveness of transitional care, early supportive discharge, hospital-at-home, or rehabilitation

Outcomes of Interest

- hospital utilization (admissions, readmissions, length of stay [LOS], emergency department [ED] utilization, admissions to long-term care facilities)
- survival/mortality

- health-related quality of life (HRQOL) / functional status
- disease-specific clinical measures / physiological measures
- patient satisfaction

Statistical Analysis

A meta-analysis was performed using Review Manager Version 5. (15) For continuous data a mean difference was calculated, and for dichotomous data a risk ratio was calculated for RCTs. A fixed effect model was used unless significant heterogeneity was observed (e.g., $P \leq 0.10$), and then a random effects model was used to address significant heterogeneity. When heterogeneity was not accounted for using a random effects model, a post-hoc subgroup analysis was considered. For continuous variables with mean baseline and mean follow-up data, a change value was calculated (if not presented in the original paper) as the difference between the 2 mean values (e.g., follow-up minus baseline). To allow for analysis and account for the change value, a corresponding standard deviation (SD) was calculated using 3 parameters: baseline SD, follow-up SD, and a correlation coefficient. The correlation coefficient represents the strength of the relationship between the 2 SDs. A correlation coefficient of 0.5 was used for this analysis. For all other continuous variables, a mean difference was calculated based on values at follow-up. Graphical display of the forest plots was also examined. A *P* value of less than 0.05 was considered statistically significant. *P* values in the text have been rounded to 3 decimal places. When the data were available, a subgroup analysis by disease category was performed.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (16) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that RCTs are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—are then taken into account. Limitations or serious limitations in these areas result in downgrading the quality of evidence. Finally, 3 main factors are considered that may raise the quality of evidence: large magnitude of effect, dose response gradient, and accounting for all residual confounding. (16) For more detailed information, please refer to the latest series of GRADE articles. (16)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to that of the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

The database search yielded 1,277 citations published between January 1, 2006, and January 25, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded from the analysis.

Seventeen studies (1 health technology assessment, 4 systematic reviews, 12 RCTs) met the inclusion criteria. The reference lists of the included studies were manually searched to identify any other potentially relevant studies, and 2 other RCTs were identified. One additional systematic review was identified from a review of MEDLINE. These were also included in this analysis.

Aside from the 17 studies analyzed in this evidence-based analysis, a clinical RCT conducted in Ontario, Canada, was also assessed for inclusion in this analysis. This RCT compared the effectiveness of community leg ulcer clinics with home care for treating patients with leg ulcers. (17) In-home care was considered usual care and care in community leg ulcer clinics was considered the intervention. Because of the reverse comparison, this study was excluded from this evidence-based analysis.

In addition, an RCT that used home-based care for heart failure patients was brought to the attention of the researcher; however, its date of publication was outside of the literature search dates. There was some agreement between our results and those of this study. (18)

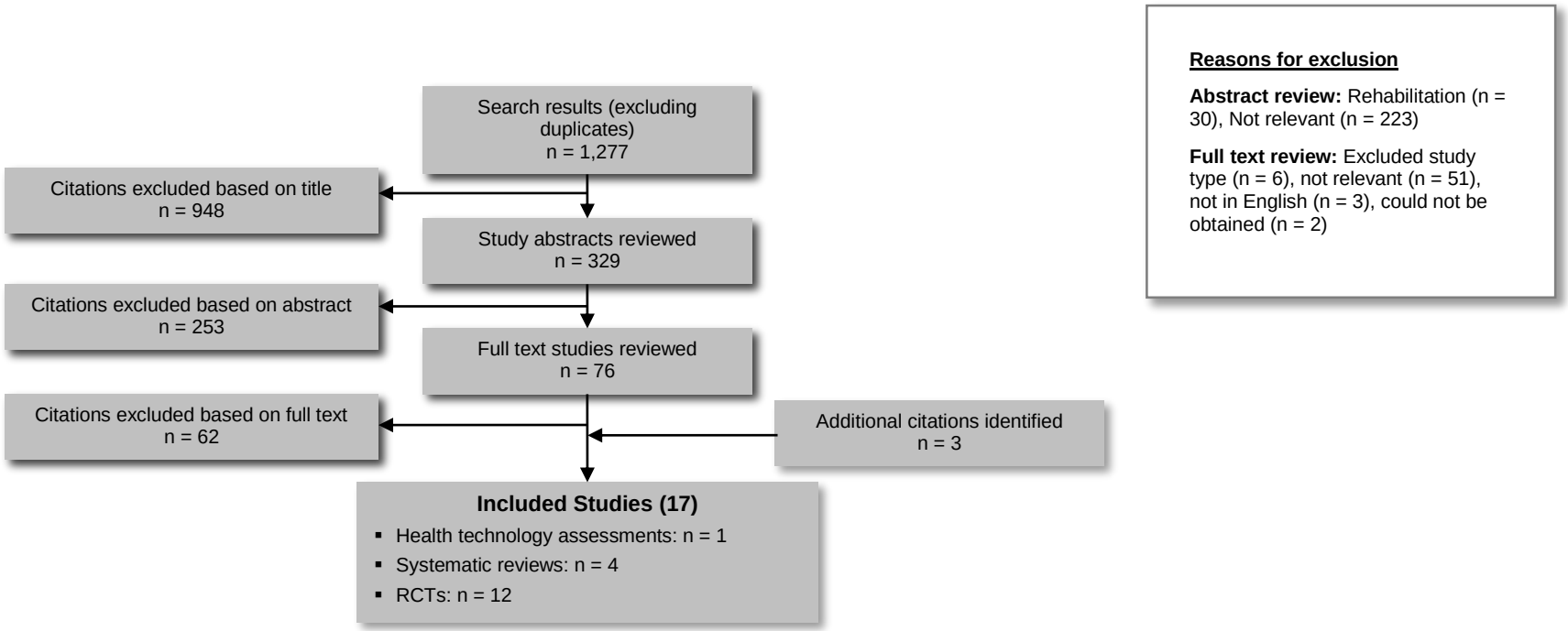

Figure 1: Citation Flow Chart

For each included study, the study design was identified and is summarized below in Table 1, which is a modified version of a hierarchy of study design by Goodman. (19)

Table 1: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	5[a]
Large RCT[b]	9
Small RCT	3
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	-
Non-RCT with non-contemporaneous controls	-
Systematic review of non-RCTs with historical controls	-
Non-RCT with historical controls	-
Database, registry, or cross-sectional study	-
Case series	-
Retrospective review, modelling	-
Studies presented at an international conference	-
Expert opinion	-
Total	**17**

Abbreviation: RCT, randomized controlled trial.

[a]Two systematic reviews included only RCTs; (20;21) 2 systematic reviews included RCTs in addition to other study designs (22;23) with only the information on RCTs used for this evidence-based analysis; one health technology assessment of RCTs. (24)

[b]Large RCTs ≥ 150 subjects.

Health Technology Assessments

Heart Failure

A health technology assessment conducted by the Tufts-New England Medical Centre Evidence-Based Practice Centre under contract to the Agency for Healthcare Research and Quality in the United States compared the effectiveness of interventions that support postdischarge care with that of usual care in heart failure patients to prevent hospital readmission. (24) The magnitude of all-cause hospital readmissions was the primary outcome, whereas all-cause mortality, length of hospital stay, cost, quality of life, and a combined endpoint of mortality and readmissions were examined as secondary outcomes. The articles searched were published from 1990 to 2007. The 1990 search date was chosen as a starting point because that was the year when the medical management of heart failure started to advance rapidly, bringing about changes in practice patterns. RCTs were included if the population of interest was made up of heart failure patients and if the mean age of the population was 50 years or older. A number of interventions were examined, including home visits. These were defined as being done by "a member of the multidisciplinary heart failure team who visited the patient at home to assess clinical stability and provide care to optimize health." The comparison group was defined as usual care, routine care, or standard care, which included non-structured care (e.g., discharge instructions, information on next appointment). A meta-analysis was performed based on the intervention of home visit (e.g., the setting where the intervention was initiated after an index hospitalization). Included were 37 studies that provided information on hospital readmissions and 30 studies that provided quantitative data for the intervention and control group. Among these were 4 studies on home visits. The meta-analysis of these 4 studies showed a statistically significant reduced risk of hospital readmission in the intervention group receiving

home visits compared with the usual care group (RR: 0.82; 95% CI: 0.69–0.97). The remaining outcomes were not analyzed by intervention setting. The results were based on good to poor quality of evidence according to a 3-level customized grading scheme (i.e., good as the highest quality). The studies included in the meta-analysis were published from 1998 to 2002. The home visits were nurse-led, and in 2 of the 4 studies, there was mention of home services provided in the control group. The authors concluded that interventions that used home visits reduced the risk of hospital readmissions.

There were no health technology assessments identified for the remaining chronic conditions of interest: stroke, coronary artery disease, atrial fibrillation, COPD, diabetes, or chronic wound care.

Systematic Reviews

COPD

A systematic review examined the effectiveness of in-home care provided for COPD patients by respiratory health care worker programs. Outcomes were mortality, hospitalizations, HRQOL, lung function, and exercise tolerance. (20) Inclusion criteria allowed for RCTs with at least 3 months of follow-up, a home visit as intervention, and COPD defined according to standard criteria. Home visits were defined as a visit to the patient's home by a respiratory nurse or respiratory health worker to facilitate health care, educate, provide social support, identify deteriorations, and reinforce correct use of inhaler therapy. The control group received routine care without access to a respiratory nurse / health care worker. The search was current as of 2009. The results of the meta-analysis of the 9 RCTs identified showed a beneficial effect of home visits by a respiratory nurse on HRQOL assessed using St George's Respiratory Questionnaire (SGRQ; mean difference [MD]: −2.60; 95% CI: −4.81 to −0.39; 4 studies). There was no effect of home visits on mortality (5 studies), hospitalizations (5 studies), or exercise tolerance (2 studies). Data for a meta-analysis of lung function, ED visits, and general practitioner or family doctor visits were insufficient. The evidence was based on heterogeneous quality of evidence ranging from low (e.g., not possible to implement blinding) to high. The authors concluded that in-home care provided by respiratory health care worker programs for COPD improved HRQOL though heterogeneous data precluded conclusions about the other outcomes.

An integrative systematic review examined nursing care provided by nurse clinics in the chronic phase of COPD. (22) A nurse clinic was defined as a respiratory nurse with advanced respiratory competence and a primary role in delivering formalized service within a multidisciplinary team. The search included RCTs and other study designs published from 1996 and 2006. Studies on acute services were excluded. No meta-analysis was performed. From the 20 articles identified (reporting on 16 studies in total), 4 themes emerged, 1 of which was home-based respiratory care. This theme was covered in 9 articles, of which 6 were RCTs. The authors found no difference in hospitalizations except in 2 studies that showed a significant reduction in hospital admissions and readmissions and ED use. There was no difference for HRQOL and mortality. There was some suggestion of improved disease-related knowledge and patient satisfaction. For these studies, the service provided included health assessment, teaching disease facts, disease management, breathing technique and medications, advice on activities of daily living (ADL), healthy lifestyle, symptom awareness, the management of exacerbations, information on service referrals and telephone contact with health professionals. A majority of studies examining home-based respiratory care used an RCT design; however, 3 of the 9 studies were a non-RCT design. For the RCTs included, the control groups were described as usual care or standard protocols, booklets about COPD, following recommendations by physicians; a control group of 1 RCT included home visits by physicians. Because the authors summarized their data for heterogeneous study designs, it is difficult to interpret their results on health care resources, HRQOL, and mortality. Therefore, the contribution of RCT findings to the outcome measures is not clear. The authors concluded that the chronic management of COPD has been mainly conceptualized as home-based respiratory care; they could not conclude whether advanced nursing is more effective than usual care.

Multimorbidity

A systematic review examined comprehensive geriatric assessment interventions and the effect on ED use. (23) The interventions were defined based on the setting where they were implemented, including the outpatient setting of home care. The interventions were grouped into 5 general categories. The search strategy was current as of 2004 and included RCTs as well as other types of study designs. Inclusion criteria allowed for studies including the frail elderly, with their potential for multiple comorbidities, and patients 60 years of age or older. No meta-analysis was performed due to the heterogeneity of the studies. Identified were 26 studies, including 16 RCTs, that used a variety of intervention settings; 4 studies used in-home care as the intervention setting. Of these 4 studies, only 1 was considered eligible based on criteria established for this evidence-based analysis (e.g., RCT study, appropriate intervention type). This RCT, which was conducted in Italy, showed a reduced time to first ED use (hazard ratio: 0.64; $P < 0.025$). (25) The nature of the intervention in this study was case management—a case manager such as a nurse or social worker coordinated community services including home support, nursing care, and meals on wheels—with the control group described as usual care. (25) However, closer examination showed that both the intervention and the comparison groups included elements of home care. (25) The authors stated that the main difference between the intervention and the comparison groups was the element of case management and care planning present in the intervention group. Although the control group were able to receive the in-home care established in the community, it was considered fragmented. Overall, the authors of this systematic review concluded that interventions initiated in the outpatient setting reduced ED use whereas hospital-based interventions had less of an effect on ED use. (23)

A qualitative systematic review examined the effectiveness of home-based health promotion provided by professional nurses on patient outcomes. (21) Patient outcomes included mortality, admissions, health status, functional status, use of health and social services, and cost. The search strategy was current as of 2003, and inclusion criteria allowed for studies that used an RCT design and for community-living adults aged 65 years and older. The home-based care component included ongoing home visits or telephone contacts. Excluded studies were therapeutic or rehabilitative, involved hospital-at-home care or patients who had been discharged from the hospital. Identified were 12 RCTs. Only 2 studies included individuals in the control group receiving usual in-home care services. The intervention group received a diverse range of in-home care services including education on nutrition, exercise, stress management, substance abuse, emotional and social functions, instrumental activities of daily living (IADL), accessing health care, supportive physical and psychosocial nursing care, functional assessment, and integrated and interdisciplinary case management, to name a few. The nurses' role included preventive care (e.g., early identification and management of health problems) and health promotion strategies (e.g., health education, goal setting). There were between 1.9 and 14.1 visits, and they lasted from 0.5 to 2 hours. The results showed favourable and significant effects for the intervention group of home-based nursing care for mortality (4 of 11 studies), functional status (4 of 8 studies), level of depression (1 of 4 studies), hospital admissions (5 of 9 studies), nursing home use (5 of 10 studies), and use of other health and social services (6 of 9 studies). Methodological limitations of included studies were randomization, blinding of outcome assessors, and incomplete follow-up. Other limitations were lack of detailed information on the content of the intervention (e.g., frequency of visits for some studies, and duration of visits) and control group (e.g., primary care, usual home care, or geriatric clinic), which specific subgroups of older individuals would most likely benefit from the intervention, and lack of information on depression and social support. The authors concluded that, despite overall positive results, it is not clear how the nursing role makes a difference in patient outcomes.

No eligible systematic reviews were identified for the remaining chronic conditions of interest: heart failure, stroke, coronary artery disease, atrial fibrillation, diabetes, or chronic wound care.

Randomized Controlled Trials

The systematic literature search found 12 RCTs eligible for this evidence-based analysis (Tables A2–A5).

Description of Studies

Of the 12 identified RCTs, 1 study was on diabetes, (26) 6 on heart failure, (27-32) 1 on COPD, (33) 1 on stroke, (34) and 3 on multimorbid chronic disease. (35-37) The sample sizes ranged from fewer than 150 subjects (28;30;33), 150 subjects or more, (26;27;29;31;32;34-37) up to even larger RCTs with more than 300 subjects. (27;36;37) The length of follow-up ranged from 1 to 3 months in 1 study (33) to 10 years in another. (32) There were 4 studies with outcome data at 6 months of follow-up (26;27;34;37) and 4 studies lasting between 1 and 2 years. (28;29;31;35) For the 6 studies on heart failure, the majority of patients were classified at study entry as New York Heart Association (NYHA) functional status class II in 2 studies, (28;30) class II/III in 1 study, (32) class III/IV in 1 study, (27) and class IV in 1 study. (29) The information was unknown for 1 study. (31) The in-home care intervention was delivered by nursing professionals in 5 studies, (28-31;34) by nursing professionals plus a pharmacist in 2 studies, (32;35) by community health workers in 1 study, (26) and allied health professionals including community pharmacists in 4 studies. (27;33;36;37) Half of the studies (6 of 12) were designed with 1 or a few scheduled in-home care visits. (27;28;30-33) Four studies scheduled ongoing in-home care visits, (26;29;36;37) and 2 provided in-home care visits as needed. (34;35) The contact time during the in-home care visit ranged from a minimum of 20 to 30 minutes (33) to a maximum of 2 hours. (28;30;34) A majority of studies (10 of 12) were designed to deliver an in-home care intervention that educated patients on disease facts, lifestyle modification, and medication use. (26-35) Two studies focused on the home environment and task performance. (36;37)

Diabetes

A randomized controlled clinical trial conducted in Detroit, United States, examined whether a culturally defined diabetes self-management home-based intervention administered by community health workers improved physiological measures in comparison with usual care in patients with type 2 diabetes. (26) Outcomes included hemoglobin A1c (HbA1c), systolic blood pressure (SBP), diastolic blood pressure (DBP), and low density lipoprotein (LDL) cholesterol, among others. (26) Primary or secondary outcomes were not explicitly stated but glycemic control was emphasized and therefore taken as the primary outcome. Eligible patients were identified from medical records, were at least 18 years of age with a physician-confirmed diagnosis of type 2 diabetes, and were self-identified as African American or Latino/Hispanic. Excluded were individuals with diabetes-related complications. Randomization was stratified by race/ethnicity and health care site. Allocation concealment was not stated. Interventionists were not blinded, although the data analysts were. Physiological measures were determined from medical records at baseline and at the 6-month follow-up. Analysis was described as an intent-to-treat. However, for the analysis on physiological measures, there were between 51 and 56 patients in the intervention group and between 55 and 65 patients in the control group, a reduction from the original 84 in the intervention group and 99 in the control group. There were no baseline differences, except for mean age (home care [HC]: 50; 95% CI: 47–52 vs. usual care [UC]: 55; 95% CI: 53–57 year; $P = 0.02$). The baseline and 6-month follow-up measures and change were presented as adjusted means.

Heart Failure

A randomized controlled clinical trial conducted in Barcelona, Spain, examined the effectiveness of a single home-based educational intervention compared with that of usual care in patients with heart failure. (28) The primary outcomes included number of unplanned hospitalizations, visits to the ED due to heart failure, and all-cause mortality. The secondary outcome relevant to this evidence-based analysis was HRQOL. Patients were eligible for inclusion if they displayed heart failure according to the Framingham criteria, had class II to IV NYHA function, and had left ventricular ejection fraction of less than 45% on echocardiography. The study did not include patients with dementia or neoplastic disease or with a

previous acute coronary syndrome or who were taking dobutamine, lived out of the geographic region, were not community living, or were without a telephone. Patients were randomized using a table of random numbers before hospital discharge. Allocation concealment was not mentioned. The physicians involved in assessment and follow-up were blinded to group assignment. Relevant primary outcomes were assessed at 6 and 24 months by 1 physician reviewing medical records. Quality of life was measured using the Medical Outcomes Study Short Form 36-Item Health Survey (SF-36), a generic health questionnaire, and the Minnesota Living with Heart Failure Questionnaire (MLWHFQ). Quality of life was ascertained at baseline by personal interview and at follow-up by telephone interview. Other baseline data were ascertained before hospital discharge. The discharging physician was blinded to group assignment. The analysis did not mention intent-to-treat. There were no baseline differences. The sample size for examining the SF-36 and MLWHFQ was reduced.

A randomized controlled clinical trial conducted in Barcelona, Spain, examined the effectiveness of a home-based intensive intervention program in comparison with usual care in heart failure patients. (29) The primary outcome was combined all-cause mortality and hospitalizations due to worsening of heart failure. The secondary outcomes relevant to this evidence-based analysis were cardiovascular death, hospitalizations due to cardiovascular disease, quality of life, and patient satisfaction. Eligible individuals were hospitalized for suspected heart failure according to the Framingham criteria and had a diagnosis of heart failure at discharge in the first or second diagnostic position. Exclusion criteria included concomitant illness and a survival prognosis of less than 1 year, a cognitive deficit, not residing in the geographic region, and clinical trial involvement in the preceding 3 months. Randomization was determined from a central data management site using a random generator and stratified by hospital. Allocation concealment was not mentioned. A standardized questionnaire ascertained information on baseline data. HRQOL was determined by the MLWHFQ. Hospital admissions and discharges were ascertained from record services. Clinical outcomes were classified by a committee blinded to group assignment. Personnel ascertaining information on HRQOL measures were aware of assignment status. Follow-up was 1 year. There was a baseline difference in the number of patients with COPD as a comorbidity (HC: 34% vs. UC: 20.1%; $P = 0.01$), with no other baseline differences. The analysis stated an intent-to-treat analysis. There was a reduced sample size for examining MLWHFQ.

A randomized controlled clinical trial conducted in Thailand examined the effectiveness of a home-based program on symptom alleviation and well-being in comparison with usual care in heart failure patients. (30) The primary outcome was not stated. Symptom alleviation was not considered relevant to this evidence-based analysis. Eligible patients were at least 40 years of age, with functional class II NYHA criteria, stable medication use, ability to verbally communicate, living within the designated geographic area, and not living alone. Exclusion criteria were not stated, but criteria for dropping out included the presence of severe symptoms and complications from heart or comorbid diseases. Patients were randomized but other specific details were not stated, including information on allocation concealment. At baseline and follow-up at 8 and 12 weeks, a researcher measured well-being in the home for both the intervention and the control group. There was no mention of blinding or of an intent-to-treat analysis. There were no baseline differences.

A randomized controlled clinical trial conducted in the United Kingdom examined the effectiveness of a home-based intervention delivered by community pharmacists to heart failure patients. (27) The primary outcome was unplanned hospitalizations. The secondary outcomes were all-cause mortality and HRQOL (e.g., EuroQoL and MLWHFQ). Eligible patients were over 18 years of age, were admitted to emergency departments with heart failure, and were taking 2 or more drugs at the time of discharge. Patients were excluded if living in long-term care facilities, on the waiting list for surgery for heart disease, or with a terminal malignancy. Randomization was computer generated, and patients were stratified by the NYHA class and recruitment site. Allocation concealment was achieved using a third party telephone randomization process. An intent-to-treat analysis was specified. Blinding was not mentioned. Follow-up

was 6 months. There were no baseline differences except for social class and use of a drug adherence aid, with the intervention group less likely to be from a non-manual labour social class (HC: 44.1% vs. UC: 54.7%; *P* value not specified) but more likely to use some form of drug adherence aid (HC: 26.5% vs. 15.5%; *P* value not specified). Post-randomization exclusions occurred in the intervention and control groups (HC: n = 20; UC: n = 26 post-randomization exclusions).

A randomized controlled clinical trial conducted in Spain compared the clinical effectiveness of a home-based education program with that of usual care in heart failure patients. (31) The primary outcome was combined unplanned hospitalizations and all-cause mortality. Secondary outcomes were unplanned hospitalizations, all-cause mortality, LOS, and ED use. Only ED visits were examined in the first 6 months of follow-up. Eligible patients did not have severe cognitive deficits, COPD, a psychiatric illness, or other terminal disease. They lived in the geographic area and had family support. Randomization was prepared by a central site and stratified by service location of recruitment. Assignment was performed by the process of closed envelopes. The randomization sequence was concealed until after assignment. Attending personnel involved outside of in-home care were unaware of patient assignment. Follow-up was up to 12 months and data were ascertained by telephone and review of clinical records. Analysis was intent-to-treat. There was no baseline differences on factors considered to be of interest.

A randomized controlled clinical trial conducted in Australia compared the clinical effectiveness of a nurse-led home-based intervention with that of usual care in heart failure patients. (32) The primary outcome was combined unplanned hospitalizations and all-cause mortality. A secondary outcome was all-cause mortality, as described in a previous publication. (38) Eligible patients were at least 55 years of age, had cardiologist-diagnosed heart failure, a history of at least 1 hospital admission for acute heart failure, functional impairment according to NYHA class II, III, or IV, and impaired left ventricular systolic function (≤ 55% ejection fraction). Exclusion criteria were a terminal malignancy or planned cardiac surgery. Randomization occurred using a blinded computerized protocol. There was no mention of allocation concealment. Baseline data were determined through patient interviews or medical record reviews before discharge. Follow-up was a minimum of 7.5 years, and data on hospital activity and mortality were ascertained from a computerized medical record system and death registry. Outcomes were ascertained in a blinded manner. Analysis was intent-to-treat. Baseline differences noted were that the intervention group were more likely to have had a prior acute myocardial infarction (HC: 55% vs. UC: 50%; *P* value not shown), left bundle-branch block (HC: 32% vs. UC: 21%; *P* value not shown), and a higher blood urea concentration (data not shown).

COPD

A randomized controlled clinical trial conducted in Louisiana, United States, compared the effectiveness of educational support either through a home visit or reading material compared with that of usual care in patients with COPD. (33) This evidence-based analysis examined only the effects of home visits. The primary outcome was HRQOL measured by SGRQ. (Secondary outcomes, for example, health knowledge, were not relevant to this evidence-based analysis.) Individuals were 18 years or older and had spirometry-confirmed, physician-diagnosed moderate to severe COPD. Having a Grade 4 reading literacy was also considered an eligibility criterion. Exclusion criteria included congestive heart failure, asthma, and severe cognitive impairment. Randomization was performed by randomly drawn letter cards. Allocation concealment was not mentioned. Personnel were not blinded to group assignment. Length of follow-up was about 30 to 90 days (*Personal communication, Clinical Expert, April 24, 2012*). There was no mention of an intent-to-treat analysis. There were no baseline differences between the intervention and the control group.

Stroke

A randomized controlled clinical trial conducted in Ohio, United States, compared the effectiveness of comprehensive postdischarge care management with that of organized stroke department care without postdischarge care. (34) The primary outcome was based on 5 domains including elements of neuromotor function, days spent in an institution, quality of life, management of risk, and stroke knowledge and lifestyle modification. Relevant individual outcomes for this evidence-based analysis were all-cause mortality, mean length of hospital stay, quality of life measured by the stroke-specific scale, and physiological outcomes, all secondary outcomes. Patients were eligible if they had a confirmed ischemic stroke, National Institutes of Health Stroke Scale score of 1 or more, were discharged home, lived in the geographic region, had no other dominating illness, spoke English, and did not have an endarterectomy planned. Randomization was generated by the study biostatistician, and group assignment was performed by a research assistant using the sealed envelope method. Length of follow-up was 6 months. Outcome measures relevant to this evidence-based analysis were ascertained by medical record review or at the home visit. Additional information ascertained at the home visit by a research nurse was blinded to patient assignment. Telephone interviews were also conducted. An intent-to-treat analysis was noted. There were no baseline differences except for the percentage of patients with diabetes as a comorbidity being higher in the intervention group (HC: 42% vs. UC: 29%; *P* value not shown) and the mean number of hospital days in the prior year being higher for the control group (HC: 0.6, standard error (SE): 0.3 vs. UC: 2.1, SE: 0.3; *P* value not shown).

Multimorbidity

A randomized controlled clinical trial conducted in a rural village near Ottawa, Canada, examined the effectiveness of the Anticipatory and Preventive Team Care (ATPCare) program on quality of care for chronic disease management. (35) The ATPCare program was designed as an in-home care intervention. The primary outcome was not relevant to this evidence-based analysis. Relevant outcomes included ED visits and all-cause hospitalizations. Eligible individuals were at least 50 years of age, enrolled in the Family Health Network, and at risk of functional decline, physical deterioration, and need of emergency services. Individuals were excluded if they displayed cognitive impairment, language, or cultural barriers, were expected to live less than 6 months, and were not residing in the geographical area for the study period. A central system assigned concealed random treatment allocation. Length of follow-up was up to 18 months. Health care utilization information was ascertained from an outcome questionnaire and verified by chart audit of electronic medical records by personnel blinded to group assignment. An intent-to-treat analysis was noted. There were no baseline differences except for age, with the intervention group younger than the control group (HC: 69.6 vs. UC: 72.8 years, $P = 0.018$). (39;40)

A randomized controlled clinical trial conducted in Philadelphia, United States, compared the effectiveness of a home-based program that reduces declining abilities in chronically ill elderly individuals with that of usual care. (36) The primary outcome for this study was mortality; however, this study was an extension of previous work by the same investigators who had examined functional difficulties as the primary outcome at the 6-month follow-up. (37) Eligible individuals for both studies were community living, ambulatory, at least 70 years of age, English speaking, cognitively intact, and reporting 1 or more functional difficulties. There was no mention of exclusions. Randomization was generated by the project statistician and prepared using double, opaque envelopes. Randomization was performed by race and living arrangement. Length of follow-up was between 2.5 and 5.25 years for the outcome of mortality, depending on when the baseline interviews were conducted. Length of follow-up was 6 months for the primary outcome of functional difficulties. The National Death Index records were used to determine mortality. Trained interviewers were blinded to group assignment. An intent-to-treat analysis was mentioned but it was not clear how this was used when examining functional difficulties. There were no baseline differences.

Meta-Analysis

An analysis was performed to address the research question on the effectiveness of care delivered in the home (i.e., in-home care) compared with no home care or usual care / care received outside of the home (e.g., health care setting). Studies with data in a format suitable for analysis are shown below for the outcomes of combined events of all-cause mortality and hospitalizations, all-cause mortality, cardiovascular-specific mortality, unplanned hospitalizations, heart failure-specific hospitalizations, LOS, ED visits, HRQOL, and functional difficulties. When data were available, the analysis was performed by disease subgroup.

The study by Gray et al (35;40) with useable information for hospitalizations and ED visits was excluded from this evidence-based analysis because the information for hospitalizations was based on all-cause hospitalizations, rather than unplanned hospitalizations as in the other 2 studies, and ED visits were based on the assumption that every deceased patient had 1 ED visit, which was different from the other included study. (35;40) One study had information on patient satisfaction but was not included in the analysis since it did not use a validated questionnaire. (29)

The interpretation of the results differs based on the outcome measure. For consistency, a beneficial effect of in-home care appears on the left-hand side of the plots. Results are presented as a risk ratio for RCTs with dichotomous data, as a mean difference at follow-up for continuous data, or as a mean difference based on change values for the HRQOL outcomes (i.e., SF-36, MLWHFQ, SGRQ). When the sample size differed between baseline and follow-up for HRQOL measures, to be conservative the smaller of the 2 sample sizes was used. (27-29)

The outcomes were examined and are displayed in Figures 2–16 below.

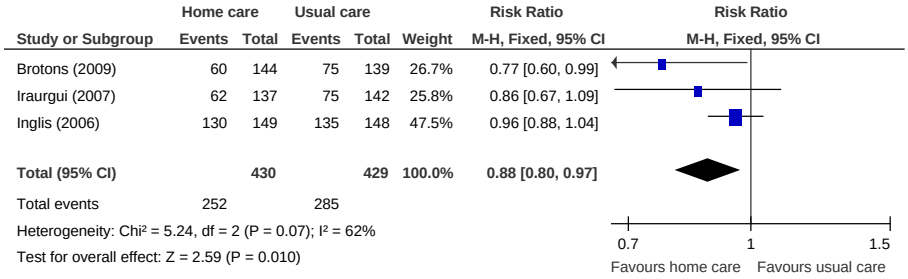

Figure 2: Combined All-Cause Mortality and Readmissions/Hospitalizations[a,b,c,d,*]

Abbreviations: CI, confidence interval; M-H, Mantel–Haenzel.
[a]Defined as all-cause mortality and hospital readmission due to worsening of heart failure; (29) all-cause mortality and unplanned hospitalizations; (31) all-cause mortality and unplanned hospitalizations. (32)
[b]Heart failure patients in all 3 studies. (29;31;32)
[c]Primary outcome in all 3 studies. (29;31;32)
[d]First-ever hospitalization in 2 studies. (29;31)

[*]Iraurgui is used throughout the text as a shortened form of the name Aldamiz-Echevarria Iraurgui.

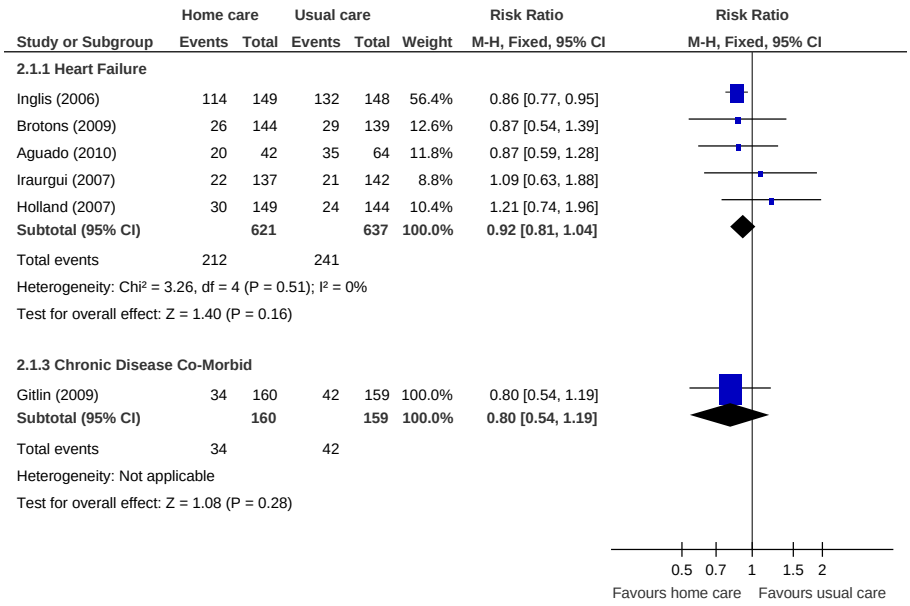

Figure 3: All-Cause Mortality[a,b]

Abbreviations: CI, confidence interval; M-H, Mantel–Haenzel.
[a]Analysis included 5 studies on heart failure patients, (27-29;31;32) 1 study on chronic disease comorbid patients. (36)
[b]Primary outcome in 1 study. (28)

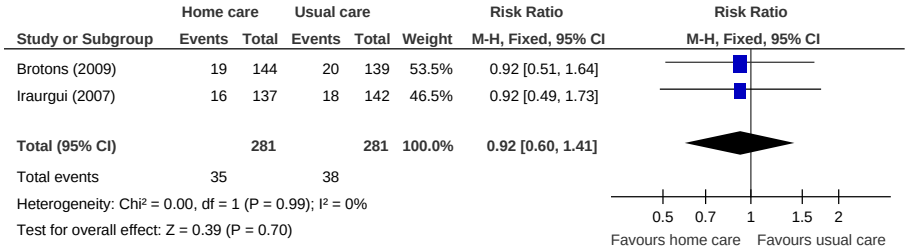

Figure 4: Cardiovascular-Specific Mortality[a,b,*]

Abbreviations: CI, confidence interval; M-H, Mantel–Haenzel.
[a]Heart failure patients in both studies. (29;31)
[b]Not identified as a primary outcome in any study.

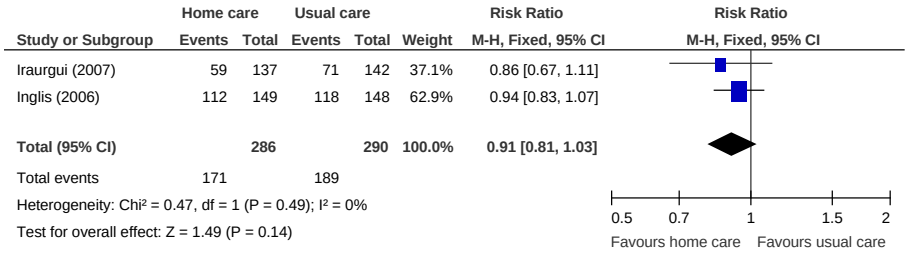

Figure 5: Unplanned Readmissions/Hospitalizations[a,b,c,d]

Abbreviations: CI, confidence interval; M-H, Mantel–Haenzel.
[a]Cumulative incidence and number of events.
[b]Heart failure patients in both studies. (31;32)
[c]Not identified as a primary outcome in any study.
[d]First-ever hospitalization in 1 study. (31)

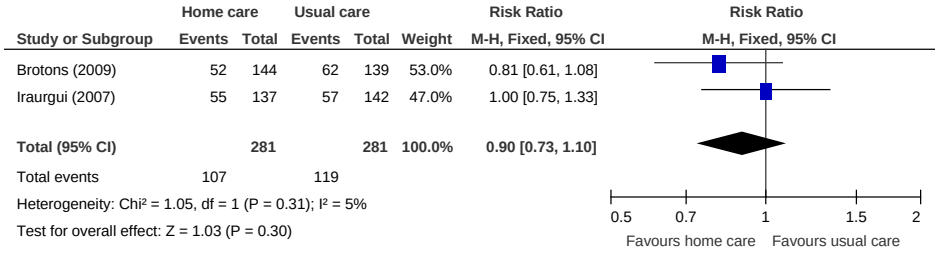

Figure 6: Heart Failure-Specific Readmissions/Hospitalizations[a,b,c]

Abbreviations: CI, confidence interval; M-H, Mantel Haenzel.
[a]Number of occasions.
[b]Heart failure patients in both studies. (29;31)
[c]Not identified as a primary outcome in any study.

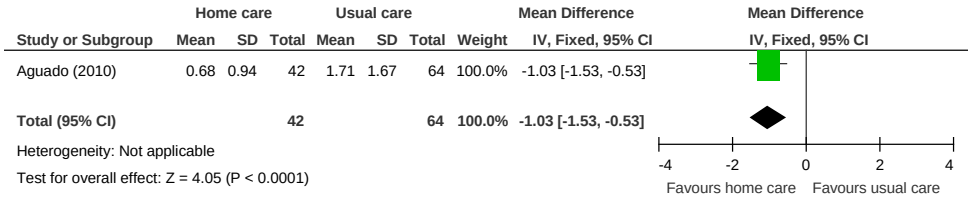

Figure 7: Mean Number of Unplanned Readmissions/Hospitalizations[a,b,c]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Number of events.
[b]Heart failure patients (28;31)
[c]Primary outcome in 1 study. (28)

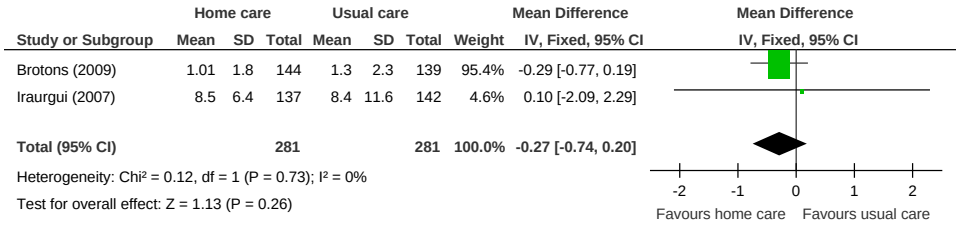

Figure 8: Mean Number of Heart Failure-Specific Readmissions/Hospitalizations[a,b,c,*]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Number of events.
[b]Heart failure patients in both studies. (29;31)
[c]Not identified as a primary outcome in any study.

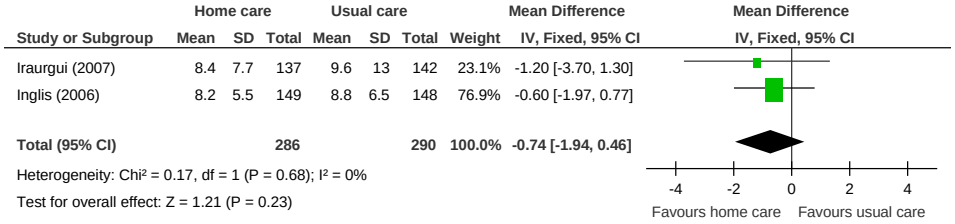

Figure 9: Mean Length of Hospital Stay[a,b,c]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Days.
[b]Heart failure patients in both studies. (31;32)
[c]Not identified as a primary outcome in any study.

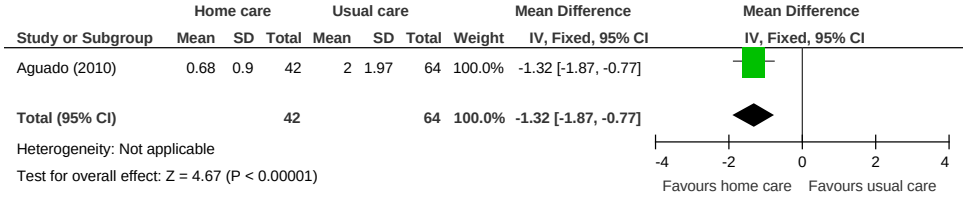

Figure 10: Mean Number of Emergency Department Visits[a,b,c]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Number of events.
[b]Heart failure patients in 1 study. (28)
[c]Not identified as a primary outcome.

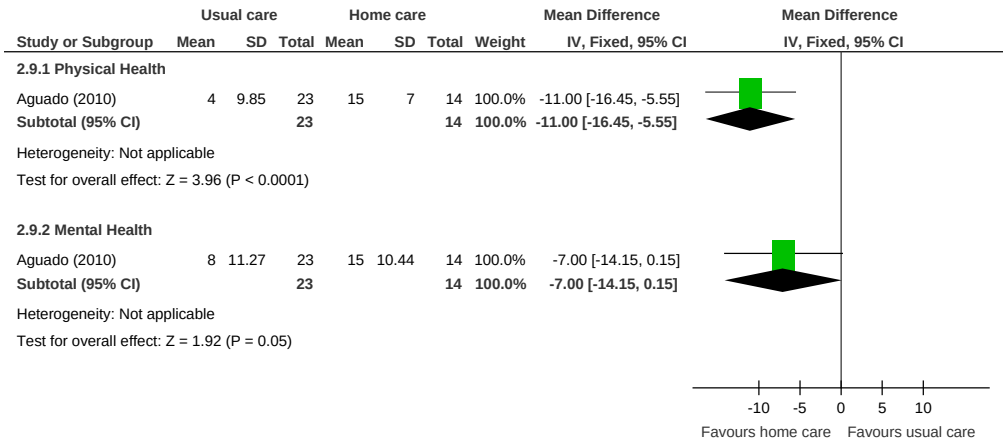

Figure 11: General Well-Being (assessed using SF-36)[a,b,c,d,e,f,g]

Abbreviations: CI, confidence interval; MCID, minimal clinically important difference; SD, standard deviation; SF-36, Medical Outcomes Study Short Form 36-Item Health Survey.
[a]Heart failure patients. (28)
[b]Not identified as a primary outcome.
[c]Change from baseline, with a positive value indicating an improvement as higher scores are favoured.
[d]Range for physical MCID: 10-40 points.
[e]Range for mental MCID: 15–37.5 points.
[f]Physical component scale includes physical functioning, role-physical, bodily pain, and general health.
[g]Mental component scale includes vitality, social functioning, role-emotional, and mental health.

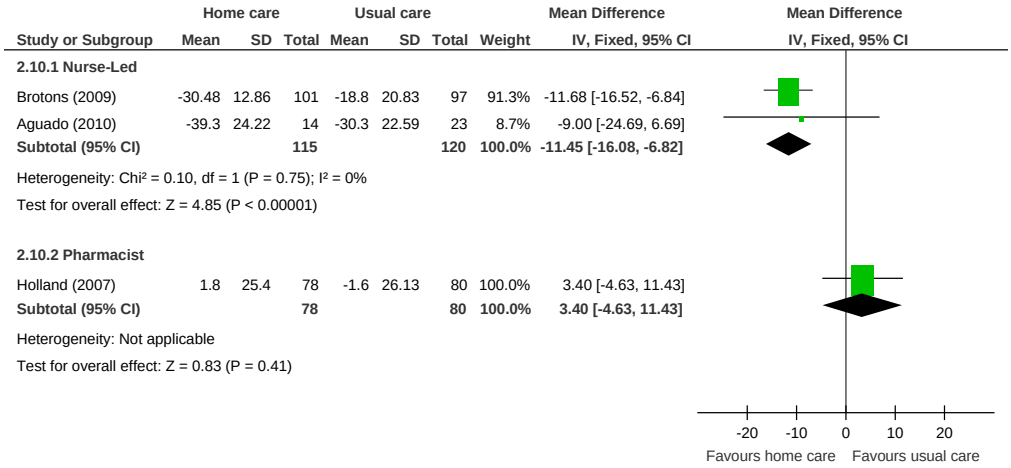

Figure 12: Heart Failure-Specific Well-Being (MLWHFQ)[a,b,c,d,e]

Abbreviations: CI, confidence interval; SD, standard deviation; MCID, minimal clinically important difference; MLWHFQ, Minnesota Living With Heart Failure Questionnaire.
[a]Heart failure patients. (27-29)
[b]Not identified as a primary outcome.
[c]Change from baseline, with a negative value indicating an improvement as lower scores are favoured.
[d]Includes questions on symptoms and signs, physical activity, social interaction, sexual activity, work, and emotions.
[e]MCID is 5 points.

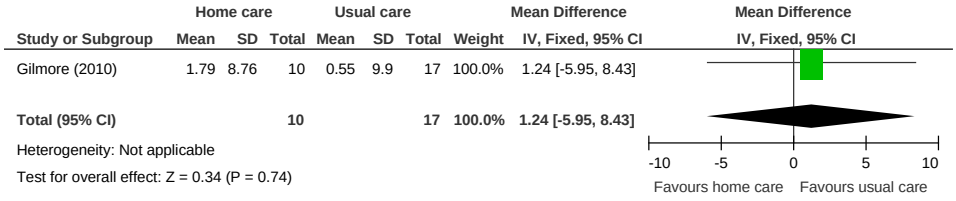

Figure 13: COPD-Specific Well-Being (SGRQ)[a,b,c,d,e]

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; MCID, minimal clinically important difference; SD, standard deviation; SGRQ, St George's Respiratory Questionnaire.
[a]COPD patients. (33)
[b]Primary outcome in study. (33)
[c]Change from baseline, with a negative value indicating an improvement as lower scores are favoured.
[d]Includes symptoms, activity, and impacts.
[e]MCID is 4 points.

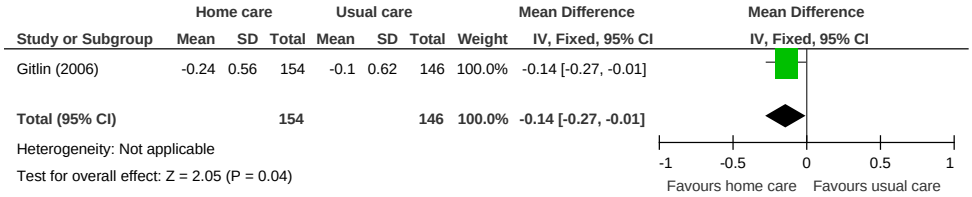

Figure 14: Activities of Daily Living[a,b,c]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Chronic disease multimorbid patients. (37)
[b]Primary outcome in study. Activities of daily living include difficulty dressing above waist or below waist, grooming, bathing/showering, toileting, and feeding.
[c]Change from baseline, with a negative value indicating an improvement as lower scores are favoured.

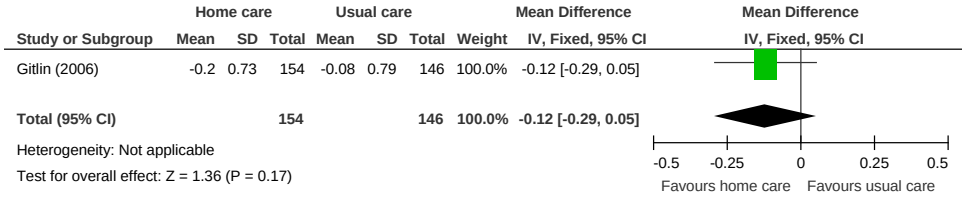

Figure 15: Mobility[a,b,c]

Abbreviations: CI, confidence interval; SD, standard deviation.
[a]Chronic disease multimorbid patients. (37)
[b]Primary outcome in study. Mobility includes getting in/out of the car, walking indoors, walking one block, climbing one flight of stairs, moving in/out of a chair, and moving in/out of bed.
[c]Change from baseline, with a negative value indicating an improvement as lower scores are favoured.

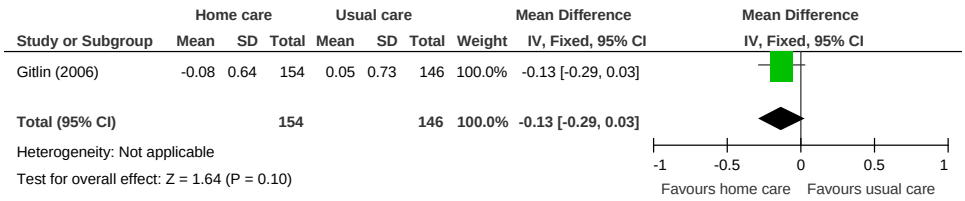

Figure 16: Instrumental Activities of Daily Living[a,b,c]

Abbreviations: CI, confidence interval; IADL, instrumental activities of daily living; SD, standard deviation.
[a]Chronic disease multimorbid patients. (37)
[b]Primary outcome in study. IADL include light housework, shopping, preparing meals, managing money, telephone use, and taking medications.
[c]Change from baseline, with a negative value indicating an improvement as lower scores are favoured.

Results of Meta-Analysis

The results of the meta-analysis show a beneficial effect of in-home care compared with usual care, without significant heterogeneity ($P > 0.10$) (where relevant), for the following outcomes:

- Heart failure patients receiving in-home care had, on average, about one less unplanned hospitalization compared with heart failure patients receiving usual care (MD: −1.03; 95% CI: −1.53 to −0.53; $P < 0.001$ (I^2: n/a; P = n/a)
- Heart failure patients receiving in-home care had, on average, about one-and-a-half fewer ED visits compared with those receiving usual care (MD: −1.32; 95% CI: −1.87 to −0.77; $P < 0.001$ (I^2: n/a; P = n/a)
- Heart failure patients receiving in-home care were more likely to have increased HRQOL compared with those receiving usual care. A statistically significant and clinically relevant effect was shown for physical well-being (MD: −11.00, 95% CI: −16.45 to −5.55; $P < 0.001$), and a statistically significant and clinically relevant effect was shown for nurse-led in-home interventions on HRQOL specific to heart failure (MD: −11.45; 95% CI: −16.08 to −6.82; $P < 0.001$; I^2: 0%, $P = 0.75$)
- Chronic disease multimorbid patients receiving in-home care were more likely to report less difficulties in ADL compared with patients receiving usual care (MD: −0.14; 95% CI: −0.27 to −0.01; $P = 0.04$).

In addition,

- Heart failure patients receiving in-home care were 12% less likely to experience an event of the combined of all-cause mortality and hospitalizations compared with those receiving usual care (RR: 0.88; 95% CI: 0.80–0.97; $P = 0.010$; I^2: 62%; $P = 0.07$). Using a fixed effect model, heterogeneity was borderline. The point estimate remained the same and heterogeneity was not reduced when using a random effects model (RR: 0.88, 95% CI: 0.74–1.05; $P = 0.15$; I^2: 62%; $P = 0.07$). The confidence interval also widened for a nonstatistically significant beneficial effect of in-home care in the latter.

The results did not show statistically significant effects of in-home care compared with results of usual care for the following outcomes:

- All-cause mortality by disease category
- Cardiovascular-specific mortality
- Heart failure-specific hospitalizations
- Length of hospital stay
- Mental well-being and heart failure-specific HRQOL when in-home care was delivered by community pharmacists
- HRQOL for COPD patients
- Functional difficulties including mobility and IADL

These results were without significant heterogeneity ($P > 0.10$) (where relevant).

Qualitative Assessment

Physiological Outcomes

Two studies had information on physiological outcomes including HbA1c, SBP, DBP, and lipid levels. (26;34) One study involved diabetes patients, (26) and the other stroke patients. (34) These studies could neither be meta-analyzed together nor individually because the data in the papers were not in a useable format. For HbA1c, the study of diabetes patients showed a beneficial effect of in-home care, (26) and the study on stroke patients did not show a difference between the intervention and the control groups. (34) There were no differences between the intervention and the control groups for SBP, DBP, and lipid levels in both studies. (26;34) Overall, the benefits of in-home care were shown for lowering HbA1c in diabetes patients.

Summary of the Literature Review

In summary, education-based in-home care is effective at improving patient outcomes when it is delivered by nurses during a single home visit or on an ongoing basis to patients with a range of heart disease severity. In-home visits by occupational therapists and physical therapists targeted at modifying tasks and the home environment improved functional activities for community-living chronic disease adults.

The beneficial effect of in-home care on the combined events of all-cause mortality and hospitalizations was based on 3 studies that included heart failure patients. (29;31;32) The disease severity ranged from NYHA class II to IV in a majority of patients. The nature of the home care intervention was similar although the frequency of the home care visits differed. The length of follow-up was 1 year in 2 studies (29;31) and up to 10 years in the third. (32) Longer follow-up accounted for the higher proportion of events in the longer-term follow-up study. Overall, in-home care has a beneficial effect on the combined events of all-cause mortality and hospitalizations. The GRADE quality of evidence was moderate.

The beneficial effect of in-home care on the mean number of unplanned hospitalizations and ED visits was based on 1 study of heart failure patients. (28) The results showed unplanned hospitalizations down by 1, and ED visits down by a mean of about one-and-a-half. The standard deviations for this study were quite small. The beneficial effect of in-home care on physical well-being, assessed using the SF-36, was also based on this study. Two summary component scales, the physical and mental component scales, which are made up from the 36 questions in the 8 individual domains covered by the questionnaire, (41) were reported. A difference of 11 points is considered within the range of possible values for a minimal clinically important difference. (42) A factor contributing to the success of the in-home care intervention in this 1 study, and hence to the results, may have been the high educational level of a majority of the individuals in the intervention group (63% with a secondary school education). (28) Overall, in-home care has a beneficial effect on lowering hospital utilization and improving HRQOL. The GRADE quality of

evidence was moderate quality for unplanned hospitalizations and ED visits, and low for the physical component of the SF-36.

The lack of a beneficial effect on unplanned hospitalizations, characterized as the number of events, may be due to the heterogeneity in the data provided in the 2 studies, with 1 study apparently considering the number of occasions so that each patient may contribute more than one event (32) and the other study considering only first-ever hospitalizations. (31) Imprecision may have also been a factor considering the sample size calculations. (31;32) The GRADE quality of evidence was low quality for unplanned hospitalizations when characterized as event data.

The lack of an effect on heart failure-specific hospitalizations suggests that the reasons for readmissions are due to different causes or comorbid conditions and not due to the index diagnosis. Imprecision may have also been a factor considering the sample size calculations. (29;31) The GRADE quality of evidence was low quality for heart failure-specific hospitalizations.

The beneficial effect of a nurse-led in-home care intervention on HRQOL in heart failure patients was based on 2 studies that used the MLWHFQ. (28;29) The MLWHFQ is a heart failure-specific questionnaire. It contains 21 questions that ask about symptoms and signs relevant to heart failure, physical activity, social interaction, sexual activity, work, and emotions. The maximum score is 105, with a lower score indicating better HRQOL. (41) A difference of about 12 points is considered to be beyond the specified clinically relevant change score of 5 points. (43) The result was weighted heavily on 1 study in which the nurse-led intervention was provided monthly for the duration of the 1-year study. (29) Also, the heart failure patients in this study were NYHA class IV, which may have been the population with the potential for the largest improvement in HRQOL. Overall, nurse-led in-home care has a beneficial effect on HRQOL; however, the GRADE quality of evidence was considered low quality.

The beneficial effect of in-home care on ADL was based on 1 study. (37) The ADL index is based on the mean perceived difficulty across 6 areas including dressing above the waist, dressing below the waist, grooming, bathing/showering, toileting, and feeding. Difficulty is rated on a score of 1 to 5, with higher scores indicating increased difficulty. A trend for a beneficial effect was shown for the other 2 measures of physical function including mobility and IADL; however, they did not reach statistical significance. Mobility assesses 6 areas including getting in/out of the car, walking indoors, walking one block, climbing one flight of stairs, moving in/out of a chair, and moving in/out bed. The IADL index comprises 6 areas including light housework, shopping, preparing meals, managing money, telephone use, and taking medications. The in-home care intervention of occupational therapists and physical therapists targeting task modifications and home hazards may have been more effective at improving the ADL compared with the other 2 indexes that assess challenges outside of the home and more complex activities. The clinical significance of the difference between comparison groups for ADL is not known. The GRADE quality of evidence was moderate for all 3 functional status measures.

There were no differences between the intervention and the control group for the remaining outcomes. For length of hospital stay, it was not clear whether the data in 1 study referred to the condition under study or if the duration of hospitalization was for another medical reason or referred to overall duration of hospitalization. (32) For all-cause mortality, there was no difference between the intervention and the control groups when studies were analyzed by disease category. For the mental health component of the SF-36, there was no difference between the intervention and the control groups. The mental health component is made up of vitality, social functioning, role-emotional, and mental health domains whereas the physical component is made up of physical functioning, role-physical, bodily pain, and general health domains. Therefore, the mental health component scale may be perceived as more complex, requiring as it does a more substantive intervention than nurse-led in-home care education on disease management to observe improvements.

There was no difference between the intervention and the control groups for pharmacist-led in-home care on heart failure-specific HRQOL. (27) In this 1 study, the lack of ongoing visits may have been the limiting factor although additional study design limitations including post-randomization exclusions may have had an effect. (27) There was no difference between the intervention and the control group for COPD-specific HRQOL measured by SGRQ. (33) The mean difference for the total SGRQ was 1.24 (95% CI: −5.95 to 8.43, $P = 0.74$) while a clinically significant change value is 4 units. (44) The confidence interval crosses the clinically significant threshold; therefore, a lack of precision may have been a limiting factor (HC, n = 10 vs. UC, n = 17 patients).

The GRADE quality of evidence for all outcomes is shown in Appendix 2.

Conclusions

Based on moderate quality of evidence, there was a beneficial effect of in-home care:

- on the combined events of all-cause mortality and hospitalizations in heart failure patients;
- on unplanned hospitalizations in heart failure patients;
- on emergency department (ED) visits in heart failure patients;
- on the functional measure of activities of daily living (ADL) in chronic ill multimorbid patients.

Based on moderate quality of evidence, there was no difference between in-home care and usual care:

- for all-cause mortality in chronically ill multimorbid patients;
- for the functional measure of mobility in chronically ill multimorbid patients;
- for the functional measure of instrumental activities of daily living (IADL) in chronically ill multimorbid patients.

Based on low quality of evidence, there was a beneficial effect:

- of in-home care on the physical component scale of the Medical Outcomes Study Short Form 36-Item Health Survey (SF-36), which assessed health-related quality of life (HRQOL) in heart failure patients;
- of nurse-led in-home care on the heart failure-specific HRQOL in heart failure patients;
- of in-home care on hemoglobin A1c in diabetes patients.

Based on low quality of evidence, there was no difference:

- for all-cause mortality in heart failure patients;
- for cardiovascular-specific mortality in heart failure patients;
- for heart failure-specific hospitalizations in heart failure patients;
- for length of hospital stay in heart failure patients;
- between in-home care and usual care for the mental health component of the SF-36 HRQOL in heart failure patients;
- between pharmacist-led in-home care and usual care for heart failure-specific HRQOL in heart failure patients;
- between in-home care and usual care for the physiological measures of systolic blood pressure (SBP), diastolic blood pressure (DBP), and lipid levels in diabetes and stroke patients.

Based on indeterminate evidence, there was no difference between in-home care and usual care for chronic obstructive pulmonary disease (COPD)-specific HRQOL.

Existing Guidelines for Home Care

While there are no specific guidelines for use of in-home care in Canada, listed below are the client populations and service programs offered by the Toronto Central Community Care Access Centres that deliver home care (*Personal communication, Community Expert, January 7, 2013*). (5)

1. Adult*
    - Seniors Integrated Care
    - Seniors Enhanced Care (Frail Seniors*)
    - Community Independence Program (Seniors Independent Living*)
    - Adult Supportive Care
    - Telehomecare Program
2. Post-acute / Short-term support
    - Rapid Response Program*
    - Acute and Rehab Transitional Program
3. Child and Family – Long and Short Stay
4. End of Life
5. Urban Health (Mental Health / Homeless)
    - Urban Health Program
    - Intercity Access Program
6. Acquired Brain Injury Program

An asterisk indicates the programs relevant to this evidence-based analysis.

Glossary

Advanced practice nurse	Advanced level of clinical nursing practice that includes the *clinical nurse* and the *nurse practitioner*.
Ambulatory	Individuals who experience some difficulty with everyday living but who are not totally dependent or homebound or who are receiving services to address functional problems.
Client	The person who is receiving home care services.
Clinical nurse	A nurse that provides clinical guidance and nursing leadership and promotes evidence-based practice to complex care clients.
Disease management	Coordinated multidisciplinary comprehensive care across the care continuum and specifically for chronic disease.
Disease management program	Multidisciplinary programs that target recently hospitalized patients in an effort to optimize their longer-term management, including post-acute discharge care within the community.
Family Health Network	A type of group practice that provides primary care services to rostered patients.
Multidisciplinary care models	Aims to address the needs of individuals from many perspectives, e.g., medical, psychological, behavioural, and financial. Involves a team of many different health professionals who also attempt to bridge patient care from the hospital to other care delivery or the home.
New York Heart Association Functional Classification	Ranks patients' limitations during physical activity, e.g., class I/II: none or mild limitation; class III: moderate limitation; class IV: severe limitation.
Nurse practitioner	Nurses who provide care in rural and remote areas that would otherwise not receive medical care and who possess the skills to diagnosis and manage disease within legislative scope.
Rehabilitation	The physical restoration of a sick or disabled person by therapeutic measures and re-education to participation in the activities of a normal life within the limitations of the person's physical disability.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Home Care – Final Search Strategy

Database: Ovid MEDLINE(R) <1946 to January Week 3 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 25, 2012>, Embase <1980 to 2012 Week 03>
Search Strategy:

137 exp Coronary Artery Disease/ (211925)
2 exp Myocardial Infarction/ use mesz (133578)
3 exp heart infarction/ use emez (216783)
4 (coronary artery disease or cad or heart attack).ti. (44430)
5 ((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti. (149495)
6 or/1-5 (539636)
7 exp Atrial Fibrillation/ use mesz (28093)
8 exp heart atrium fibrillation/ use emez (55436)
9 ((atrial or atrium or auricular) adj1 fibrillation*).ti,ab. (73456)
10 or/7-9 (99330)
11 exp heart failure/ (300723)
12 ((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab. (234410)
13 11 or 12 (381620)
14 exp Stroke/ (177913)
15 exp Ischemic Attack, Transient/ use mesz (16370)
16 exp transient ischemic attack/ use emez (19656)
17 exp stroke patient/ use emez (5632)
18 exp brain infarction/ or exp cerebrovascular accident/ use emez (100939)
19 (stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab. (281020)
20 or/14-19 (391349)
21 exp Diabetes Mellitus, Type 2/ use mesz (68223)
22 exp non insulin dependent diabetes mellitus/ use emez (101510)
23 exp diabetic patient/ use emez (12865)
24 (diabetes or diabetic* or niddm or t2dm).ti,ab. (764490)
25 or/21-24 (789402)
26 exp Skin Ulcer/ (72029)
27 ((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab. (28663)
28 (decubitus or bedsore*).ti,ab. (8526)
29 or/26-28 (90720)
30 exp Pulmonary Disease, Chronic Obstructive/ use mesz (17049)
31 exp chronic obstructive lung disease/ use emez (54703)
32 (chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab. (54430)
33 (copd or coad).ti,ab. (45643)
34 chronic airflow obstruction.ti,ab. (1063)
35 exp Emphysema/ (37422)
36 exp chronic bronchitis/ use emez (6977)
37 ((chronic adj2 bronchitis) or emphysema).ti,ab. (50825)

38 or/30-37 (159227)
39 exp Chronic Disease/ (340679)
40 ((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab. (219900)
41 39 or 40 (506233)
42 6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 (2605524)
43 exp Home Care Services/ use mesz (36884)
44 exp home care/ use emez (46848)
45 exp home care agencies/ or exp home health aides/ use mesz (48362)
46 exp House Calls/ use mesz (2048)
47 ((home or domicil* or communit*) adj2 (visit* or care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)).ti,ab. (86989)
48 (homecare or homemaker service* or home nurs* or meals on wheels).ti,ab. (3972)
49 43 or 44 or 45 or 46 or 47 or 48 (143324)
50 42 and 49 (17054)
51 limit 50 to 42ochran language (14353)
52 limit 51 to yr="2006 –Current" (5606)
53 limit 52 to (controlled clinical trial or meta analysis or randomized controlled trial) (690)
54 exp Technology Assessment, Biomedical/ or exp Evidence-based Medicine/ use mesz (63489)
55 exp Biomedical Technology Assessment/ or exp Evidence Based Medicine/ use emez (523373)
56 (health technology adj2 assess$).ti,ab. (3059)
57 exp Random Allocation/ or exp Double-Blind Method/ or exp Control Groups/ or exp Placebos/ use mesz (379638)
58 Randomized Controlled Trial/ or exp Randomization/ or exp RANDOM SAMPLE/ or Double Blind Procedure/ or exp Triple Blind Procedure/ or exp Control Group/ or exp PLACEBO/ use emez (901804)
59 (random* or RCT).ti,ab. (1255504)
60 (placebo* or sham*).ti,ab. (414042)
61 (control* adj2 clinical trial*).ti,ab. (35063)
62 meta analysis/ use emez (58594)
63 (meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or 42ochrane).ti,ab. (252855)
64 or/53-63 (2164699)
65 52 and 64 (1348)
66 remove duplicates from 65 (960)

CINAHL

#	Query	Results
S43	S39 and S42 Limiters – Published Date from: 20060101-20121231; English Language	411
S42	S40 or S41	157006
S41	random* or sham*or rct* or health technology N2 assess* or meta analy* or metaanaly* or pooled analysis or (systematic* N2 review*) or published studies or medline or embase or data synthesis or data extraction or 43ochrane or control* N2 clinical trial*	148913
S40	(MH "Random Assignment") or (MH "Random Sample+") or (MH "Meta Analysis") or (MH "Systematic Review") or (MH "Double-Blind Studies") or (MH "Single-Blind Studies") or (MH "Triple-Blind Studies") or (MH "Placebos") or (MH "Control (Research)")	83970
S39	S33 and S38	6361
S38	S34 or S35 or S36 or S37	66000
S37	homecare OR homemaker service* OR home nurs* OR meals on wheels	9390
S36	((home OR domicil* OR communit*) N2 (visit* OR care OR caring OR caregiver* OR healthcare OR assist* OR aid* OR agenc* OR service* OR rehabilitation))	57389
S35	(MH "Home Health Agencies") OR (MH "Home Health Care Information Systems")	4318
S34	(MH "Home Health Aides") OR (MH "Home Health Care+")	27543
S33	S5 or S8 or S11 or S15 or S19 or S22 or S27 or S32	223005
S32	S28 or S29 or S30 or S31	71626
S31	chronic* N2 disease* or chronic* N2 ill*	43890
S30	comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* N1 patient*) OR (multiple N2 (condition* OR disease* OR patient*))	30356
S29	(MH "Comorbidity")	16703
S28	(MH "Chronic Disease")	23713
S27	S23 or S24 or S25 or S26	8821
S26	chronic N2 bronchitis or emphysema	1823
S25	(MH "Emphysema")	886
S24	chronic obstructive N2 disease* or chronic obstructive N2 disorder* or copd or coad	7394
S23	(MH "Pulmonary Disease, Chronic Obstructive+")	5374
S22	S20 or S21	16228
S21	pressure N1 ulcer* or bedsore* or bed N1 sore* or skin N1 ulcer* OR pressure N1 wound* OR decubitus	9608
S20	(MH "Skin Ulcer+")	14882
S19	S16 or S17 or S18	70413
S18	diabetes or diabetic* or niddm or t2dm	70413
S17	(MH "Diabetic Patients")	3551
S16	(MH "Diabetes Mellitus, Type 2+")	18307

S15	S12 or S13 or S14	38366
S14	stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA	37868
S13	(MH “Cerebral Ischemia, Transient”)	1907
S12	(MH “Stroke”) OR (MH “Stroke Patients”)	25741
S11	S9 OR S10	18910
S10	myocardi*failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation or cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	18898
S9	(MH “Heart Failure+”)	14423
S8	S6 OR S7	8118
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	8118
S6	(MH “Atrial Fibrillation”)	6503
S5	S1 OR S2 OR S3 OR S4	30205
S4	TI myocardi* N2 infarct* or TI heart N2 infarct* or TI cardiac N2 infarct* OR TI coronary N2 infarct* or TI arterioscleros* or TI atheroscleros*	9678
S3	coronary artery disease OR cad OR heart attack*	7725
S2	(MH “Myocardial Infarction+”)	19236
S1	(MH “Coronary Arteriosclerosis”)	4653

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	MeSH descriptor **Chronic Disease** explode all trees	9875
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR “patient* with multiple” OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	68126
#27	MeSH descriptor **Home Care Services** explode all trees	1872
#28	MeSH descriptor **Home Care Agencies** explode all trees	7

#29	MeSH descriptor **Home Health Aides** explode all trees	17
#30	MeSH descriptor **House Calls** explode all trees	215
#31	((home or domicil* or communit*) NEAR/2 (care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)):ti or ((home or domicil* or communit*) NEAR/2 (care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)):ab	2169
#32	(homecare or homemaker service*):ti and (homecare or homemaker service*):ab	8
#33	(#27 OR #28 OR #29 OR #30 OR #31 OR #32)	3650
#34	(#26 AND #33), from 2006 to 2012	335

CRD

	Line	Search	Hits	
☐	1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230	Delete
☐	2	(coronary artery disease or cad or heart attack*):TI	213	Delete
☐	3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	224	Delete
☐	4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225	Delete
☐	5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0	Delete
☐	6	((atrial or atrium or auricular) adj1 fibrillation*):TI	168	Delete
☐	7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418	Delete
☐	8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	280	Delete
☐	9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549	Delete
☐	10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32	Delete
☐	11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	622	Delete
☐	12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511	Delete
☐	13	(diabetes or diabetic* or niddm or t2dm):TI	1223	Delete
☐	14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253	Delete
☐	15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73	Delete
☐	16	(decubitus or bedsore*):TI	0	Delete
☐	17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237	Delete
☐	18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	219	Delete
☐	19	(copd or coad):TI	108	Delete

☐	20	(chronic airflow obstruction):TI	0	Delete
☐	21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10	Delete
☐	22	((chronic adj2 bronchitis) or emphysema):TI	47	Delete
☐	23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687	Delete
☐	24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	252	Delete
☐	25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146	Delete
☐	26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22	Delete
☐	27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4656	Delete
☐	28	MeSH DESCRIPTOR home care services EXPLODE ALL TREES	375	Delete
☐	29	MeSH DESCRIPTOR home care agencies EXPLODE ALL TREES	1	Delete
☐	30	MeSH DESCRIPTOR home health aides EXPLODE ALL TREES	2	Delete
☐	31	MeSH DESCRIPTOR house calls EXPLODE ALL TREES	32	Delete
☐	32	(((home or domicil* or communit*) adj2 (visit* or care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation))) FROM 2006 TO 2012	785	Delete
☐	33	#28 OR #29 OR #30 OR #31 OR #32	1057	Delete
☐	34	#27 AND #33	190	Delete
☐	35	#27 AND #33	190	Delete

Appendix 2: GRADE Tables

Table A1: GRADE Evidence Profile for Comparison of In-Home Care and Usual Care: Mortality

No. Of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
All-cause mortality – heart failure patients							
5 (RCTs)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low
All-cause mortality – chronic disease							
1 (RCTs)	No serious limitations	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕⊕ Moderate
Combined all-cause mortality and hospitalizations							
3 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate
Cardiovascular-specific mortality							
2 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low

Table A2: GRADE Evidence Profile for Comparison of In-Home Care and Usual Care: Hospital Utilization

No. Of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Unplanned hospitalizations							
2 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low
Heart failure-specific hospitalizations							
2 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low
Mean number of unplanned hospitalizations							
1 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate
Mean number of heart failure-specific hospitalizations							
2 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low
Length of stay							
2 (RCTs)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (-1)[b]	Undetected	n/a	⊕⊕ Low
Mean number of emergency department visits							
1 (RCT)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate

Table A3: GRADE Evidence Profile for Comparison of In-Home Care and Usual Care: Health-Related Quality of Life and Functional Status

No. Of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
General well-being – physical							
1 (RCT)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low
General well-being – mental							
1 (RCT)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low
Heart failure-specific well-being – nurse-led							
2 (RCTs)	Very serious limitations (–2)[e]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low
Heart failure-specific well-being – pharmacist							
1 (RCT)	Very serious limitations (–2)[f]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low
COPD-specific well-being							
1 (RCT)	Very serious limitations (–2)[g]	No serious limitations	No serious limitations	Very serious limitations (-2)[g]	Undetected	n/a	Indeterminate
Activities of daily living							
1 (RCT)	Serious limitations (–1)[h]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate
Mobility							
1 (RCT)	Serious limitations (–1)[h]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate
Instrumental activities of daily living							
1 (RCT)	Serious limitations (–1)[h]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕⊕ Moderate

Table A4: GRADE Evidence Profile for Comparison of In-Home Care and Usual Care: Physiological Measures

No. Of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Hemoglobin A1c							
2 (RCTs)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low (Qualitative assessment)[i]
Systolic blood pressure							
2 (RCTs)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low (Qualitative assessment)[i]
Diastolic blood pressure							
2 (RCTs)	Very serious limitations (–2)[d]	**No serious limitations**	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low (Qualitative assessment)[i]
Lipids (low density lipoprotein and total cholesterol)							
2 (RCTs)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	n/a	⊕⊕ Low (Qualitative assessment)[i]

Abbreviations: RCT, randomized controlled trial.

[a] Allocation concealment was not identified and post-randomization exclusions may have biased results.

[b] Imprecision based on sample size calculation.

[c] Allocation concealment was not identified.

[d] Allocation concealment was not identified and losses to follow-up may have biased results.

[e] Allocation concealment was not identified, lack of blinding, and losses to follow-up may have biased results.

[f] Lack of blinding and post-randomization exclusions may have biased results.

[g] Lack of blinding and allocation concealment was not identified, imprecision (small sample size and confidence interval crosses threshold).

[h] Losses to follow-up may have biased results.

[i] Unable to meta-analyze results across the 2 studies.

Appendix 3: Summary Tables

Table A5: Summary of Study Characteristics (N = 12 Studies)

Author, Year	Study Location	Cohort	Study Design	Length of Follow-Up (Length of Intervention[a])	HC / UC	Losses to Follow-Up (HC / UC)
Spencer et al, 2011 (26)	Medical records, Detroit, USA	T2 DM	Parallel RCT	6 mo (6 mo)	84 / 99	56 / 57[b]
Aguado et al, 2010 (28)	University hospital, Spain	HF	Parallel RCT	Up to 2 y (n/a)	42 / 64	-[c]
Gilmore et al, 2010 (33)	Outpatient clinic, Louisiana, USA	COPD	FT RCT	1–3 mo (n/a)	10 / 17[d]	-
Gray et al, 2010 (35)	FHT, Ottawa, Canada	Chronic[e]	Parallel RCT	1–1.5 y (12–18 mo)	120 / 121	-
Allen et al, 2009 (34)	Acute care, Ohio, USA	Stroke[f]	Parallel RCT	6 mo (6 mo)	190 / 190	-[g]
Brotons et al, 2009 (29)	4 hospitals (U+C), Spain	HF	Parallel RCT	1 y (1 y)	144 / 139	144 / 138[c]
Gitlin et al, 2009 (36)	Community, Philadelphia, USA	Chronic	Parallel RCT	Up to 5.25 y (6 mo)	160 / 159	-
Wongpiriyayothar et al, 2008 (30)	Hospital clinic, Thailand	HF	Parallel RCT	Up to 3 mo (n/a)	48 / 48	48 / 45
Holland et al, 2007 (27)	3 hospitals, UK	HF	Parallel RCT	6 mo (n/a)	169 / 170	148 / 143[c,h]
Iraurqui et al, 2007 (31)	Tertiary care hospital, Spain	HF	Parallel RCT	1 y (n/a)	137 / 142	-
Gitlin et al, 2006 (37)	Community, Philadelphia, USA	Chronic	Parallel RCT	6 (6 mo)	160 / 159	154 / 146
Inglis et al, 2006 (32)	Tertiary centre, Australia	HF	Parallel RCT	Up to 10 y (n/a)[i]	149 / 148	-

Abbreviations: C, community hospital; chronic, chronic disease; COPD, chronic obstructive pulmonary disease; FHT, Family Health Team; FT, factorial RCT; HbA1c, hemoglobin A1c; HC, home care; HF, heart failure; HRQOL, health-related quality of life; mo, month; RCT, randomized controlled trial; T2 DM, type 2 diabetes mellitus; U, University hospital; UC, usual care; y, year.

[a]Length of intervention information may be indicated by n/a if the HC intervention was a single visit or a few visits (e.g., 2–3 visits), and refers to the application of the intervention and does not refer to longer-term surveillance (e.g., the addition of telephone follow-up).

[b]Reduced sample size for HbA1c, primary outcome. This is the number with complete data at baseline and 6-month follow-up.

[c]Reduced sample size for HRQOL outcome (Aguado et al, 2010 (28), HC: 14 / UC: 23; Brotons et al, 2009 (29), HC: 101 / UC : 97; Holland et al, 2007 (27), HC: 78 / 80).

[d]Study subjects after losses to follow-up.

[e]For this particular study, 4 chronic diseases were specified: coronary artery disease, diabetes, congestive heart failure, COPD.

[f]Ischemic stroke.

[g]Reduced sample size for physiologic measures (HC: 175 / UC: 163).

[h]Post-randomization exclusions (HC: 149 / UC: 144), plus reduced sample size at the end of follow-up (HC: 148 / UC: 143).

[i]Reduced length of follow-up for the primary outcome of combined all-cause mortality and hospitalizations and separately for hospitalizations, median: 4.2 y, range: 3 to 6 y.

Table A6: Detailed Description of Home Care Intervention (N = 12 Studies)

Author, Year	Components of Home Care	Type of Providers[a]	Frequency	Duration
Spencer et al, 2011 (26)	Promotion of healthy lifestyle and DM self-management education activities + 1 TC / 2 wks CHWs also provided community DM education classes and escorted PCP clinic visits, in-home care: goal setting, progress support, communication skills, facilitated referrals	CHWs / family health advocates	2 visits / mo	60 min
Aguado et al, 2010 (28)	Education in relevant aspects of disease and self-management Elements of education included patient's habits, understanding of medication, and preventive activities	2 physician-trained nurses	1 visit	2 h
Gilmore et al, 2010 (33)	Educational support for disease management and evaluation of the patient's general health environment Structured assessment form to summarize ADL, medications, and living space; evaluation of the home environment, medication access, and family or personnel assistance	Respiratory therapist	1 visit	20–30 min
Gray et al, 2010 (35)	To ensure disease management and strong social supports + TC Patient care plan priorities based on 5 dimensions of care: disease management, medical review, education and self-care, social support and community integration, psychological issues Providers working with family physicians, educational classes, 22 patients received a telehealth / remote monitoring of clinical factors	3 nurse practitioners, pharmacist	NP for 18 mo, P for 12 mo[b] as needed	1 h for NP
Allen et al, 2009 (34)	Comprehensive assessment, PT as needed, education for lifestyle modification, medication use, social services, education to recognize signs and symptoms of recurrence, self-management + 1 TC / wk (1st mo) and then 1 TC / mo (up to 6 mo)	Advanced practice nurse care manager	Initial visit and then as necessary	1–2 h
Brotons et al, 2009 (29)	Intensive, including disease education, warning symptom recognition, assessment of medication adherence and lifestyle habits, medical history review, functional status and vital sign examination + TC / 15 days Additional information provided prior to hospital discharge, worked with PCP or cardiologist	Nurses	Monthly	40–45 min

Author, Year	Components of Home Care	Type of Providers[a]	Frequency	Duration
Gitlin et al, 2009 (36) and Gitlin et al, 2006 (37)	Aimed to compensate for declining abilities by home environment and task performance modifications during the active phase (6 mo) + 3 TC (OT) during the maintenance phase (6–12 mo) OTs for environmental barriers and support, goal setting, cognitive, behavioural, and environmental strategies; PTs for balance and muscle strength exercises and fall recovery techniques	OT, PT	OT: 4 + 1 TC, plus PT: 1 (active phase), 1 final OT visit (maintenance phase)	OT: 90 min, PT: 90 min
Wongpiriyayothar et al, 2008 (30)	Patient education and plan to enhance patient's symptom monitoring and management skills + 2 TC / weekly Educational booklet also provided, coaching strategies used	Advanced practice nurse	2 visits 1 week apart	1st: 2 h, 2nd: 45–60 min
Holland et al, 2007 (27)	Patient education on disease, medication, healthy lifestyle, signs and symptoms, removed discontinued drugs, educational booklet Worked with PCP and local pharmacist for use of drug adherence aid; community pharmacists were not independent prescribers to modify drug regimen; standardized visit form	17 community pharmacists	2 visits	1st: 72 min 2nd: 50 min
Iraurqui et al, 2007 (31)	Educational program about disease facts and management (symptoms, lifestyle, diet, therapy), with special emphasis Home attention included physician visits and clinical exam, tests and analyses when needed therapeutic review; information manual, TC available for queries	Nurses	3 visits @ 2, 5, 10 days	1 hr
Inglis et al, 2006 (32)	Comprehensive assessment, physical exam, reviewed medication adherence and disease knowledge, assessed social supports, remedial counselling, strategies, and monitoring action + TC at 6 mo (routine and surveillance) Report shared with PCP and cardiologist, community pharmacist contacted to help manage medications	Nurse and P, or cardiac nurse	1 visit	60–90 min

Abbreviations: ADL, activities of daily living; CHW, community health workers; DM, diabetes; HC, home care; h, hours; min, minutes; mo, months; NP, nurse practitioner; OT, occupational therapist; P, pharmacist; PCP, primary care provider; PT, physical therapist; TC, telephone call; wks, weeks.

[a]Type of providers who delivered the in-home care.

[b]Intervention period reduced to 12 months for those recruited last.

Table A7: Detailed Summary of Study Design Characteristics (N = 12 Studies)

Author, Year	Study Population	Description of HC / UC	Results	Other Comments
Spencer et al, 2011 (26)	≥ 18 y, physician dx T2 DM, AA or L/H, geographic defined, identified from MR	HC: Culturally defined HB CHW intervention for T2 DM in low income inner city AA and Latinos UC: Contacted once per mo to update contact information	Mean age: 52.5 y; high school graduate: 60%; insulin use: 28% % change from baseline, at 6 mo, HbA1c, HC: n = 56, −0.8 (−1.2, −0.4, $P < 0.01$)[a] vs. UC: n = 57, 0.0 (−0.4, 0.4, ns)[a]; LDL, HC: n = 51, −10 (−17, −2, $P < 0.05$)[a] vs. UC: n = 55, −4 (−12, 4, ns)[a]; SBP, HC: n = 54, −2 (−6, 2, ns)[a] vs. UC: n = 65, −3 (−6, 1, ns)[a]; DBP, HC: n = 54, 0 (−3, 3, ns)[a] vs. UC: n = 65, −2 (−5, 1, ns)[a]	Community living, all participants received REACH related to living a healthy lifestyle and diet, and at designated health care facilities; LFU 28/164 (17.1%)
Aguado et al, 2010 (28)	Patients admitted to hospital with systolic HF, class II to IV NYHA and < 45% on EC or in prior 6 mo	HC: HB education visit for discharged HF patients UC: no educational component Both: conventional discharge care and outpatient care by attending physicians	Mean age: 77.6 y; secondary school education: 63%; NYHA class II: 46%; comorbidities, hypertension (59%), DM (39%), COPD (31%), CVA (15%) At 24 mo, all-cause mortality, HC: 20/42 (46.7%) vs. 35/64 (55.4%), $P = 0.448$; mean (SD) ED visits, HC: 0.68 (0.90) vs. UC: 2.00 (1.97), $P = 0.001$; mean (SD) unplanned hospitalizations, HC: 0.68 (0.94) vs. UC: 1.71 (1.67), $P = 0.003$; mean (SD) MLWHFQ score, HC: 11.9 (10.5) vs. UC: 18.3 (16.2); mean (SD) SF-36 physical score, HC: 50 (5) vs. UC: 44 (3); mean (SD) SF-36 mental score, HC: 52 (7) vs. UC: 44 (6)	Intervention 1 week after discharge; LFU for outcome of HRQOL, HC: 28/42 (66.6%) vs. UC: 41/64 (64%), compliance with medication in HB group; 0 LFU for primary study outcomes; reduced SS for HRQOL, HC: 14 and UC: 23
Gilmore et al, 2010 (33)	≥ 18 y, confirmed spirometry, physician dx COPD, moderate to severe by GOLD, ≥ 4th grade reading literacy	HC: HB education visit for moderate to severe COPD UC: clinic visit with no educational component Both: information on medication use, physician initiated patient education related to inhalers and indications for medications	Mean age: 58 y; mean (SD) education: 10.4 (2.5) y; mean (SD) FEV_1: 45.2% (15.7) At 30–90 days, mean (SD) overall SGRQ change from baseline, HC: 1.79 (8.76) vs. UC: 0.55 (9.9) (ns)	Outpatient pulmonary clinic, designed to examine education support by both a standardized home visit and COPD educational guide, additional information of SGRQ domains, additional information on knowledge and self-efficacy, LFU, 10/37 (27%)

Author, Year	Study Population	Description of HC / UC	Results	Other Comments
Gray et al, 2010 (35)	≥ 50 y, at risk of functional decline, physical deterioration, or needing emergency services	HC: HB team care program (APTCare) UC: usual medical care Both: PCP visits	Mean age: 72 y; high school education or higher: 61%; mean number of chronic conditions[b], HC: 2.7 vs. UC: 2.4 (without SDs) Mean (95% CI) ED visits, HC: 7.84 (6.9–8.8) vs. UC: 7.81 (6.9–8.7); mean (95% CI) all-cause hospitalizations, HC: 0.40 (0.3–0.5) vs. 0.46 (0.3–0.6) (without SDs)	Community living, primary outcome: composite of quality of care for 4 chronic conditions of CAD, DM, HF, COPD (152 of 241 (63.1%) had 1 of 4 chronic conditions), mean LFU: 14.3 mo, additional information on appointments with physicians and day surgeries; ED visits: deceased patients were assumed to have each had 1 ED visit
Allen et al, 2009 (34)	Ischemic stroke dx, NIHSS ≥ 1, discharged home, geographic region, no other dominant illness, English speaking, no planned endarterectomy	HC: comprehensive care management UC: organized stroke department care Both: UC and enhanced discharge planning	Mean age: 68 y; diabetes: 36%; mean number of comorbidities: 0.7 At 6 mo, all-cause mortality, HC: 9/190 (4.5%) vs. UC: 7/190 (3.5%) (ns); mean LOS, HC: 1.6 vs. UC: 1.4[a] days; mean HRQOL total score, HC: 196 vs. UC: 199; % HbA1c > 6.5%, HC: 28.3 vs. 22.8; % SBP > 140 mm Hg, HC: 31.5 vs. UC: 30.0; % DBP > 90 mm Hg, HC: 5.6 vs. UC: 5.2; % total CHL > 180 mg/dL, HC: 35.4 vs. UC: 30.8	Intervention within 1 week of discharge; outcomes selected to reflect the process of care management – 5 domains; no SDs for HRQOL and physiological measures; HC: 175 / UC: 163 for physiological outcomes
Brotons et al, 2009 (29)	Hospitalized for suspected HF per Framingham, HF dx at hospital discharge in 1st or 2nd position (any age)	HC: intensive HB care UC: referred to PCP and/or cardiologist	Mean (SD) age: 76.3 (8.2) y; NYHA class IV at hospitalizations, 51%; comorbidities, hypertension (76%), DM (42%), COPD (27%), with baseline differences for COPD At 1 y, combined, HC: 60/144 (41.7%) vs. UC: 75/138 (54.3%), $P = 0.043$; all-cause mortality, HC: 26/144 (18.1%) vs. 29/138 (21%) (ns); CVD mortality, HC: 19/144 (13.2%) vs. UC: 20/138 (14.5%); HF hospitalizations, HC: 52/144 (36.1%) vs. UC: 62/138 (44.9%) (ns); mean HF hospitalizations, HC: 1.01 vs. UC: 1.30 (ns) (without SDs); mean (SD) MLWHFQ score, HC: 18.57 (13.1) vs. UC: 31.11 (23.9), $P < 0.001$	Monthly visits after discharge; reduced sample size for HRQOL: 198 (70.2%); additional information on patient satisfaction and adherence to treatment; combined: hospitalization due to worsening of HF

Author, Year	Study Population	Description of HC / UC	Results	Other Comments
Gitlin et al, 2009 (36) and Gitlin et al, 2006 (37)	Community-living adults, ambulatory, ≥ 70 y, cognitively intact, ≥ 1 functional difficulties, English speaking	HC: ABLE program UC: Home safety education booklet at study end	Mean age: 79 y; less than a high school education: 31%, high school education: 32.3%, more than a high school education: 36.7%; comorbidities, hypertension (71%), CVD (39%), DM (23%) Up to 5.25 y, all-cause mortality, HC: 34/160 (21.3%) vs. UC: 42/159 (26.4%) At 6 mo, ADL, HC: 1.58 (0.54) vs. UC: 1.66 (0.63), *P* = 0.03[a]; mobility, HC: 2.35 (0.72) vs. UC: 2.41 (0.80), *P* = 0.15; IADL, HC: 1.97 (0.69) vs. UC: 2.07 (0.77), *P* = 0.04 [HC: n = 154 / UC: n = 146]	Risk groups created by mortality risk, ↑ scores indicate ↑ risk, mean of 7 health conditions, additional information on 6 and 12 mo measures of fear of falling, functional self-efficacy, home hazards, and control-oriented strategies
Wongpiriyayothar et al, 2008 (30)	HF, ≥ 40 y, class II NYHA, stable medication use, ability to communicate, geographic area, not living alone	HC: HB program on symptom alleviation and well-being UC: HF booklet at end of study follow-up Both: received care from hospital health care providers	Mean age: 60 y; finished primary school: 89% At 12 weeks, mean SF-36 physical score, HC: 78.3 vs. UC: 60.4, *P* < 0.001; mean SF-36 mental score, HC: 77.7 vs. UC: 58.6, *P* < 0.001 (without SDs)	Intervention within 1 week of outpatient visit; not clear what is the primary outcome; additional information on symptom severity, as described in the text: many patients had comorbid diseases and > 1 CVD dx, no baseline info on NYHA
Holland et al, 2007 (27)	HF, > 18 y, taking ≥ 2 drugs	HC: HB community pharmacist-led UC: usual care	Mean age: 77 y; NYHA class III, HC: 34.9% vs. UC: 32.6%; NYHA class IV, HC: 32.2% vs. UC: 34% At 6 mo, all-cause mortality, 30/149 (20.1%) vs. UC: 24/144 (16.6%), *P* = 0.54; mean (SD) MLWHFQ score, HC: 47.7 (26.3), n = 78 vs. UC: 44.5 (27.9), n = 80 (*P* = 0.32)	Intervention within 2 weeks of discharge, post-randomization exclusions (HC: 20, UC: 26), additional information on EQ-5D and drug adherence

Author, Year	Study Population	Description of HC / UC	Results	Other Comments
Iraurqui et al, 2007 (31)	HF, no COPD, severe cognitive deficits, psychiatric, or terminal disease, family support, geographic area	HC: HB educational program UC: PCP Both: PCP	Mean age: 75.8 y; primary schooling or less: 89%; comorbidities, hypertension (68%), DM (36%) At 1 y, combined CI, HC: 62/137 (45.3%) vs. 75/142 (52.8%), *P* = 0.232; all-cause mortality CI, HC: 22/137 (16.1%) vs. 21/142 (14.8%), *P* = 0.769; CVD mortality, HC: 16/137 (11.7%) vs. UC; 18/142 (12.7%) (ns); unplanned hospitalization CI, HC: 59/137 (43.1%) vs. UC: 71/142 (50%), *P* = 0.280; mean (SD) hospitalizations, HC: 8.6 (7.2) vs. UC: 10.1 (12.9) (ns); mean (SD) HF hospitalizations, HC: 8.5 (6.4) vs. UC: 8.4 (11.6); mean (SD) LOS, HC: 8.4 (7.7) vs. UC: 9.6 (13) days (ns); ED visits, HC: 59/137 (43.1%) vs. UC: 57/142 (40.1%) (ns); HF ED visits, HC: 7/137 (5.1%) vs. 10/142 (7%) (ns)	Intervention up to 15 days later; subgroup analysis with emphasis on non-adherers
Inglis et al, 2006 (32)	≥ 55 y, HF dx, class II, III, IV NYHA, impaired systolic function (≤ 55%), hx ≥ 1 admission for acute HF[c]	HC: HB care UC: PCP and outpatient care Both: postdischarge planning, PCP, outpatient cardiology review	Mean age: 75 y; NYHA class II, HC: 47% vs. UC: 44%; NYHA class III, HC: 45% vs. UC: 45%; comorbidities, hypertension (58%), COPD (36%), DM (29%) At 7.5 y, all-cause mortality, HC: 114/149 (76.5%) vs. 132/148 (89.1%), *P* = 0.0006; up to 10 y, mean (SD) LOS, HC: 8.2 (5.5) vs. UC: 8.8 (6.5) days (ns) At a median of 4.2 y, combined, HC: 130/149 (87%) vs. UC: 135/148 (91%); unplanned hospitalizations, HC: 112/149 (75%) vs. UC: 118/148 (80%) (ns)	Minimum follow-up of 7.5 y, and up to 10 y, mean Charlson index score, HC: 2.9 (1.4) vs. UC: 2.8 (1.4), additional outcome information (e.g., median, event-free, hospital survival)

Abbreviations: AA, African American; ABLE, Advancing Better Living for Elders; ADL, Activities of Daily Living; APTCare, Anticipatory and Preventive Team Care; CHW, community health workers; COPD, chronic obstructive pulmonary disease; CHL, cholesterol; CVD, cardiovascular disease; DBP, diastolic blood pressure; EC, echocardiography; dx, diagnosed; DM, diabetes mellitus; ED, emergency department; EQ-5D, EuroQoL; FEV_1, forced expiratory volume in 1 second; GOLD, Global Initiative for Chronic Obstructive Lung Disease; HB, home-based; HbA1c; hemoglobin A1c; HC, home care; HF, heart failure; HRQOL, health-related quality of life; hx, history; IADL, Instrumental Activities of Daily Living; LFU, length of follow-up; L/H, Latino/Hispanic; LOS, length of stay; mo, months; MLWHFQ, Minnesota Living With Heart Failure Questionnaire; MR, medical records; ns, nonsignificant; NIHSS, National Institutes of Health Stroke Scale; NYHA, New York Heart Association; PCP, primary care physician; QoL, quality of life; REACH, Racial and Ethnic Approaches to Community Health; SBP, systolic blood pressure; SD, standard deviation; SF-36, Medical Outcomes Study Short Form Health Survey; SGRQ, St George's Respiratory Questionnaire; SS, sample size; T2 DM, type 2 diabetes mellitus; UC, usual care; y, years.

[a]Adjusted for covariates.

[b]Chronic conditions included diabetes, congestive heart failure, chronic anxiety, depression, or other mental illnesses, chronic obstructive pulmonary disease, coronary artery disease, neurologic conditions, hypertension, anemia, arthritis or back problems, cancer, asthma, cerebrovascular disease, ischemic heart disease, atrial fibrillation, peripheral vascular disease.

[c]Acute HF defined as pulmonary congestion/edema and acute dyspnea at rest.

Table A8: Summary of Study Outcomes (Primary and Secondary) by Chronic Disease Population for Included Studies (N = 12 Studies)

Author, Year	Clinical								Other		
	Combined[a]	All-cause Mortality	HF Mortality	All-cause HP	HF HP	LOS	ED Visits	HF ED Visits	HrQOL	Disease-specific	Functional status
Heart Failure											
Aguado et al, 2010 (28)		✓[b]		✓[b]			✓	✓[b]	✓		
Brotons et al, 2009 (29)	✓[b]	✓	✓		✓				✓		
Wongpiriyayothar et al, 2008[c](30)									✓		
Holland et al, 2007 (27)		✓		✓[b]					✓		
Iraurqui et al, 2007 (31)	✓[b]	✓	✓	✓	✓	✓	✓				
Inglis et al, 2006 (32)	✓[b]	✓		✓		✓	✓				
Stroke											
Allen et al, 2009[d] (34)		✓				✓			✓	✓	
COPD											
Gilmore et al, 2010 (33)									✓[b]		
T2 DM											
Spencer et al, 2011 (26)										✓[b]	
Chronic											
Gray et al, 2010[d] (35)				✓			✓				
Gitlin et al, 2009[e] (36)		✓									
Gitlin et al, 2006 (37)											✓[b]

Abbreviations: COPD, chronic obstructive pulmonary disease; ED, emergency department; HF, heart failure; HP, hospitalizations; HRQOL, health-related quality of life; LOS, length of stay; T2 DM, type 2 diabetes mellitus.

[a]Combined outcome of unplanned all-cause hospitalizations and all-cause mortality, except for Brotons (2009), (29) which included hospitalizations due to worsening of heart failure.

[b]Primary outcome(s). Sample size calculation based on hospitalizations for Aguado et al, 2010 (28).

[c]Primary outcome is not known.

[d]Primary outcome was not relevant to this evidence-based analysis.

[e]Primary outcome was based on a previous analysis of functional difficulties, self-efficacy, and fear of falling at 6 and 12 months.

Table A9: Risk of Bias for 12 Randomized Controlled Trials for the Comparison of Home Care versus Usual Care

Author, Year	Allocation Concealment[a]	Blinding[b]	Complete Accounting of Patients and Outcome Events[c]	Selective Reporting Bias	Other Limitations
Spencer et al, 2011 (26)	Limitations	No limitations	Limitations	-	SSC?
Aguado et al, 2010 (28)	Limitations	No limitations	No limitations/Limitations	-	-
Gilmore et al, 2010 (33)	Limitations	Limitations	No limitations	-	-
Gray et al, 2010 (35)	No limitations	Limitations	No limitations	-	-
Allen et al, 2009 (34)	No limitations	No limitations	No limitations/Limitations	-	Baseline difference[d]
Brotons et al, 2009 (29)	Limitations	No limitations/Limitations	No limitations/Limitations	-	Baseline difference[d]
Gitlin et al, 2009 (36)	No limitations	No Limitations	No limitations	-	SSC[e]
Wongpiriyaythar et al, 2008 (30)	Limitations	Limitations	No Limitations	-	Primary outcome?
Holland et al, 2007 (27)	No limitations	No limitations/Limitations	Limitations[f]	-	-
Iraurqui et al, 2007 (31)	No limitations	No limitations	No Limitations	-	-
Gitlin et al, 2006 (37)	No limitations	No limitations	Limitations	-	-
Inglis et al, 2006 (32)	Limitations	No limitations	No limitations	-	Baseline differences[d]

Abbreviations: CHL, cholesterol; DBP, diastolic blood pressure; HbA1c, hemoglobin A1c; HRQOL, health-related quality of life; LDL, low density lipoprotein; SBP, systolic blood pressure; SSC, sample size calculation.

[a]Absence of information.

[b]Spencer et al, 2011 (26), abstraction of HbA1c from medical records was not performed by personnel unaware of group assignment; Brotons et al, 2009 (29), no limitations for primary clinical outcomes, possible limitations for secondary outcome, HRQOL; Holland et al, 2007 (27), lack of blinding is a limitation for HRQOL outcome but not for mortality outcome; Gitlin et al, 2009 (36), no limitations for mortality outcome.

[c]Complete accounting of patients refers to losses to follow-up being described, and for outcome events, having performed an intent-to-treat analysis. Losses to follow-up may have biased results [HbA1c, SBP, DBP, LDL: Spencer et al, 2011 (26); HRQOL: Aguado et al, 2010 (28), Brotons et al, 2009 (29); HbA1c, SBP, DBP, total CHL: Allen et al, 2009 (34)].

[d]Baseline differences: Allen et al, 2009 (34), in terms of percent with diabetes and mean hospital days in previous year; Brotons et al, 2009 (29), in terms of COPD; Inglis et al, 2006 (32), in terms of prior acute myocardial infarction, left bundle-branch block, and blood urea concentration.

[e]Sample size calculation based on a previous study of the same patients, with the primary outcomes of the previous study not included in the current study.

[f]Post-randomization exclusions is a source of bias.

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Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

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To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

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This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

This evidence-based analysis reviews relational and management continuity of care. Relational continuity refers to the duration and quality of the relationship between the care provider and the patient. Management continuity ensures that patients receive coherent, complementary, and timely care. There are 4 components of continuity of care: duration, density, dispersion, and sequence.

Objective

The objective of this evidence-based analysis was to determine if continuity of care is associated with decreased health resource utilization, improved patient outcomes, and patient satisfaction.

Data Sources

MEDLINE, EMBASE, CINAHL, the Cochrane Library, and the Centre for Reviews and Dissemination database were searched for studies on continuity of care and chronic disease published from January 2002 until December 2011.

Review Methods

Systematic reviews, randomized controlled trials, and observational studies were eligible if they assessed continuity of care in adults and reported health resource utilization, patient outcomes, or patient satisfaction.

Results

Eight systematic reviews and 13 observational studies were identified. The reviews concluded that there is an association between continuity of care and outcomes; however, the literature base is weak. The observational studies found that higher continuity of care was frequently associated with fewer hospitalizations and emergency department visits. Three systematic reviews reported that higher continuity of care is associated with improved patient satisfaction, especially among patients with chronic conditions.

Limitations

Most of the studies were retrospective cross-sectional studies of large administrative databases. The databases do not capture information on trust and confidence in the provider, which is a critical component of relational continuity of care. The definitions for the selection of patients from the databases varied across studies.

Conclusions

There is low quality evidence that:

- Higher continuity of care is associated with decreased health service utilization.
- There is insufficient evidence on the relationship of continuity of care with disease-specific outcomes.
- There is an association between high continuity of care and patient satisfaction, particularly among patients with chronic diseases.

Plain Language Summary

There are 3 broad categories of continuity of care: informational, management and relational. Relational continuity is the main focus of this review. Relational continuity refers to the ongoing relationship between the care provider and the patient. This review identified several observational studies that assessed continuity of care through the use of validated indices. All of the studies identified demonstrated that higher continuity was associated with either reduced hospitalization rates or reduced emergency department visits. The limitations of this review are that the primary data source was from retrospective studies of administrative data and that all of the studies were focused on physician continuity with a patient—no studies were identified which assessed continuity with other providers such as nurses, social workers or other allied health professionals.

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List of Abbreviations

CAD	Coronary artery disease
COC	Continuity of Care Index
COPD	Chronic obstructive pulmonary disease
ED	Emergency department
FCI	Fragmentation of Care Index
HbA1c	Hemoglobin A1c
NHANES	National Health and Nutrition Examination Survey
SECON	Sequential Continuity Index
UPC	Usual Provider of Care Index

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this analysis was to determine if continuity of care is associated with health resource utilization and patient outcomes. This evidence-based analysis on continuity of care is a part of the larger mega-analysis on Optimizing Chronic Disease Management.

Technology/Technique

There are 3 defined areas of continuity of care: informational, management, and relational or interpersonal. (1) This evidence-based analysis will address management[1] and relational continuity, but not informational continuity:

- *Informational continuity* is continuity where previous patient information is available (usually through a patient chart or an electronic medical record) and used to provide patient-appropriate care. Ideally the patient information is available to multiple health care professionals in different settings.
- *Management continuity* involves the use of standards and protocols to ensure that care is provided in an orderly, coherent, complementary, and timely fashion. Often this applies to when care is being provided my multiple providers. This also includes accessibility (availability of appointments, medical tests), flexibility to adapt to care needs, and consistency of care and transitions of care (e.g., the coordination of home care by a family physician).
- *Relational continuity (interpersonal)* refers to the ongoing relationship between the care provider and the patient. It refers to the duration of the relationship as well as the quality of the relationship, which is affected by the attentiveness, inspiration of confidence, and the medical knowledge of the health professional.

Several indices have been developed to assess the 4 primary components of relational continuity of care: (2)

- duration—length of time with a particular provider
- density—number of visits with the same provider over a defined time period
- dispersion—number of visits with distinct providers
- sequence—order in which different providers are seen

Commonly used indices are listed in Table 1.

The Usual Provider of Care (UPC) index is primarily aimed at addressing the density of care, while the Continuity of Care Index (COC) addresses density, but really focuses on the dispersion of care. In other words, the COC index measures the number of different providers seen; the more providers that are seen, the lower the continuity index. The Modified COC and Modified Modified COC indices were designed to improve the COC index; however, these indices are not reported as widely in the literature as the original COC index. The Sequential Continuity (SECON) Index is designed to assess the sequence of visits. In an ideal continuity of care scenario, a patient would be seen consecutively by one provider (provider A) for one episode of care, and then seen by another provider (provider B) consecutively for another episode of care. Thus, the sequence would be AAABBB, rather than ABABAB, which would result in a low SECON index.

[1] No studies specifically focused on management continuity were identified from the literature search.

Table 1: Measures of Continuity of Care

Name of Index	Description	Score Range	Index Measures				Strengths	Weaknesses
			Duration[a]	Density[b]	Dispersion[c]	Sequence[d]		
Usual Provider of Continuity (UPC) index	The number of visits to a usual provider in a given period over the total number of visits to similar providers	0 to 1	Yes	Yes	No	No	Since a 'usual provider' is defined, it may be useful in analyzing the role of other health providers in addition to physicians	Only assesses visits with usual provider, other providers not included in the index Not independent of utilization levels Measure decreases as number of visits increases
Continuity of Care (COC) index	Measures both the dispersion and concentration of care among all providers seen	0 to 1	Yes	Yes	Yes	No	Sensitive to shifts in the distribution of visits among providers Good mathematical performance; tends to have a mean of 0.5 and a large coefficient of variation	May mask important differences in sequencing of care Mot independent of utilization levels Measure decreases as number of visits increases Measure falls rapidly with increasing number of providers seen
Modified Continuity Index (MCI)	Measure of concentration of care in population of patients calculated by dividing the average number of visits by a group by the average number of providers in the a population	0 to 1	Yes	Yes	Yes	No	Requires summary utilization measures only (compared with COC which requires more utilization data)	Extremes of continuity not reflected in measure (i.e., 2 visits to same provider yields an intermediate result rather than perfect continuity)
Modified Modified Continuity Index (MMCI)	Measure of concentration of care with providers at the individual patient level Developed to account for problems of COC and MCI indices	0 to 1	Yes	Yes	Yes	No	Requires summary utilization measures only (compared with COC which requires more utilization data) Not overly sensitive to large number of providers	No sequential data captured
Sequential Continuity (SECON) index	Fraction of sequential visit pairs where the same provider is seen	0 to 1	Yes	Yes	No	Yes	Sensitive to shifts in sequence of visits Potentially useful as measure of amount of inter-provider communication necessary because of transfers of care	Insensitive to the distribution of visits among providers if sequencing remains constant

[a] Duration refers to the length of time with a particular provider.
[b] Density refers to the number of visits with the same provider over a defined time period.
[c] Dispersion refers to the number of visits with distinct providers.
[d] Sequence refers to the order in which different providers are seen.
Source: Reid et al, 2002. (3)

Evidence-Based Analysis

Research Question

Is higher continuity of care effective at reducing health resource utilization and improving patient outcomes?

Research Methods

Literature Search

Search Strategy

A literature search was performed on December 8, 2011 (then updated January 27, 2012) using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002, until December 8, 2011 (updated January 27, 2012). A 10-year timeframe was chosen because there was a comprehensive systematic review by Cabana and Jee published in 2004 that included studies up until 2002. (4) Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search. The full search strategy is listed in Appendix 1.

Inclusion Criteria

- English language full-reports
- published between January 1, 2002, and January 27, 2012
- randomized controlled trials, systematic reviews, meta-analyses, prospective observational, and retrospective studies
- studies with adult patients
- studies investigating provider level or clinic level continuity
- studies investigating interpersonal (relational) continuity or management continuity[2]
- studies with patients with diabetes, heart failure, chronic obstructive pulmonary disease (COPD), atrial fibrillation, stroke, coronary artery disease, chronic wounds or studies with patients with multiple chronic conditions
- studies reporting at least 1 outcome of interest

Exclusion Criteria

- studies of informational continuity
- studies with physicians in training, residents, fellows
- studies of patients in hospital, mental health facilities, or long-term care facilities
- studies of transitions of patients to or from inpatient setting
- studies including only a pediatric population
- studies focusing on prevention or screening for disease

[2]No studies specifically focused on management continuity were identified from the literature search.

- case series, case reports, editorials
- non-English studies

Outcomes of Interest

- health resource utilization (hospitalizations, emergency department visits [ED])[3]
- mortality
- disease-specific outcomes
- quality of life
- patient satisfaction

Quality of Evidence

The quality of the body of evidence for each outcome is examined according to the GRADE Working Group criteria. (5) The overall quality is determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design is the first consideration; the starting assumption is that randomized controlled trials are high quality, whereas, observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—are then taken into account. Limitations or serious limitations in these areas result in downgrading the quality of evidence. Finally, 3 main factors are considered which may raise the quality of evidence: large magnitude of effect, dose response gradient, and accounting for all residual confounding. (5) For more detailed information, please refer to the latest series of GRADE articles. (5)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

[3]Please note: All hospitalization and ED visit data represent all-cause hospitalizations, and do not distinguish between initial hospitalization or ED visit and rehospitalization or repeat ED visits.

Results of Evidence-Based Analysis

The database search yielded 6,462 citations published between January 1, 2002, and December 8, 2011 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded in the analysis. Twenty-three studies (8 systematic reviews and 15 observational studies) met the inclusion criteria.

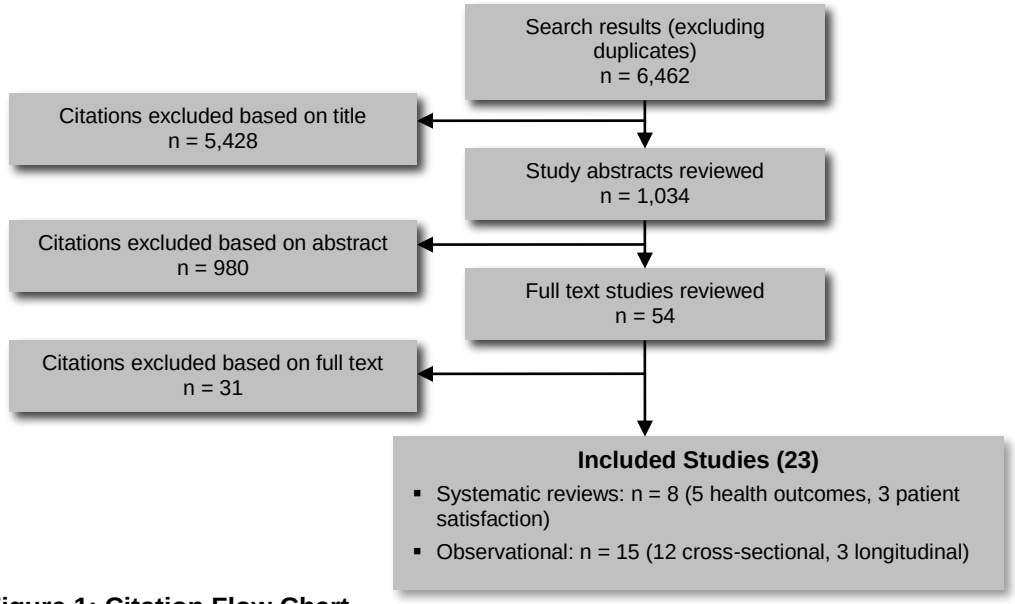

Figure 1: Citation Flow Chart

The results of the evidence-based analysis were stratified under the following subheadings:

- systematic reviews assessing the effectiveness of continuity of care (5 studies)
- studies of continuity of care in patients with any condition (5 studies)
- studies of continuity of care in patients with diabetes (10 studies [3 studies of the same trial])
- studies of continuity of care in patients with COPD (1 study)
- studies of continuity of care in patients with coronary artery disease (1 study)
- systematic reviews assessing patient satisfaction associated with continuity of care (3 studies)

For each included study, the study design was identified and is summarized below in Table 2, which is a modified version of a hierarchy of study design by Goodman. (6)

Table 2: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	
Large RCT	
Small RCT	
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	8
Non-RCT with historical controls	
Database, registry, or cross-sectional study	15
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	23

Abbreviation: RCT, randomized controlled trial.

Systematic Reviews Assessing the Effectiveness of Continuity of Care

Five systematic reviews were identified that assessed the effectiveness of continuity of care on health system utilization and patient outcomes (Table 3). None of the reviews specifically focused on patients with chronic conditions. With the exception of the review by Worrall and Knight, (7) the reviews included studies with any patient population. The Worrall and Knight systematic review included studies of adults 50 years or older. (7)

Unlike the other systematic reviews identified, the systematic review by Jee and Cabana (2) did not assess the effectiveness of continuity of care, but rather the intent of this review was to identify the indices to assess continuity of care. The authors only included studies with a clearly defined measure of continuity and they found that there was considerable heterogeneity across indices for measuring continuity.

The systematic review by van Walraven et al (8) assessed quality of continuity of care using 4 criteria: the representativeness of the cohort; how the continuity measure was collected; how the outcome measure was collected and; and the adequacy of follow-up. Of the 18 studies included, 16 studies met 3 or 4 of the criteria. Only 1 study met only 1 criterion, and the other met 2 criteria.

Overall, the systematic reviews found that there appears to be an association between continuity of care and improved patient outcomes; however, the literature base is weak.

Table 3: Summary of Systematic Reviews on Continuity of Care

Study	Research Question	Sources & Years Searched	Inclusion Criteria	Number of Studies Included	Conclusion
van Walraven et al, 2010 (8)	Is there an association between continuity of care and outcomes?	MEDLINE (1950–2008)	Studies measuring continuity and outcomes Accounted for relative timing of continuity and outcomes	18	"Increased provider continuity is associated with improved patient outcomes and satisfaction"
Jee & Cabana, 2006 (2)	What are the indices of continuity of care?	MEDLINE, PSYCH INFO (1966–2002)	Studies with a defined measure of continuity	44	There is variability in the continuity indices
van Servellen et al, 2006 (9)	To what extent are informational, management, and relational continuity associated with quality of care indicators?	MEDLINE (1996–2005)	Studies measuring continuity and outcomes Any patient population	32	No summary statement on literature
Worrall & Knight, 2006 (7)	How important is continuity of care for older patients in family practice?	MEDLINE, EMBASE, CINAHL (1970–2005)	Interpersonal continuity and outcomes Adults > 50 years	5	Evidence that continuity in the elderly is 'scanty'
Cabana & Jee, 2004 (4)	Does continuity of care improve patient outcomes?	MEDLINE, PSYCH INFO (1966–2002)	Primary care setting Continuity and outcomes	18	Continuity improves quality of care consistently in patients with chronic diseases

Studies of Continuity of Care in Patients With Any Condition

Five studies were identified that assessed continuity of care in patients with any condition (Tables 4, 5). There was 1 longitudinal study that tracked patient data for 7 year; (10) the others were cross-sectional studies. (11-14) Four of the studies analyzed data from administrative databases, and the other used survey data to generate results on continuity of care. (13) The studies using the larger administrative databases included from 30,000 to more than 500,000 patients. The selection of patients analysed from the databases differed across the studies. Selection criteria varied in terms of age cut-off, minimum number of visits, and the duration that data were gathered for. In each of the studies continuity with the patients' primary physicians was assessed. The literature search did not identify continuity of care assessments with other health care providers. Three of the studies are Canadian (1 from Newfoundland & Labrador, and 2 from Manitoba) and the other 2 are from Taiwan. In Taiwan, national health insurance is relatively new (mid 1990s). The system has been arranged so that patients choose their primary care physician and their specialists. They do not require a referral to see a specialist and they can choose to see any primary care physician and go back and forth to different primary care providers as they choose. Thus, the issue of continuity of care is of interest to Taiwan to see if inconsistent contact with physicians is impacting health outcomes.

The study by Cheng et al from 2011 (11) reported that across 3 indices of continuity, higher continuity was associated with lower rates of hospital admissions and ED visits. This study used data from 2005 to assess continuity using the indices, and they applied this data to 2005 and 2006 outcomes for hospitalization and ED visits. The authors noted that although still significant, the effect of high continuity in 2005 was diminished in 2006. The results were consistent across all 3 indices of continuity used.

The prospective Ontario-based study by van Walraven et al (15) from 2010 assessed the continuity of care of patients discharged to the community after a hospitalization (either elective or emergency). The authors were specifically looking at physician continuity before, during, and after hospitalization. The study reported that continuity with the preadmission physician (either family physician or specialist) was associated with a decrease in subsequent hospitalizations (adjusted hazard ratio 0.94; 95% confidence interval, 0.91–0.98). In other words, if the patient saw the preadmission physician after discharge they were less likely to be readmitted to hospital than if they had been seen by another physician post discharge. Visits with the hospital physician post discharge did not have a significant impact on readmissions or mortality.

Three of 5 studies reported hospitalization rates in relation to continuity of care. Higher continuity was associated with a statistically significant reduced hospitalization rate in 2 of the 3 studies. (10;11) The study by Menec et al (13) reported a statistically significant reduction in the rate of hospitalizations in patients being admitted for ambulatory care–sensitive conditions, but not for all admissions.

Three of 5 studies reported ED visits in relation to continuity of care. All 3 studies reported a statistically significant reduction in ED visits in patients with higher continuity, regardless of how continuity was assessed. (11;12;14)

Table 4: Characteristics of Studies Assessing Continuity of Care in Patients With Any Condition

Study	Type of Study	Research Question	Population	N	Continuity With Whom/What	Primary Outcomes
Cheng et al, 2011 (11) (Taiwan)	Cross-sectional database study	Does continuity of care matter in a health care system that lacks referral arrangements?	Patients with more than 4 physician visits within 1 year	134,422	Measurement of continuity with the same physician provider	Hospitalization and ED visits
Cheng et al, 2010 (10) (Taiwan)	Longitudinal database study	What is the effect of continuity of care on avoidable hospitalization and hospital admission for any condition in a health care system with a high level of access to care?	3 or more physician visits per year	30,830	Measurement of continuity with the same physician provider	Avoidable hospitalization and hospitalization for any condition
Ionescu-Ittu et al, 2007 (12) (Canada)	Cross-sectional database study	Is continuity of primary care associated with ED visits in elderly people in both urban and rural areas?	Adults ≥ 65 years with 3 or more physician visits over 2 year period	95,173	Measurement of continuity with the same physician provider	ED visits
Menec et al, 2006 (13) (Canada)	Retrospective analysis of survey data	Does continuity of care with a family physician reduce hospitalizations among older adults?	Adults ≥ 67 years with 4 or more physician visits in 2 year period	1,863	Measurement of continuity with the same physician provider	Hospitalization
Menec et al, 2005 (14) (Canada)	Cross-sectional database study	Does continuity of care matter in a universally insured population?	All individuals who had at least 1 physician contact in 2 year period	536,893	Measurement of continuity with the same physician provider	ED visits and preventive care (pap smears, mammograms, flu shots)

Abbreviations: ED, emergency department; N, number of patients.

Table 5: Results of Studies Assessing Continuity of Care in Patients With Any Condition

Study	N	Indices Used (How Was Continuity Measured?)	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits
Cheng et al, 2011 (11) (Taiwan)	134,422	UPC, COC, SECON	3 equal tertiles for each index—UPC, COC, SECON	UPC Low: 31.9% Medium: 34.7% High: 33.4% COC Low: 30.6% Medium: 32.7% High: 28.4% SECON Low: 30.2% Medium: 28.9% High: 32.5%	Odds ratio (No CI reported): UPC Low: 1.00 Medium: 0.92 [a] High: 0.79 [a] COC Low: 1.00 Medium: 0.77 [a] High: 0.90 [a] SECON Low:1.00 Medium: 0.88 [a] High: 0.87 [a]	Odds ratio (No CI reported): UPC Low: 1.00 Medium: 0.88 [a] High: 0.70 [a] COC Low: 1.00 Medium: 0.85 [a] High: 0.68 [a] SECON Low: 1.00 Medium: 0.82 [a] High: 0.71 [a]
Cheng et al, 2010 (10) (Taiwan)	30,830	COC	0–16% low continuity 17–33% medium continuity 34–100% high continuity (equal tertiles based on study population)	NR	≥ 65 years (any hospitalization) Odds ratio (95% CI) Low: 1.00 Medium: 0.62 (0.56–0.67) [a] High: 0.32 (0.29–0.36) [a]	NR
Ionescu-Ittu et al, 2007 (12) (Canada)	95,173	UPC	≤ 50% low continuity 50–80% med continuity > 80% high continuity	Low: 21% Medium: 32% High: 30%	NR	Rate ratio (95% CI): Low: 1.00 Medium: 0.79 (0.77–0.80) [a] High: 0.68 (0.66–0.69) [a]
Menec et al, 2006 (13) (Canada)	1,863	"majority of care definition"—patients who made 75% of all visits to their family physician—high continuity	≤ 75% low continuity > 75% high continuity	Low: 35.5% High: 64.5%	Odds ratio (95% CI): All Conditions Low: 1.00 High: 0.83 (0.67–1.01) ACSC Low: 1.00 High: 0.67 (0.51–0.90) [a]	NR

Study	N	Indices Used (How Was Continuity Measured?)	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits
Menec et al, 2005 (14) (Canada)	536,893	"majority of care definition"—patients who made 75% of all visits to their family physician—high continuity	≤ 75% low continuity > 75% high continuity And ≤ 50% low continuity > 50% high continuity	NR	NR	Odds ratio (99% CI): COC 75% (Adults ≥15 yrs): Low: 1.00 High: 0.85 (0.80–0.90) [a] COC 50% (Adults ≥15 yrs): Low: 1.00 High: 0.78 (0.73–0.83) [a]

Abbreviations: ACSC, ambulatory care sensitive conditions; CI, confidence interval; COC, Continuity of Care index; ED, emergency department; MMCI, Modified Modified Continuity Index; N, number of patients; NR, not reported; SECON, Sequence of Continuity index; UPC, Usual Provider of Care index.

[a] $P < 0.05$

Studies of Continuity of Care in Patients With Diabetes

Eight studies were identified that assessed continuity of care in patients with diabetes (Tables 6, 7). More studies were identified for assessing continuity with diabetes care than any other chronic disease.

Knight et al (16) hypothesized that patients with more chronic conditions had lower continuity of care because they were more likely to be seen more urgently and thus not always able to visit their usual care provider on short notice compared to those patients with fewer chronic conditions who may have not needed to see their provider as urgently.

In 2011, Chen and Cheng (17) assessed continuity of care using 3 indices: UPC, COC, and SECON. They reported consistently that higher continuity of care was associated with fewer hospitalizations and ED visits. They also conducted a sensitivity analysis of the effect of the COC index on health care utilization by tertile of physician visits. Patients were stratified into low number of visits per year (4–19 visits), medium number of visits per year (20–32 visits), or high number of visits per year (≥ 33 visits). Again, the authors reported the same results, where patients with high continuity of care were associated with fewer hospitalizations and ED visits, regardless of which tertile of number of visits the patients were assigned (Table 6). The analysis was adjusted for age, sex, low-income status, hospitalizations in previous year, and diabetes complication severity index score.

Table 6: Continuity of Care Index Results From Chen and Cheng's Sensitivity Analysis by Visit Tertiles

Variable	Hospitalization Odds Ratio (95% CI)	ED Visits Odds Ratio (95% CI)
Low visit group (4–19 visits/year)		
Low continuity	1.00	1.00
Medium continuity	0.59 (0.56–0.62)	0.66 (0.62–0.70)
High continuity	0.24 (0.23–0.26)	0.33 (0.31–0.36)
Medium visit group (20–32 visits/year)		
Low continuity	1.00	1.00
Medium continuity	0.57 (0.55–0.60)	0.66 (0.63–0.70)
High continuity	0.26 (0.24–0.27)	0.34 (0.32–0.36)
High visit group (≥ 33 visits/year)		
Low continuity	1.00	1.00
Medium continuity	0.57 (0.55–0.59)	0.62 (0.59–0.65)
High continuity	0.28 (0.27–0.30)	0.36 (0.33–0.38)

Abbreviation: CI, confidence interval.
Source: Chen and Cheng, 2011. (17)

The study by Liu et al (18) used the Fragmentation of Care Index (FCI) to assess continuity with clinic site; it did not assess individual care provider continuity. The study reported, not surprisingly, that patients with more chronic diseases had higher fragmentation scores (i.e., lower continuity) because they had more specialist appointments at different clinic sites. The study found that there was a significant association between the number of ED visits and the FCI. They calculated that for each 0.1 increase in FCI, there was an 18% increase in ED visits over the 2-year study period.

The study by Atlas et al (19) did not use a previously published index of continuity to measure continuity; instead, they assessed patients' 'connectedness' with a physician or practice using a validated algorithm developed by the study authors. The study found that being connected to a physician versus being connected to a practice significantly improved glycosylated hemogolbin (HbA1c) levels in patients with diabetes ($P = 0.004$).

The study by Mainous et al (20) used data from the National Health and Nutrition Examination Survey (NHANES) to examine if there was an association between continuity of care and diabetes control. The study assessed continuity of care using the following questions from the survey: "Is there a particular clinic, health centre, doctor's office, or other place that you usually go if you are sick, need advice about your health, or for routine care?" If they responded yes to the preceding question then they were asked "Is there one particular doctor or health professional you usually see?" Based on the responses to these questions, a continuity variable was created based on 3 categories: 1) no usual source of care; 2) usual site but no usual provider; or 3) usual site and provider. The study found that 85% of the respondents reported that they had both a usual site and a usual provider of care. Five percent reported having no usual source of care and 9% reported a usual site, but no usual provider of care. They reported a significant improvement in HbA1c levels in patients with high continuity of care (usual provider) versus low continuity (no provider), but they did not report a significant difference associated with continuity for systolic blood pressure or lipid levels.

Five studies reported hospitalization rates associated with continuity. Four studies reported that there were statistically significantly fewer hospitalizations associated with higher continuity compared to low or medium continuity. (16;17;21;22) These studies each used different indices to measure continuity. The study by Lin et al (18) reported a significant reduction in long-term complications leading to hospitalization (as defined by the International Classification of Diseases codes) in patients with high continuity of care compared to low continuity, but not compared to medium continuity. They did not report a significant difference in the relationship between continuity and short-term complications leading to hospitalization (defined by International Classification of Diseases codes). The authors attributed the nonsignificance to a low rate of events (n = 50).

Three studies reported the number of ED visits associated with continuity. All 3 studies reported a significantly reduced number of ED visits in patients with higher continuity of care. (17;22;23) Two of the studies used the COC index and the other used the FCI.

Two studies reported HbA1c levels in relation to continuity of care. Both reported that optimal glycemic control was more likely in patients with higher continuity compared to lower continuity. (19;20) The study by Mainous et al (20) also reported systolic blood pressure and lipid levels, but the study did not identify any significant differences in these outcomes in relation to continuity of care.

Table 7: Characteristics of Studies Assessing Continuity of Care in Patients With Diabetes

Study	Type of Study	Research Question	Population	N	Continuity With Whom/What	Primary Outcomes
Chen & Cheng, 2011 (17) (Taiwan)	Longitudinal database study	What is the effect of continuity of care on health care utilization and expenses for patients with diabetes?	Adult patients with diabetes (type 1 or 2) with 3 or more physician visits per year for 7 years	48,107	Measurement of continuity with the same physician provider	Healthcare utilization and healthcare expenses
Worrall & Knight, 2011 (21) (Canada)	Cross-sectional database study	What is the relationship between continuity of family physician care and all-cause mortality and hospitalizations in older people with diabetes?	Patients with diabetes over 65 years with 2 or more fee for service claims within 2 year period	305	Measurement of continuity with the same physician provider	Mortality Hospitalization
Hong et al, 2010 (22) (Korea)	Cross-sectional database study	Is there an association between continuity of care and health outcomes?	Patients with diabetes aged 65 to 84 years with 4 or more physician visits within previous 3 years	268,220	Measurement of continuity with the same physician provider	Hospitalizations, ED visits
Lin et al, 2010 (18) (Taiwan)	Cross-sectional database study	Is the discontinuity of care associated with hospitalization?	Patients with diabetes with 4 visits over 5 years	6,476	Measurement of continuity with the same physician provider	Diabetes-related admissions
Liu et al, 2010 (23) (USA)	Cross-sectional database study	What is the association between patterns of fragmented care and ED use among people with diabetes?	Patients with diabetes with 2 or more visits to a primary care practice within the previous year	3,873	Measurement of continuity by clinic site not individual providers	ED visits
Atlas et al, 2009 (19) (USA)	Cross-sectional database study	Does patient-physician connectedness affect measures of clinical performance?	Adults with 1 or more visits to primary care physician in a 3 year period	155,590	Measurement of continuity by clinic site and physician providers	HbA1c
Knight et al, 2009 (16) (Canada)	Longitudinal database study	Does higher continuity of family physician care reduce hospitalizations in elderly people with diabetes?	Elderly (> 65 years) with newly diagnosed diabetes; 6 physician visits over 3 years	1,143	Measurement of continuity with the same physician provider	Hospitalizations
Mainous et al, 2004 (20) & Koopman et al, 2003 (24) & Harvey et al, 2004 (25) (USA)	Cross-sectional database study	What is the relationship between continuity of care and diabetes control?	Patients with diabetes who participated in the 3rd NHANES	1,400	Measurement of continuity with the same physician provider	HbA1c, blood pressure, lipid control

Abbreviations: ED, emergency department; HbA1c, glycosylated hemoglobin; N, number of patients; NHANES, National Health and Nutrition Examination Survey.

Table 8: Results of Studies Assessing Continuity of Care in Patients With Diabetes

Study	N	Indices Used	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits	Diabetes-Specific Outcomes
Chen & Cheng, 2011 (17) (Taiwan)	48,107	UPC, COC, SECON	< 0.47 low continuity 0.47–0.86 medium continuity ≥ 0.87 high continuity	NR	Odds ratio (95% CI) UPC Low: 1.00 Medium: 0.61 (0.59–0.62) High: 0.26 (0.25–0.27) COC Low: 1.00 Medium: 0.58 (0.56–0.59) High: 0.26 (0.25–0.27) SECON Low: 1.00 Medium: 0.67 (0.66–0.69) High: 0.30 (0.29–0.31)	Odds ratio (95% CI) UPC Low: 1.00 Medium: 0.68 (0.66–0.70) High: 0.35 (0.0.34–0.36) COC Low: 1.00 Medium: 0.64 (0.62–0.66) High: 0.34 (0.33–0.36) SECON Low: 1.00 Medium: 0.69 (0.67–0.72) High: 0.36 (0.35–0.37)	NR
Worrall & Knight, 2011 (21) (Canada)	305	UPC	≥ 0.75 high continuity < 0.75 low continuity	Low: 27.2% High: 72.8%	Percentage over 3 years: Low: 67.5% High: 54.5%[b]	NR	*Mortality (percentage over 3 years):* *Low: 18.1%* *High: 9.0%*[b]
Hong et al, 2010 (22) (Korea)	268,220	COC	Equal tertiles based on study population	NR	Odds ratio (95% CI) Low: 1.00 Medium: 0.75 (0.72–0.78)[a] High: 0.68 (0.66–0.71)[a]	Odds ratio (95% CI) Low: 1.00 Medium: 0.77 (0.69–0.85)[a] High: 0.71 (0.64–0.79)[a]	NR
Lin et al, 2010 (18) (Taiwan)	6,476	UPC	< 0.47 low continuity 0.47–0.75 medium continuity ≥ 0.75 high continuity	NR	Odds ratio (95% CI) Long-term complications leading to admissions: Low: 1.00 Medium: 0.76 (0.58–1.00) High: 0.75 (0.58–0.98) a Short-term complications leading to admissions: Low: 1.12 (0.55–2.31) Medium: 0.78 (0.38–1.59) High: 0.89 (0.43–1.82)	NR	NR
Liu et al, 2010 (23) (USA)	3,873	FCI (0–1) (low score, higher continuity)	Divided into quintiles	NR	NR	IRR: 0.87 (95% CI, 0.83–0.92; *P* < 0.01)	NR

Study	N	Indices Used	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits	Diabetes-Specific Outcomes
Atlas et al, 2009 (19) (USA)	155,590 (~10,000 with diabetes)	Created algorithm to define connectedness to physician, practice, or neither.	Equal tertiles based on study population	NR	NR	NR	HbA1c < 8% Physician connectedness: 74.7% (95% CI, 73.4–76.0) Practice connectedness: 70.5% (95% CI, 67.8–73.0) *P* = 0.004
Knight et al, 2009 (16) (Canada)	1,143	UPC, COC, SECON	≥ 0.75 high continuity < 0.75 low continuity	COC Low: 36.6% High: 63.4% UPC Low: 23.7% High: 76.3% SECON Low: 18.5% High: 81.4%	Odds Ratio (95% CI) High COC 0.82 (0.69–0.97) High UPC 0.82 (0.68–0.98) High SECON 0.75 (0.61–0.91)	NR	NR

Study	N	Indices Used	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits	Diabetes-Specific Outcomes
Mainous et al, 2004 (20) & Koopman et al, 2003 (24) & Harvey et al, 2004 (25) (USA)	1400	Based on responses to questions on NHANES[a]	3 categories: no usual source of care usual site, but no usual provider usual site and provider	NR	NR	NR	[c] Odds ratio, 95% CI HbA1c ≤ 7% No usual source: 1.00 Usual site: 11.81 (4.02–34.71) Usual provider: 6.69 (2.61–17.18) HbA1c ≤ 8% No usual source: 1.00 Usual site: 6.13 (2.08–18.04) Usual provider: 4.62 (2.02–10.60) SBP ≤ 130mmHg No usual source: 1.00 Usual site: 2.76 (0.70–10.93) Usual provider: 1.78 (0.55–5.72) SBP ≤ 140mmHg No usual source: 1.00 Usual site: 1.02 (0.28–3.78) Usual provider: 0.87 (0.36–2.13) Lipids ≤ 100mg/dL No usual source: 1.00 Usual site: 1.93 (0.71–5.24) Usual provider 1.10 (0.44–2.73) Lipids ≤ 130mg/dL No usual source: 1.00 Usual site: 2.37 (0.82–6.79) Usual provider: 1.59 (0.55–4.57)

Abbreviations: CI, confidence interval; HbA1c, glycosylated haemoglobin; IRR, incidence rate ratio; N, number of patients; NHANES, National Health and Nutrition Examination Survey; NR, not reported.

[a] Based on responses to the following questions on the NHANES:

- Is there a particular clinic, health center, doctor's office, or other place that you usually go if you are sick, need advice about your health, or for routine care?
- If yes, is there one particular doctor or health professional you usually see?

[b] $P < 0.05$

[C] Results for all outcomes adjusted for age, gender, education, insurance coverage, health status, income, length of time with diabetes

Studies of Continuity of Care in Patients With COPD

One cross-sectional study was identified that assessed continuity of care in patients with COPD (Tables 8, 9). This study by Hong et al (22) also included elderly patients (aged 65–84 years) with diabetes, hypertension, and asthma, in addition to COPD. The authors stratified the results by chronic disease. They used a Korean health administrative database to gather information of continuity on 131,512 patients with COPD. They reported a statistically significant increase in hospitalizations and ED visits in patients with low or medium continuity compared to patients with high continuity of care ($P < 0.001$).

Table 9: Characteristics of Studies Assessing Continuity of Care in Patients With COPD

Study	Type of Study	Research Question	Population	N	Continuity With Whom/What	Primary Outcomes
Hong et al, 2010 (22) (Korea)	Cross-sectional database study	Is there an association between continuity of care and health outcomes?	Patients with COPD aged 65 to 84 years with 4 or more physician visits within previous 3 years	131,512	Measurement of continuity with the same clinic site	Hospitalizations, ED visits

Abbreviations: COPD, chronic obstructive pulmonary disease; ED, emergency department; N, number of patients.

Table 10: Results of Studies Assessing Continuity of Care in Patients With COPD

Study	Indices Used	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED visits
Hong et al, 2010 (22) (Korea)	COC	Equal tertiles based on study population	NR	Odds ratio (95% CI) Low 1.00 Medium 0.67 (0.62–0.71) [a] High 0.50 (0.47–0.69)[a]	Odds ratio (95% CI) Low 1.00 Medium 0.77 (0.63–0.94) [a] High 0.56 0.46–0.69) [a]

Abbreviations: CI, confidence interval; COC, continuity of care; COPD, chronic obstructive pulmonary disease; ED, emergency department; NR, not reported.

[a] $P < 0.05$

Studies of Continuity of Care in Patients With Coronary Artery Disease

One cross-sectional study was identified that reported continuity of care in patients with coronary artery disease (CAD) (Tables 10, 11). This study also reported outcomes for patients with diabetes. They did not use a previously published index of continuity to measure continuity. Instead, Atlas et al (19) assessed patients' 'connectedness' with a physician or practice using a validated algorithm developed by the study authors. They found that being connected to a physician versus being connected to a practice did not significantly influence cholesterol levels in patients with CAD.

Table 11: Characteristics of Studies Assessing Continuity of Care in Patients With CAD

Study	Type of Study	Research Question	Population	N	Continuity With Whom/What	Primary Outcome
Atlas et al, 2009 (19) (USA)	Cross-sectional database study	Does patient-physician connectedness affect measures of clinical performance?	Adults with 1 or more visits to primary care physician in a 3 year period.	155,590 (~7,000 with CAD)	Measurement of continuity by clinic site and physician providers	LDL cholesterol

Abbreviations: CAD, coronary artery disease; LDL, low density lipoprotein; N, number of patients.

Table 12: Results of Studies Assessing Continuity of Care in Patients With CAD

Study	Indices Used	Continuity Cut-Off	Proportion of Patients in Each Continuity Category	Hospitalization	ED Visits	CAD-Specific Outcomes
Atlas et al, 2009 (19) (USA)	Created algorithm to define connectedness to physician, practice, or neither	Equal tertiles based on study population	NR	NR	NR	LDL level < 2.59 mmol/L Physician connectedness: 77.0% (95% CI, 75.7–78.4) Practice connectedness: 77.6% (95% CI, 74.4–80.5) *P* = 0.74

Abbreviations: CAD, coronary artery disease; CI, confidence interval; ED, emergency department; LDL, low density lipoprotein; NR, not reported.

Limitations

The studies identified for this review were designed to assess the continuity of care, and not the most appropriate care. The continuity indices have been designed to measure continuity by implying that dispersion (i.e., seeing many different providers) is not optimal. However, there are situations in which this reasoning does not apply, especially for patients with chronic diseases that require some dispersion and need to see various specialists to optimally manage their care. Therefore, there are circumstances where dispersion is good and important for quality care. The continuity indices are not able to distinguish the 'good' dispersion from the 'inappropriate' dispersion.

Another limitation of this body of literature is that all of the studies were assessing physician continuity. There were no studies identified which assessed continuity of care among other health care providers (nurses, social workers, diabetes educators, etc.).

The majority of studies assessing continuity of care were large cross-sectional studies based on data from health administrative databases. There are some limitations associated with using large administrative datasets, including the accuracy of diagnosis. Often the databases are not used for research purposes; rather, the data is used for insurance claims which question the validity of the diagnosis. Many studies required that patients had multiple visits in order to be included in the study sample, thus trying to minimize the risk of error. Another limitation is the heterogeneity in the methods for choosing patients for the sample. For instance, some studies required 4 visits over a defined time period, while others required only 2 visits to be eligible for the study. Also, using large datasets allows for a large sample size, but the amount of data that can be gathered is limited. These large datasets do not capture information on trust and confidence in a patient's provider or measures of patient and provider satisfaction.

Also, results from studies from countries where there is not a formal referral system, such as Taiwan, may not be generalizable to Ontario where most patients seek care first through primary care physicians.

Systematic Reviews Assessing Patient Satisfaction Associated With Continuity of Care

Three systematic reviews were identified that examined the relationship between continuity of care and patient satisfaction (Table 12). (1;26;27)

In 2012, Waibel et al (1) published a synthesis of qualitative studies assessing patients' perspectives on continuity of care. This meta-synthesis was thorough in describing the methods of identifying studies, selecting studies for inclusion, extracting data, and in defining themes. As is common with many search strategies for qualitative studies, their literature search may have missed some studies due to the inconsistency of terminology used in studies and the terms indexed in the literature search databases. To mitigate some of this bias, they hand-searched references of selected studies for any studies missed in the original literature search. Waibel et al (1) identified 25 studies to include in their analysis and stratified the studies into 3 groups: relational continuity, management continuity, and informational continuity. The majority of the studies were focused on relational continuity. In other words, they were interested in the patient-provider interaction and relationship. Based on the meta-synthesis of the qualitative studies, Waibel et al (1) concluded that chronically ill patients valued continuity with one provider over time, compared to younger patients who valued both continuity with the provider and convenient access.

In 2010, Adler et al (26) published a systematic review on continuity of care focused specifically on relational continuity. The authors reported that patient satisfaction was described in several different ways in the 12 studies included in their review. This heterogeneity did not permit them to make strong conclusions as to whether there was an association between continuity and patient satisfaction.

Saultz and Albedaiwi (27) also reviewed the association between relational continuity of care and patient satisfaction. Like Adler et al, (26) Saultz and Albedaiwi (27) also identified a lot of heterogeneity in the literature on continuity of care and patient satisfaction. Nonetheless, they concluded that patient satisfaction was improved with higher continuity of care because of the consistency of results in the studies they identified.

Overall, there does appear to be a positive relationship between high continuity of care and patient satisfaction.

Table 13: Summary of Systematic Reviews of Patient Satisfaction

Study	Research Question	Sources & Years Searched	Inclusion Criteria	Number of Studies Included	Conclusions
Waibel et al, 2012 (1)	What do we know about patients' perceptions of continuity of care?	MEDLINE, Social Sciences Citation Index (up to 2009)	Explicit or implicit analysis of continuity Qualitative study design patient's perspective	25	Continuity is valued more in patients with chronic illnesses compared with younger, healthier patients
Adler et al, 2010 (26)	What is the evidence on the relationship between continuity and patient satisfaction?	MEDLINE, CINAHL (1984–2007)	Reported measures of relational continuity and patient satisfaction	12	Inconsistent results across studies
Saultz & Albedaiwi, 2004 (27)	What is the association between interpersonal continuity and the level of patient satisfaction?	MEDLINE (1996–2002)	Reported measures of relational continuity and patient satisfaction	22	"A consistent and significant positive relationship exists between interpersonal continuity and patient satisfaction"

Conclusions

There is low quality evidence that:

- Despite heterogeneity in how continuity is measured, higher continuity of care appears to decrease health service utilization (hospitalizations and ED visits).
- There is insufficient evidence to comment on the relationship of continuity of care with disease-specific outcomes.
- There appears to be a positive association between high continuity and patient satisfaction, particularly among patients with chronic disease.

Table 14: Summary of Findings

Outcome	Number of Studies (N)	Results	GRADE
Hospitalizations	9 (622,573)	9/9 studies reported fewer hospitalizations with higher continuity	LOW
ED visits	7 (1,218,200)	7/7 studies reported fewer ED visits with higher continuity	LOW
HbA1c (Diabetes)	2 (11,400)	2/2 studies reported greater HbA1c control with higher continuity	LOW
LDL cholesterol (CAD)	1 (7,000)	No difference	VERY LOW
Patient satisfaction	3 systematic reviews	Positive association between high continuity and patient satisfaction	LOW[a]

Abbreviations: CAD, coronary artery disease; ED, emergency department; HbA1c, glycosylated hemoglobin; LDL, low density lipoprotein; n, number of patients.

[a] Grading is based on the most recent systematic review by Waibel et al. (1)

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
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Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: December 8-9th, 2011
Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination.

Limits: 2002-present; English; NOT comments, editorials, letters (conference abstracts in Embase)

Database: Ovid MEDLINE(R) <1948 to November Week 3 2011>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <December 8, 2011>, Embase <1980 to 2011 Week 48>
Search Strategy:

#	Searches	Results
1	Continuity of Patient Care/ use mesz	12501
2	"Referral and Consultation"/ use mesz	46299
3	(((continuity or continuum) adj5 (care or health care or healthcare or in-patient? or inpatient? or patient? or physician? or provider? or out-patient? or outpatient? or visit?)) or continuity-of-care or continuous care or continuous health care or continuous healthcare).ti,ab.	16244
4	((patient-physician relation* or physician-patient relation* or patient relation?) and (continuous* or length or time)).mp.	15553
5	*Patient Care/ use emez	35993
6	*Patient Referral/ use emez	11041
7	or/1-6	130862
8	exp Coronary Artery Disease/	210163
9	exp Myocardial Infarction/ use mesz	136258
10	exp heart infarction/ use emez	213996
11	(coronary artery disease or cad or heart attack).ti.	44510
12	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	150312
13	or/8-12	538832
14	exp Atrial Fibrillation/ use mesz	28533
15	exp heart atrium fibrillation/ use emez	53857
16	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	72761
17	or/14-16	98450
18	exp heart failure/	299162
19	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	236085
20	18 or 19	381647
21	exp Stroke/	177440
22	exp Ischemic Attack, Transient/ use mesz	16615
23	exp transient ischemic attack/ use emez	19389
24	exp stroke patient/ use emez	5349
25	exp brain infarction/ or exp cerebrovascular accident/ use emez	101283
26	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	280877
27	or/21-26	391325
28	exp Diabetes Mellitus, Type 2/ use mesz	70333
29	exp non insulin dependent diabetes mellitus/ use emez	100079
30	exp diabetic patient/ use emez	11998
31	(diabetes or diabetic* or niddm or t2dm).ti,ab.	767609
32	or/28-31	792582
33	exp Skin Ulcer/	72332
34	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	29008
35	(decubitus or bedsore*).ti,ab.	8583
36	or/33-35	91251
37	exp Pulmonary Disease, Chronic Obstructive/ use mesz	17237
38	exp chronic obstructive lung disease/ use emez	53936
39	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54470
40	(copd or coad).ti,ab.	45341
41	chronic airflow obstruction.ti,ab.	1067
42	exp Emphysema/	37319

43	exp chronic bronchitis/ use emez	6930
44	((chronic adj2 bronchitis) or emphysema).ti,ab.	51113
45	or/37-44	159066
46	exp Chronic Disease/	344492
47	(chronic*adj2 disease* or (chronic* adj2 ill*)).ti,ab.	32477
48	46 or 47	363168
49	Comorbidity/	143490
50	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or (multiple adj2 (condition* or disease* or patient*))).ti,ab.	228158
51	49 or 50	309127
52	13 or 17 or 20 or 27 or 32 or 36 or 45 or 48 or 51	2739149
53	7 and 52	13143
54	limit 53 to yr="2002 - 2012"	8443
55	limit 54 to english language	7414
56	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use mesz	2943299
57	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5773844
58	55 not (56 or 57)	6462
59	remove duplicates from 58 [Sets larger than 6000 cannot be de-duped]	6462

Appendix 2: GRADE Tables

Table A1: GRADE Evidence Profile for Continuity of Care

Number of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Hospitalization							
8 (observational)	No serious limitations	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
ED Visits							
6 (observational)	No serious limitations	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Patient Satisfaction							
25 (observational) *from Waibel et al (1) systematic review*	No serious limitations	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low

Abbreviation: ED, emergency department.

Table A2: Risk of Bias Among Observational Trials on the Effectiveness of Continuity of Care on Health Resource Utilization

Author, Year	Appropriate Eligibility Criteria	Appropriate Measurement of Exposure	Appropriate Measurement of Outcome	Adequate Control for Confounding	Complete Follow-Up
Chen & Cheng, 2011 (17)	No limitations	No limitations	No limitations	No limitations	No limitations
Cheng et al, 2011 (11)	No limitations	No limitations	No limitations	No limitations	No limitations
Worrall & Knight, 2011 (21)	No limitations	No limitations	No limitations	No limitations	No limitations
Cheng et al, 2010 (10)	No limitations	No limitations	No limitations	No limitations	No limitations
Hong et al, 2010 (22)	No limitations	No limitations	No limitations	No limitations	No limitations
Lin et al, 2010 (18)	No limitations	No limitations	No limitations	No limitations	No limitations
Liu et al, 2010 (23)	No limitations	No limitations	No limitations	No limitations	No limitations
Atlas et al, 2009 (19)	No limitations	No limitations	No limitations	No limitations	No limitations
Knight et al, 2009 (16)	No limitations	No limitations	No limitations	No limitations	No limitations
Ionescu-Ittu et al, 2007 (12)	No limitations	No limitations	No limitations	No limitations	No limitations
Menec et al, 2006 (13)	No limitations	No limitations	No limitations	No limitations	No limitations
Menec et al, 2005 (14)	No limitations	No limitations	No limitations	No limitations	No limitations
Mainous et al, 2004 (20)	No limitations	No limitations	No limitations	No limitations	No limitations
Harvey et al, 2004 (25)	No limitations	No limitations	No limitations	No limitations	No limitations
Koopman et al, 2003 (24)	No limitations	No limitations	No limitations	No limitations	No limitations

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Impact of Advanced (Open) Access Scheduling on Patients With Chronic Diseases: An Evidence-Based Analysis

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Abstract

Background

The goal of advanced access scheduling is to eliminate wait times for physician visits by ensuring access to same-day appointments, regardless of urgency or health care need. The intent is to reduce delays in access, leading to improvements in clinical care and patient satisfaction, and reductions in the use of urgent care.

Objective

To evaluate whether implementation of an advanced access scheduling system reduced other types of health service utilization and/or improved clinical measures and patient satisfaction among adults with chronic diseases.

Data Sources and Review Methods

A literature search was performed on January 29, 2012, for studies published from 1946 (OVID) or 1980 (EMBASE) to January 29, 2012. Systematic reviews, randomized controlled trials, and observational studies were eligible if they evaluated advanced access implementation in adults with chronic diseases and reported health resource utilization, patient outcomes, or patient satisfaction. Results were summarized descriptively.

Results

One systematic review in a primary care population and 4 observational studies (5 papers) in chronic disease and/or geriatric populations were identified. The systematic review concluded that advanced access did not improve clinical outcomes, but there was no evidence of harm. Findings from the observational studies in chronic disease populations were consistent with those of the systematic review. Advanced access implementation was not consistently associated with changes in clinical outcomes, patient satisfaction, or health service utilization.

Limitations

All studies were retrospective: 3 studies (4 papers) included historical controls only, and 1 included contemporaneous controls. Findings were inconsistent across studies for a number of outcomes.

Conclusions

Based on low to very low quality evidence, advanced access did not have a statistically (or clinically) significant impact on health service utilization among patients with diabetes and/or coronary artery disease (CAD). Very low quality evidence showed a significant reduction in the proportion of patients with diabetes and CAD admitted to hospital whose length of stay was greater than 3 days. Evidence was inconsistent for changes in clinical outcomes for patients with diabetes or CAD. Very low quality evidence showed no increase in patient satisfaction with an advanced access scheduling system.

Plain Language Summary

Timeliness of health care access—reducing wait times and delays for those receiving and providing care—is a key measure of health system quality. However, in international comparison studies, Canada ranked either last or next to last when it came to timely access to regular doctors. Efforts in Ontario to address delays in access have included the implementation of the Advanced Access and Efficiency for Primary Care initiative through the Quality Improvement and Innovation Partnership, later incorporated into Health Quality Ontario.

Advanced access is a physician appointment scheduling system that aims to eliminate wait times for physician visits and ensure same-day access for all patients, regardless of urgency or health care need. While it can generally be agreed that timely access to health care is necessary for all patients, same-day access may not always be required. Indeed, advanced access may adversely affect the care of patients with chronic diseases if clinics implement strict same-day appointment rules and patients cannot pre-book follow-up appointments. This review evaluated the effect of advanced access scheduling on clinical outcomes, patient satisfaction, and health service utilization in patients with selected chronic diseases, as part of the Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis.

In patients with diabetes or coronary artery disease, advanced access implementation had little or no impact on acute health care use (hospitalizations, emergency department visits, and/or urgent care visits) and had inconsistent effects on clinical outcomes (blood glucose, low-density lipoprotein [LDL] cholesterol, and blood pressure). Two studies reported reduced monitoring of patients with chronic diseases after implementation of advanced access. Another study reported improved patient management (regular blood glucose and cholesterol testing) after advanced access implementation, but this was attributed to improved provider continuity rather than to reduced appointment wait times. There was no increase in patient satisfaction with the advanced access scheduling system. The quality of the evidence ranged from low to very low.

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List of Abbreviations

CAD	Coronary artery disease
CHD	Coronary heart disease
CI	Confidence interval
ED	Emergency department
EPOC	Effective Practice and Organization of Care
HbA_{1c}	Hemoglobin A_{1c}
LDL-C	Low density lipoprotein cholesterol
LOS	Length of stay
OA	Open access (alternate term for advanced access)
RCT	Randomized controlled trial
SBP	Systolic blood pressure

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this analysis was to evaluate whether implementation of an advanced access scheduling system—intended to ensure that patients have access to same-day appointments with a physician (primary care or specialty care)—reduced other types of health service utilization (hospital, emergency department [ED], acute care length of stay) and/or affected clinical measures and patient satisfaction among adults with chronic diseases.

Clinical Need and Target Population

The Institute of Medicine report *Crossing the Quality Chasm: A New Health System for the 21st Century* (1) identified timeliness (defined as reducing waits and sometimes harmful delays for those who receive and give care) as 1 of 6 key areas for health care improvement in the United States. Wait times and delays are also an issue for Canadians: the Commonwealth Fund's 2010 International Health Policy survey (2) compared health care systems in 11 developed countries, including Canada, and found that Canadians ranked last or next to last on questions of timely access to health care. Only 45% of surveyed Canadians reported that they were able to see a doctor or nurse the same or the next day when they needed care (compared to 93% of respondents from Switzerland), and 33% indicated that it took 6 or more days to see a doctor when they were last sick, compared to fewer than 10% of respondents from the United Kingdom, New Zealand, the Netherlands, and Switzerland. (2) Canadians also fared the worst in terms of access to after-hours health care and had the highest rates of ED use in the preceding 2 years. (2) These results are consistent with a previous version of the same survey, in which Canadians were found to be the heaviest users of EDs, with 16% of patients reporting an ED visit for a condition their physician could have treated if he or she had been available. (3)

However, while there is little disagreement about the importance of availability and access to health care—specifically access to primary care (4)—the definition of timely access is not clear. According to the federal report *The Health of Canadians: The Federal Role,* (5) timely access means that service is provided in a manner consistent with clinical practice guidelines to ensure that a patient's health is not negatively affected while waiting for care. In other words, timely access does not necessarily mean *immediate* access.

Patients also appear to make this distinction. In a repeat cross-sectional telephone survey (2001 and 2004), Canadians ranked 10 priorities according to their importance for primary care performance evaluation. (6) Consistently in both years, waiting time for an appointment with a family physician for a nonurgent problem was ranked lowest. The top 3 primary care priorities—clinical knowledge, diagnostic skills, and ability to explain things to patients—were also consistent over time. Other priorities ranked higher than wait times for nonurgent care included timely referrals to specialists; health care provider sensitivity and caring nature; and whether health care providers or their staff contacted patients with routine follow-up reminders. (6) The authors commented: "We note the consistently low prioritization of access to care. Waiting time for a nonurgent appointment remains the lowest priority for primary care performance, despite attention at the federal and provincial levels to issues of access and ways to address them." (6)

Nevertheless, while acceptable access to health care has still yet to be defined, Ontario has identified shorter wait times as a priority and has proceeded with the implementation of advanced access scheduling for primary care. The goal of advanced access scheduling is to eliminate wait times for physician visits, regardless of urgency or health care need, as a means of reducing the use of urgent care and improving clinical care and patient satisfaction. It remains to be determined whether patients need same-day access

to ensure timely care and whether advanced access scheduling is associated with improvements in clinical care or patient outcomes.

Technology/Technique

Advanced access scheduling (also known as *open access* or *same-day access* scheduling) was developed by Mark Murray, Catherine Tantau, and Donald Berwick. (7-9) The authors applied queuing theory and principles of industrial engineering adapted to clinical settings, and posited that access delays could be reduced substantially without employing additional resources. Advanced access is premised on the idea that demand for appointments is predictable and, by balancing supply and demand and working through an existing appointment backlog, it is possible to implement an appointment system that allows patients to see a physician within 24 hours of requesting an appointment. (7-9)

The 6 steps to advanced access implementation are:

1. Match demand and supply daily.
2. Reduce (existing) backlog.
3. Simplify appointment types and times.
4. Create contingency plans.
5. Reduce demand for unnecessary visits.
6. Optimize the team care.

Murray and Tantau noted that some appointments—such as follow-up appointments scheduled by the physician or appointments booked on the day of a patient's choosing rather than on the day of calling—are consistent with advanced access scheduling, but the volume of these appointment types should be taken into consideration when measuring demand and assigning open supply. (7) For example, practices with a larger proportion of elderly patients or patients with chronic diseases may need to accommodate more prescheduled appointments. (9) The developers also stressed the importance of physician-patient continuity: (7;9) "A patient calling to request an appointment with a physician not present that day should be given the choice of seeing another physician today or waiting to schedule an appointment with his or her physician later in the week." (9) Despite these considerations, "the anchor metric for advanced access (success) is delays, measured as the time in days to the third next available routine appointment." (9)

Advanced access scheduling has received substantial support in the United States and the United Kingdom: it has been endorsed by the Institute for Healthcare Improvement, (9) undergone rapid evaluation in the National Health Service in the United Kingdom, (10) and has been implemented by the United States Department of Veterans' Affairs, (11) as well as in a number of managed care organizations in the United States and in some Canadian settings, including primary care practices in Ontario.

However, concerns about advanced access scheduling centre on its implementation and on variability in short- and long-term success rates (specifically reductions in wait times). In a number of evaluations, substantial variability in implementation and in short-term success have been noted, (10-14) as well as an inability to sustain shorter wait times over the long term (1 study reported on wait times 2 years after implementation). (14) Other potential unintended effects of advanced access implementation include reductions in provider continuity and follow-up; (15-18) acute problems crowding out chronic disease prevention and management; and disadvantages for specific populations, such as the frail elderly or those with cognitive impairments, language barriers, or socioeconomic barriers, (18;19) especially if advanced access is dogmatically implemented.

Ontario Context

The Advanced Access and Efficiency for Primary Care initiative was initially implemented in Ontario in 2008 by the Quality Improvement and Innovation Partnership and continues to be implemented through Health Quality Ontario. The aim of the program is to realize improvements in access to primary care and efficiency in the delivery of primary care within 6 months of initiating the program. The core objective is to ensure that patients calling to schedule a physician visit are offered an appointment with their primary care provider on the same day or a day of their choosing. As such, the program stresses the importance of continuity, as well as same-day access to care. Measures of successful implementation include time to the third next available appointment (less than 1 day) and that 85% of patients from multi-provider practices see their own provider at each visit. (20) As of the date of writing (July 2012), Ontario was completing wave 4 of the project; 413 primary care physicians had participated in the first 4 waves. Recruitment for wave 5 began in June 2012, with implementation scheduled to begin in September 2012.

Evidence-Based Analysis

Research Question

What is the effectiveness and cost-effectiveness of advanced access scheduling compared to traditional scheduling for the management of chronic diseases (atrial fibrillation, chronic obstructive pulmonary disease, chronic wounds, coronary artery disease [CAD], diabetes, heart failure, stroke, or multiple chronic conditions) in Ontario adults?

Research Methods

Literature Search

Search Strategy

A literature search was performed on January 29, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from 1946 (OVID) or 1980 (EMBASE) to January 29, 2012. While no date cut-off was used to limit the search, advanced access was developed in the late 1990s and more widely applied in the early 2000s; no literature exists on this intervention prior to that time.

Titles and abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

This review adopted the model of advanced access as developed by Murray and Tantau. (7;9;21) Studies of other scheduling interventions (such as carve-out scheduling) were not included. Of note, advanced access is largely implemented in primary care, but the search strategy and inclusion/exclusion criteria were not limited to this setting.

Inclusion Criteria

English language full-text reports

- published before January 29, 2012
- studies that described implementation and evaluation of advanced access scheduling
- studies in a general chronic disease population or in 1 of the selected chronic disease populations (atrial fibrillation, chronic obstructive pulmonary disease, chronic wounds, CAD, diabetes, heart failure, stroke, or multiple chronic conditions)
- studies with a comparison group (historical, contemporaneous)
- studies that report at least 1 of the outcomes of interest (see below)

Exclusion Criteria

- letters to the editor, commentaries, descriptions of implementation without an evaluation
- studies in pediatric populations
- studies to assess access to diagnostic testing or technologies
- animal studies
- duplicate publications
- grey literature

Outcomes of Interest

Patient-Specific Outcomes

- disease-specific clinical outcomes (e.g., hemoglobin A_{1c} [HbA_{1c}], cholesterol)
- health-related quality of life
- functional status
- patient satisfaction
- survival/mortality

Health System Outcomes

- acute care hospital admissions and readmissions
- ED visits
- length of stay in hospital long-term care admissions

Statistical Analysis

Given the variability in implementation, study design, populations, and outcomes assessed among the included studies, it was not possible to conduct a meta-analysis of results; instead, the results are summarized descriptively. *P* values of less than 0.05 were considered significant.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (22) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption is that randomized controlled trials are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (22) For more detailed information, please refer to the latest series of GRADE articles. (22)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Risk of Bias Assessment

Given that no randomized controlled trials (RCTs) were found, the risk of bias for each included study was assessed using updated criteria from the Effective Practice and Organization of Care (EPOC) group of the Cochrane collaboration, (23) which are more tailored to observational research than the criteria used by GRADE. Each study was evaluated, taking into consideration study design, randomization, allocation concealment, blinding, power/sample size, withdrawals/dropouts, intention-to-treat analyses, presence of control groups, assessment, and management of bias using design and statistical methods.

Assessment criteria differentiate between studies that include a contemporaneous control group and those that include historical controls, but factors that are common to both include the following:

- potential for incomplete data
- whether the intervention allocation is concealed
- management of missing data
- whether the paper is free from selective outcome reporting
- other sources of bias

In addition to the above, studies with contemporaneous controls were assessed for baseline outcome measurements and baseline characteristics. Studies with historical controls were assessed for the following:

- whether the intervention was independent of other changes
- whether the intervention effect was prespecified
- whether the intervention itself affected data collection

Results of Evidence-Based Analysis

The database search yielded 3,075 citations published before January 29, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded in the analysis.

Six papers (1 systematic review, 1 observational with concurrent controls, and 4 observational with historical controls) met the inclusion criteria. Two of the papers reported on the same study; (24;25) the findings from these papers are presented separately, as they reported on different populations and outcomes, but when describing the studies and assessing risk of bias they were treated as 1 study. The reference lists of included studies and health technology assessment websites were hand-searched to identify any additional potentially relevant studies; no additional citations were identified.

The included studies were limited to advanced access implementation in primary care or geriatric care settings. Because no studies were identified in specialty care settings, it is not possible to draw any conclusions about the effect of advanced access on specialist access or outcomes of care from the results of this review.

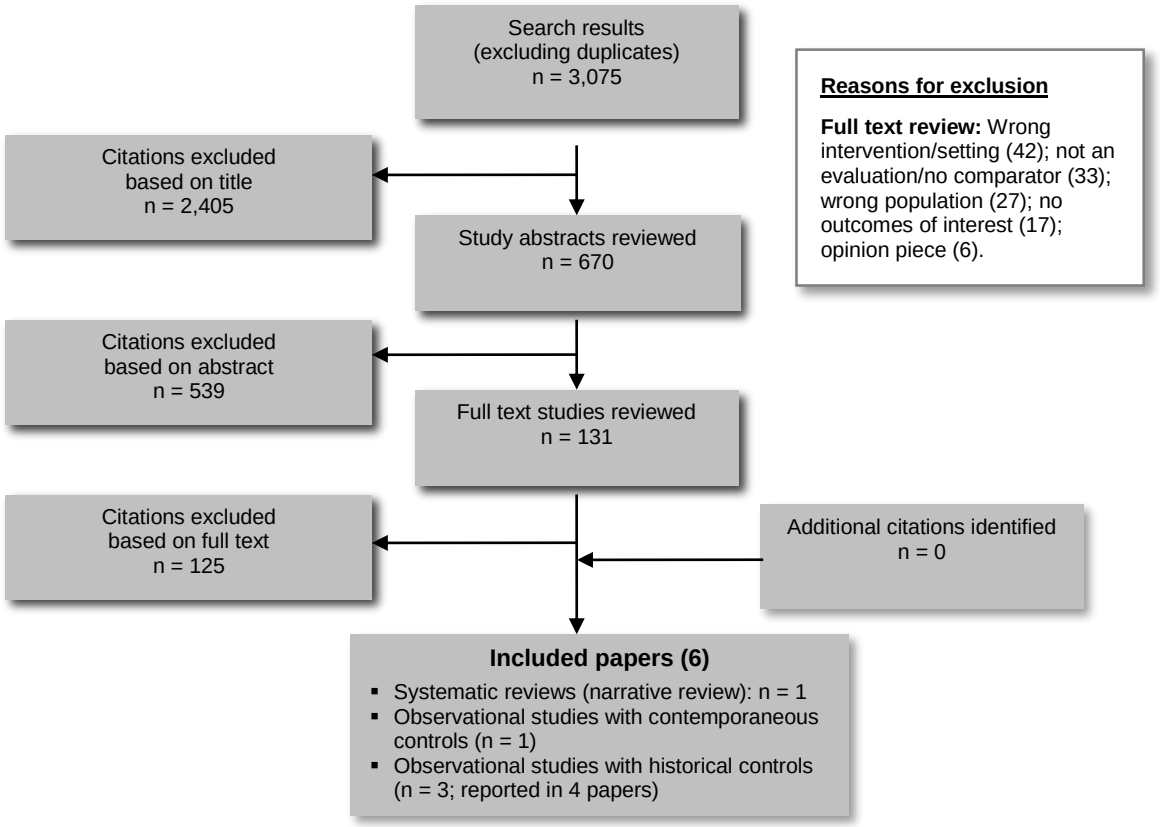

Figure 1: Citation Flow Chart

For each included study, the study design was identified and is summarized below in Table 1, which is a modified version of a hierarchy of study design by Goodman. (26)

Table 1: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	0
Large RCT	0
Small RCT	0
Observational Studies	
Systematic review of non RCTs with contemporaneous controls	1
Non RCT with non-contemporaneous controls	0
Non RCT with contemporaneous controls	1
Non RCT with historical controls	3[a]
Database, registry, or cross-sectional study	0
Case series	0
Retrospective review, modelling	0
Studies presented at an international conference	0
Expert opinion	0
Total	**5[a]**

Abbreviation: RCT, randomized controlled trial.
[a]One study was reported in 2 papers.

Systematic Review of Advanced Access Implementation in Primary Care

Description of Review

Rose et al (27) conducted a systematic review of advanced access implementation in primary care settings. While the review did not specifically evaluate advanced access scheduling in chronic disease populations, it did include studies that were specific to adults with chronic diseases. The review evaluated 28 articles representing 24 studies and included publications and grey literature up to August 2010. Publications included articles, research letters, and brief reports written or translated into English. The authors did not limit inclusion based on study design, but they did exclude reports that were not written in scientific format or that did not have a full description of methods, study population, baseline data, or results. Because of heterogeneity among the publications, the authors did not conduct a meta-analysis; they restricted their analysis to a narrative review.

Impact of Advanced Access in Primary Care

Outcomes included in the review—along with the findings for each outcome—are reported in Table 2.

Table 2: Systematic Review—Outcomes, Measures, and Results

Outcome	Measure (# of Studies)	Results
Successful implementation of advanced access	Time to third next appointment (8 studies)	Advanced access was associated with a decrease in time to third next appointment in all studies, with statistically significant declines reported in 5 studies[a]
No-show rate	Percent of patients who miss booked appointments (11 studies)	Ten studies showed some improvement in no-show rates, with statistically significant improvement reported in 5 studies
Continuity of care	Any measure used to assess how often patients saw their own primary care physician (9 studies)	There was an improvement in continuity of care in 7 studies and a decline in 2 studies. Statistically significant improvements were reported in 3 studies
Health care utilization (ED visits, urgent care visits, and hospital admissions)	Percent of patients who had a visit to an ED, an urgent care clinic, or a hospital admission at least once (2 studies)	Neither study reported significant changes in ED visits or hospitalizations. One study reported a significant reduction in urgent care visits
Clinical indicators	HbA_{1c}, lipids, blood pressure (3 studies)[b]	Two studies reported statistically significant improvements in HbA_{1c}, but the difference was clinically significant in only 1 study. One study reported a statistically significant improvement in lipid control, while another study reported a statistically significant decline in blood pressure control.
Patient satisfaction	Overall patient satisfaction (4 studies)	Two studies reported improvements in patient satisfaction; this finding was statistically significant in 1 study
	Appointment-system satisfaction (4 studies)	Two studies showed some improvement in satisfaction, but these findings were not statistically significant. One study reported a statistically significant decline in satisfaction

Abbreviations: ED, emergency department; HbA_{1c}, hemoglobin A_{1c}.

[a]No studies reported a time to third next appointment of less than 1 day, the goal of advanced access scheduling.

[b]One study conducted in the Veterans' Administration reported significant clinical improvements but was excluded by the authors because a number of other concurrent quality improvement initiatives were underway.

Results varied substantially across studies; this finding may be attributed at least in part to differences in implementation and the success of advanced access scheduling. Generally, implementation reduced no-show rates and improved access, and some (but not all) studies were able to reduce wait times to 2 days or fewer. The reviewers additionally reported small to neutral changes in patient satisfaction and continuity of care, but with some inconsistency in the findings. The effects on clinical outcomes were mixed, and there were no clinically and statistically significant reductions in health service utilization, with the exception of a reduction in urgent care visits noted in 1 study.

With respect to improvements in patient access, the authors concluded the following: "Most practices attempting advanced access reduce wait time substantially, although few achieve same-day access. For practices with high no-show rates, advanced access appears to yield marked improvements; however, it is less effective for practices with lower baseline no-show rates." (27)

However, while the authors suggested that wait times for primary care access were improved, they were equivocal about the effect of advanced access on clinical outcomes: "Overall, it does not appear that

advanced access in itself is a particularly robust method of improving clinical outcomes. However, we found no compelling evidence of harm." (27)

Limitations

This review had a number of limitations, most stemming from those of the original studies. Few of the studies were high quality or rigorous; 1 cluster RCT was included, but it had evidence of substantial contamination, possibly explaining the lack of significant findings in this study. While a few studies included contemporaneous controls, most were before-and-after designs, and did not account for secular trends or other improvement initiatives that were concurrently underway. Almost all of the included studies involved self-selection of participating sites, and the authors noted that the overall risk of bias was high. Measurement was inconsistent for some of the included outcomes (e.g., continuity of care, patient satisfaction), but the authors reported combined results nevertheless. Finally, the authors had intended to include studies that evaluated advanced access implementation in primary care practice, but they also included studies that were specific to pediatric or geriatric populations. While these studies may have been reflective of primary care, the specificity of their populations warranted a separate analysis.

> ***Health Quality Ontario Comments***
> This systematic review was intended to explore advanced access scheduling in a general primary care population and so included patient populations beyond the scope of this review.

Studies of Advanced Access Implementation in Chronic Disease Populations

Description of Studies

Four observational studies (reported in 5 papers) also met the inclusion criteria for this review, 3 of which were also included in the systematic review by Rose et al. (27) Table 3 describes the included studies and the relevant review-specific outcomes reported in each.

All studies conducted a retrospective, pre-versus-post analysis. One study included concurrent controls, but a number of patient and clinic characteristics differed significantly between the intervention and control populations. (28) Intervention sites were self-selected in all studies, and all included 1 year of data from the baseline (pre-implementation) period and 1 year of data from the post-implementation period. One study (24;25) defined a separate 1 year implementation period, for which data were separately collected and reported in 1 of the papers. (25) The other 3 studies did not define an implementation period, instead using a single date to distinguish between pre- and post-implementation. (18;28;29)

Two of the 5 papers included multiple chronic disease populations. Solberg et al (24) reported on the impact of advanced access scheduling on patients with diabetes (diabetes type was not distinguished), depression, and/or coronary heart disease (CHD) in a multicentre, primary care network. Gladstone and Howard (29) included patients with hypertension, type 2 diabetes, and CAD in a solo practice primary care setting. Neither study specifically identified a multiple morbidity cohort, but they did report prevalence rates that were indicative of multiple morbidity. Instead, patients with multiple conditions were included in several different single-condition cohorts, which created the potential for double counting. The study by Sperl-Hillen et al (25) was a follow-up publication to Solberg et al (24), focusing on the population with diabetes (with or without other conditions). The populations in the other 2 studies were patients with diabetes (diabetes type not distinguished) in a health care plan in Indiana (28) and the patient population of a United States Veterans' Affairs geriatric clinic in Florida. (18)

In four of the papers, identification of chronic disease populations was based on either chart review using information from patients' clinical and medication histories (29) or on validated administrative data algorithms using *International Classification of Disease, 9th Edition* codes. (24;25;28) The final study

assessed the impact of advanced access scheduling in a geriatric clinic population, and the entire patient panel was included in the analysis. (18)

Only 2 studies specifically reported measures of successful advanced access implementation. Sperl-Hillen et al (25) reported the time to third next appointment, and Cherniack et al (18) reported missed appointment rates and follow-up rates.

Table 3: Description of Study Elements and Outcomes[a]

Study, Setting	Design	Research Question	Population	All Reported Outcomes	Review-Specific Outcomes, Y/N				
					Hospitalizations	ED Visits	Inpatient LOS	Clinical Measures	Patient Satisfaction
Subramanian et al, (28) Indiana, United States	Pre/post observational study with concurrent controls	What is the effect of OA scheduling on processes and outcomes of diabetes care and health care utilization in OA clinics compared to control clinics (traditional scheduling)?	Indiana University Medical Group, primary care clinic patients with diabetes who were covered under the Wishard Advantage health plan and receiving care in 1 of 12 participating clinics (6 intervention, 6 control) • Adults with diabetes: n = 4,060 • Intervention patients: n = 3,147 • Control patients: n = 913	*Health service utilization*: mean number of hospitalizations, mean number of outpatient visits (ED/urgent care and primary care) *Clinical measures*: HbA_{1c}, LDL-C, SBP *Process of care*: annual measurement of HbA_{1c}, urine protein, LDL-C	Y	Y[a]	N	Y	N
Solberg et al, (24) Minnesota, United States	Pre/post observational study with historical controls	Is implementation of advanced access in a large, multispecialty medical group associated with changes in utilization or costs for patients with diabetes, CHD, or depression?	Patients with diabetes, CHD, or depression who were receiving care in 17 primary care clinics in a multispecialty medical group (about 240,000 plan members) *Diabetes* • 1999: n = 6,741 • 2001: n = 7,238 *CHD* • 1999: n = 3,555 • 2001: n = 3,802	*Health service utilization:* mean number of primary care visits per patient; % of patients who had 1+ ED visits, urgent care visits, or hospitalizations; hospital LOS > 3 days *Advanced access*: continuity of care Proportion of visits in primary care that were for chronic conditions Total costs of care for patients	Y	Y	Y	N	N
Sperl-Hillen et al, (25) Minnesota, United States (diabetes population only)		Does implementation of advanced access affect composite measures of diabetes care? Specifically, does improved availability of appointments and continuity resulting from advanced access affect diabetes quality of care measures?	Patients with diabetes who were receiving care in 17 primary care clinics in a multispecialty medical group (about 240,000 plan members) • 1999: n = 6,741 • 2000: n = 7,056 • 2001: n = 7,238	*Health service utilization:* primary care visits, urgent care, and/or ED visits *Clinical measures*: composite measures of LDL-C and HbA_{1c} *Process of care*: composite measures of % of patients with 1+ LDL-C and HbA_{1c} in 1 year *Advanced access*: continuity of care, wait times for appointments	N	Y[a]	N	Y	N

Gladstone et al, (29) Ontario, Canada	Pre/post observational study with historical controls	What is the effect of advanced access scheduling on the care of patients with chronic diseases (hypertension, type 2 diabetes, and CAD) in a Canadian family practice?	Patients in a single family physician practice in Brantford, Ontario (panel size about 2,000) with a clinical record of hypertension, type 2 diabetes, and/or CAD • Hypertension: n = 216 • Type 2 diabetes: n = 156 • CAD: n = 77	*Clinical measures*: HbA_{1c}, LDL-C, SBP *Process of care:* number of visits for chronic disease management, total number of visits	N	N	No	Y	N
Cherniack et al, (18) Florida, United States (Veterans Affairs)	Pre/post observational study with historical controls	What is the impact of advanced access scheduling on geriatric patients (in a geriatric practice setting)?	Patients in a Veterans' Affairs geriatric clinic in Miami, Florida. Patient population of 1,000; sample of patients included was not specified	Patient satisfaction Patient visits *Advanced access:* missed appointments	N	N	N	N	Y

Abbreviations: CAD, coronary artery disease; CHD; coronary heart disease; ED, emergency department; HbA_{1c}, hemoglobin A_{1c}; LDL-C, low-density lipoprotein cholesterol; LOS, length of stay; OA, open access; SBP, systolic blood pressure.

[a]This table is ordered to reflect the quality of the included studies.

Hospitalizations

The association between advanced access implementation and hospitalization rates was assessed in 2 papers. One study included patients with diabetes, (28) and the other study included patients with diabetes and/or CHD. (24) See Table 4 for details.

For patients with diabetes, both studies reported a nonsignificant increase in hospitalizations. Subramanian et al compared outcomes for open access (OA) and non-OA clinics but did not find a difference in hospitalization rates between the two clinic types. (28)

For patients with CHD, Solberg et al (24) reported a slight but significant reduction in hospitalizations in the post-implementation period compared to the pre-implementation period; however, rates in both periods were high, and the absolute reduction was less than 1%, suggesting that the study may have been overpowered for this outcome.

Table 4: Impact of Advanced Access Implementation on Hospitalization Rates[a]

Study	Results
Subramanian et al (28)	The mean number of all-cause hospitalizations (per patient) **increased nonsignificantly** in both OA (0.30 to 0.35) and non-OA clinics (0.24 to 0.27) in the post-implementation period Rate ratio, OA clinics to non-OA clinics = 0.95 (95% CI, 0.81–1.11)[b]
Solberg et al (24)	*Diabetes:* The percentage of patients who were admitted at least once **increased nonsignificantly** between the pre- and post-implementation periods, from 9.5% to 9.7% (P = 0.70)[c] *CHD:* The percentage of patients who were admitted at least once **decreased slightly but significantly** between the pre- and post-implementation periods, from 58.4% to 57.3% (P = 0.002)[c]

Abbreviations: CAD, coronary artery disease; CI, confidence interval; OA, open access.
[a]The table is ordered to reflect the quality of the included studies.
[b]Based on multivariate modelling adjusted for patient and clinic characteristics.
[c]Rates were adjusted for age, sex, and modified Charlson score.

Emergency Department and/or Urgent Care Visits

The association between advanced access implementation and ED and/or urgent care visits was assessed in 3 papers (2 studies). See Table 5 for details.

For patients with diabetes, Subramanian et al (28) detected no change in the mean number of combined, all-cause ED and urgent care visits between the pre- and post-implementation periods and did not find a significant difference in the change in visit rates between intervention (OA) and control (non-OA) clinics.

Also for patients with diabetes, Solberg et al (24) reported a nonsignificant increase in the percentage of patients who had more than 1 ED visit between the pre- and post-implementation periods; however, Sperl-Hillen et al (25) reanalyzed these data combining ED and urgent care visits and reported a significant decline between the pre- and post-implementation periods, but no significant decline between the pre- implementation and implementation periods. The difference in findings between these 2 papers from the same study is likely due to a change in outcome definition.

For patients with CHD, Solberg et al (24) reported a slight, nonsignificant decrease in the percentage of patients who attended an ED at least once.

Table 5: Impact of Advanced Access Implementation on Emergency Department/Urgent Care Visits[a]

Study	Results
Subramanian et al (28)	The mean number of all-cause ED and urgent care visits (per patient) **did not change** in either the OA (1.1 visits in both periods) or non-OA clinics (0.9 visits in both periods) between the pre- and post-implementation periods Rate ratio, OA clinics to non-OA clinics = 0.97 (95% CI, 0.92–1.02)[b]
Solberg et al[c] (24)	*Diabetes:* The percentage of patients who had 1+ ED visits **increased nonsignificantly** between the pre- and post-implementation periods, from 14.4% to 15.1% ($P = 0.08$)[d] *CHD:* The percentage of patients who had 1+ ED visits **decreased nonsignificantly** between the pre- and post-implementation periods, from 51.5% to 50.9% ($P = 0.07$)[d]
Sperl-Hillen et al[c] (25)	The percentage of patients who had 1+ ED or urgent care visits **decreased significantly** between the pre- and post-implementation periods, from 41.0% to 37.6% ($P < 0.001$) The decline between the pre-implementation and implementation periods was not significant (41.0% to 40.1%, $P = 0.26$); no comparison was made between the implementation and post-implementation periods

Abbreviations: CAD, coronary artery disease; CI, confidence interval; ED, emergency department; OA, open access.
[a]The table is ordered to reflect the quality of the included studies.
[b]Based on multivariate modelling adjusted for patient and clinic characteristics.
[c]Solberg et al (24) and Sperl-Hillen et al (25) reported on findings from the same study but used different outcome measures.
[d]Rates were adjusted for age, sex, and modified Charlson score.

Acute Care Length of Stay

Solberg et al (24) analyzed the association between advanced access implementation and acute care length of stay (LOS) in patients with diabetes and/or CHD. See Table 6 for details.

For both populations, the authors reported a significant decline in the percentage of patients who stayed in hospital for more than 3 days after advanced access implementation.

Table 6: Impact of Advanced Access Implementation on Acute Care Length of Stay

Study	Results
Solberg et al (24)	*Diabetes:* The percentage of patients who had an acute care LOS of more than 3 days **decreased significantly** between the pre- and post-implementation periods, from 58.2% to 54.4% ($P = 0.03$)[a]
	CHD: The percentage of patients who had an acute care LOS of more than 3 days **decreased significantly** between the pre- and post-implementation periods, from 55.7% to 51.9% ($P = 0.003$)[a]

Abbreviations: CAD, coronary artery disease; LOS, length of stay.
[a]Rates were adjusted for age, sex, and modified Charlson score.

Disease-Specific Clinical Outcomes

The association between advanced access implementation and specific clinical disease outcomes was assessed in 3 studies. See Table 7 for details.

Among patients with diabetes, Subramanian et al (28) reported that intervention (OA) sites had a larger mean reduction in HbA_{1c} but a significant increase in mean systolic blood pressure over time compared to control (non-OA) sites. There was no difference in change in low-density lipoprotein cholesterol (LDL-C) between intervention and control sites.

Also among patients with diabetes, Sperl-Hillen et al (25) and colleagues reported a significant increase in the percentage of patients with controlled HbA_{1c} and/or LDL-C after advanced access implementation compared to the pre-implementation period.

Among patients with CAD and/or diabetes, Gladstone et al (29) also reported declines in both clinical measures, but the change in HbA_{1c} was not statistically significant, and the authors reported that the change in LDL-C, although statistically significant, was not clinically meaningful.

Table 7: Impact of Advanced Access Implementation on Disease-Specific Clinical Outcomes[a]

Study	Results
Subramanian et al (28)	OA clinic patients had a **significant decrease** in mean HbA_{1c}, but a **significant increase** in mean SBP compared to non-OA clinic patients. There was no difference in change in LDL-C between OA and non-OA clinic patients Mean difference OA to non-OA clinics: HbA_{1c} (%): –0.12 (95% CI, –0.21, –0.03) SBP (mm Hg): 6.4 (95% CI, 5.4, 7.5) LDL-C (mg/dL): –0.2 (95% CI, –2.0, 1.5)
Sperl-Hillen et al (25)	The percentage of patients with HbA_{1c} < 7% **increased significantly** between the pre- and post-implementation periods, from 44.4% to 52.3% ($P < 0.001$)[b] The percentage of patients with LDL-C < 100 mg/dL **increased significantly** between the pre- and post-implementation periods, from 29.8% to 38.7% ($P < 0.001$)[b]
Gladstone et al (29)	Mean HbA_{1c} **decreased nonsignificantly** between the pre- and post-implementation periods, from 7.2% to 7.1% ($P = 0.17$) Mean LDL-C **decreased slightly but significantly** between the pre- and post-implementation periods, from 2.7 mmol/L to 2.6 mmol/L ($P = 0.04$)

Abbreviations: CI, confidence interval; HbA_{1c}, hemoglobin A_{1c}; LDL-C, low-density lipoprotein cholesterol; OA, open access; SBP, systolic blood pressure.

[a]The table is ordered to reflect the quality of the included studies.

[b]Utilization rates were adjusted for age, sex, and modified Charlson score.

Patient Satisfaction

Only 1 study specifically measured patient satisfaction with advanced access scheduling. Cherniack et al (18) reported that 55% of a convenience sample of 125 patients in a geriatric clinic preferred advanced access scheduling to traditional appointment scheduling, but no statistical analyses were conducted.

Other Reported Outcomes

Process-of-Care Measures

Process-of-care measures for chronic disease management were assessed in 3 papers.

Subramanian et al (28) conducted multivariate analyses on process-of-care measures in OA clinics compared to non-OA clinics. In OA clinics, the percentage of patients who underwent testing for HbA_{1c}, LDL-C, and urine microalbumin changed very little in the post-implementation year compared to the pre-implementation year, but there were substantial improvements in the non-OA clinics in all 3 measures. As a result, the odds ratios associated with processes of care suggested that OA clinics had significantly fewer improvement in their processes of diabetes care than non-OA clinics for HbA_{1c} and urine microalbumin (the odds ratio associated with urine microalbumin screening was significant only for non–African American patients). The authors did not mention that other quality-improvement initiatives were underway during the study period; it may be that to see significant improvements in quality of care, efforts may be better directed at improving clinical care rather than increasing access to care.

Conversely, Sperl-Hillen et al (25) reported that significantly higher proportions of patients underwent HbA_{1c} (2 or more in 1 year) and LDL-C (1 or more in 1 year) testing after the implementation of advanced access scheduling. The study authors conducted multivariate analyses (controlling for age, sex, CAD, and study year) to assess the independent association between wait times and provider continuity and composite measures of the following:

- process of care (patients had 2 or more HbA_{1c} measurements and 1 or more fasting lipid profiles during the year)
- good clinical control (HbA_{1c} < 8% and LDL-C < 130 mg/dL)
- excellent clinical control (HbA_{1c} < 7% and LDL-C < 100 mg/dL)

Higher provider continuity was significantly associated with improvements in clinical process ($P = 0.01$), good clinical control ($P = 0.03$), and excellent clinical control ($P < 0.001$). On the other hand, lower wait times were not associated with any of these composite measures. The authors concluded that diabetes care could be improved by increasing continuity of care by primary care physicians, and that there was no direct relation between wait time and improved care. The authors also noted that shorter provider wait times were only weakly associated with increased continuity of care and that "...gains in continuity of care should be attributed only cautiously to advanced access." (25)

The third study to report on process-of-care measures was from a primary care practice in Ontario. (29) This study reported significant declines in the mean number of measurements of blood pressure (3.3 to 2.9, $P = 0.001$), HbA_{1c} (1.7 to 1.5, $P = 0.01$) and LDL-C (1.5 to 1.2, $P < 0.001$) between the pre-implementation year and the post-implementation year. The authors also reported a significant decline in the number of visits for chronic disease management after advanced access implementation (from 2.6 visits to 2.2 visits per year, $P = 0.02$), although there was no change in the average number of visits per patient in the pre- versus post-implementation years (4.3 visits in both), suggesting a shift away from chronic disease management visits towards visits for acute problems; these increased from 1.7 to 2.1 visits during the same period ($P = 0.02$). (29)

Such a reduction in the proportion of visits for chronic disease management echoes the findings of Solberg et al, (24) who reported an absolute increase in the total number of visits and the number of

chronic disease visits for all 3 cohorts (diabetes, CHD, and/or depression) but also noted a significant decline in the proportion of total visits that were specifically for chronic disease care for patients with CHD ($P = 0.002$) and/or diabetes ($P < 0.001$). It is not possible to determine whether patients are receiving adequate chronic disease care from either of these studies. (24;29)

Costs

Solberg et al (24) also reported on total costs of care. The authors reported a 10% to 20% increase in total costs of care (inpatient, outpatient, and skilled nursing facilities) in the post-implementation period compared to the pre-implementation period for all 3 patient cohorts (diabetes, CHD, and/or depression); this may have been partly related to the increased number of visits noted above. These costs did not include the costs of the actual intervention. Without a control group comparison, it is not possible to make an association between advanced access implementation and costs, but the increases in the number of visits and total health care costs merits further investigation.

Missed Appointments

Cherniack et al (18) looked at the impact of advanced access implementation in a geriatric clinic population. While this study did not examine clinical outcomes or processes of care, the authors did look at rates of missed appointments (i.e., no-show rates) and number of patient visits per month. The authors reported a significant reduction in the proportion of missed appointments per month (as a percentage of total visits) after advanced access implementation (from 18% to 11%, $P < 0.001$), but they also reported a decrease in total number of visits per month in the early period after advanced access implementation. (18) This decrease was addressed by hiring a medical assistant part-way through the study, who called patients to schedule regular follow-up appointments. This implies that without additional resources, this clinic may have seen a significant reduction in patient follow-up. The authors suggested the following:

> *"...because an open access scheduling system requires patients to take the initiative to schedule their appointments, it may disadvantage frail elderly individuals, who have more sensory or cognitive impairments and are thus less able to schedule appointments on their own ... the system may also disadvantage less educated patients, who might be less likely to schedule important follow-up visits for diseases for which they are asymptomatic." (18)*

Limitations

There are a number of study limitations that limit the strength of evidence for this review. None of the studies employed an RCT design, although a cluster randomized design would have been possible, especially in some of the larger implementations. (11;25;28;30) Even though an RCT design was not available, the identification of control sites and measurement of outcomes in these sites should have been undertaken. Only 1 study included control sites, but even in this study, intervention and control sites were self-selected and differed significantly with respect to clinic and population characteristics. As well, the authors did not report blind assessment of outcomes, although this should have been possible.

Advanced access is often implemented as part of larger quality-improvement programs, but only 1 study identified other quality-improvement efforts underway. (24) Even in this study, however, the authors did not attempt to adjust their findings to take these additional programs (1 of which was in diabetes management) into account. For this reason, changes may have been attributed to advanced access rather than to other improvement efforts.

The study by Subramanian et al (28) used administrative data to assess outcomes and determined that care outside of the health insurance plan would not be captured. They indicated that since the study population was from a lower socioeconomic group, it was unlikely that they would receive care outside the insured

health system, but there was no effort to quantify outside use. The other American study that assessed outcomes (24;25) did not discuss the possibility of health service use outside of the health plan, even though this would likely be an issue for outcome assessment in this study as well. Such lack of capture could have resulted in undercounting of events (e.g., hospitalizations, ED use) possibly leading to an overestimated effect of advanced access.

Two studies included multiple chronic disease cohorts, but neither study attempted to distinguish patients with multiple chronic diseases. (24;29) As a result, both studies attributed outcomes such as numbers of visits, hospitalizations, and process of care measures to multiple disease cohorts, and may have led to double counting of outcomes. The impact of this error could both positively and negatively affect the assessment of advanced access.

Only 2 papers reported on the successful implementation of advanced access, (18;25) and only 1 assessed the association between reductions in wait times for appointments with outcomes. (25) It is possible that the lack of findings for a number of outcomes was associated with the unsuccessful implementation of advanced access.

Discussion

Advanced access scheduling has been shown to be effective at reducing wait times for appointments and no-show rates, and it may even improve health care provider satisfaction (although this was not assessed in this review), but it appears to have limited impact on patients' health service utilization and clinical outcomes. It is possible that a review that specifically assesses the impact of advanced access scheduling in chronic disease populations will be limited in its ability to detect important benefits. However, it is also possible that because advanced access is best suited to managing acute problems, its benefits are substantially greater for populations without chronic disease. Still, given the increasing burden of chronic disease in Ontario and the typically higher rates of health service utilization and costs in such populations, any health care reforms undertaken must not negatively affect people with chronic diseases.

This review and the systematic review by Rose et al (27) found that advanced access seems to be most effective at improving access, particularly for practices with significantly greater access-related problems. As such, advanced access should be considered an optional intervention for practices for which access to care is a significant issue, with the caveat that continuity of care should not be compromised simply to increase access.

In contrast, advanced access has shown little benefit in terms of patient outcomes, and may in fact negatively impact the regular management of chronic disease. Four studies in this analysis reported on process-of-care measures and/or follow-up, but the findings were inconsistent. A study of advanced access implementation in a geriatric population found that some patients were at risk of not receiving adequate follow-up as a result of advanced access implementation. (18) To address this, the clinic hired an additional medical assistant to ensure that patients were being contacted and follow-up appointments booked; this suggests that advanced access may negatively impact the ability of older patients to receive timely follow-up.

Gladstone et al (29) reported fewer chronic disease visits during the post-implementation year (compared to the pre-implementation year) and also noted a commensurate reduction in regular cholesterol and blood glucose testing. Similarly, Subramanian et al (28) reported significantly lower rates of HbA_{1c}, LDL-C, and urine microalbumin testing among patients with diabetes in advanced access clinics compared to control clinics. The findings from these 2 independent studies suggest that advanced access implementation may negatively affect chronic disease management. While both studies reported reduced

rates of patient monitoring and/or follow-up, clinical outcomes were inconsistent, which may be due to the process of implementation and the short follow-up periods (neither study followed patients for more than 1 year after implementation).

The third study that evaluated process-of-care measures reported improvements in clinical care after advanced access implementation, but the authors attributed this (in multivariate modelling) to improvements in provider continuity rather than to shorter appointment wait times. (25) In fact, the authors concluded that continuity of care was more important for patients with diabetes, and that shorter wait times were only slightly associated with improvements in continuity of care. This suggests that if advanced access is to be implemented, ensuring that patients see their own physician whenever possible is more important than getting patients an appointment within 24 hours.

One of the drivers of advanced access implementation is the belief that by increasing access to primary care, urgent care utilization and hospitalization rates will decrease. The idea is that by addressing problems at the primary care level, they will not progress toward the need for more costly, acute care. Unfortunately, the research findings do not support this, either in general primary care or in specific chronic disease populations. In the 2 studies (3 papers) that examined hospitalizations, ED visits, and urgent care visits, advanced access was inconsistently associated with changes in acute care utilization. (24;25;28) Two papers reported no change in hospitalization rates or ED and/or urgent care visits for patients with diabetes (24;28) and the 1 paper that reported on hospitalization rates for patients with CHD reported a statistically significant decline that was likely not clinically relevant. (24) The study by Solberg et al (24) was re-analyzed by Sperl-Hillen et al (25) and combined ED visits and urgent care utilization and reported a significant reduction after advanced access implementation, but it is difficult to interpret this inconsistency beyond attributing it to the change in definition.

Since advanced access scheduling improves access to health care, it may be important to focus resources on this intervention, but only for those practices where access is truly an issue. Where access is not an issue, or if the issue has already been addressed successfully, quality-improvement efforts should focus instead on improving the continuity and quality of care received by patients.

Summary

Table 8: Summary of Findings

Outcome	Number of Studies	Results	GRADE
Diabetes Population			
Hospitalizations	2 studies (24;28)	No significant change in hospitalization rates in either study Subramanian et al (28) reported a nonsignificant increase in the mean number of all-cause hospitalizations in both OA and non-OA clinics post-implementation. The rate ratio of OA clinics to non-OA clinics was 0.95 (95% CI, 0.81–1.11) Solberg et al (24) reported that the percentage of patients who were admitted at least once increased nonsignificantly between the pre- and post-implementation periods, from 9.5% to 9.7% (*P* = 0.70)	Low
ED visits	1 study (24)	No significant change in ED visit rates: % with 1+ ED visits, pre vs. post = 14.4% to 15.1% (*P* = 0.08)	Very low
ED visits and/or urgent care visits	2 studies (25;28)	Inconsistent findings across studies Subramanian et al (28) reported no significant change in the mean number of ED and/or urgent care visits either between pre- and post-implementation periods (within OA clinics) or when comparing the change in rates in OA vs. non-OA clinics; rate ratio, OA clinics to non-OA clinics = 0.97 (95% CI, 0.92–1.02). Sperl-Hillen et al (25) reported a significant reduction in the percent of patients with 1 or more urgent care and/or ED visit, from 41.0% to 37.6% (*P* < 0.001)	Very low
LOS	1 study (24)	Significant reduction in % of patients with LOS > 3 days, pre vs. post = 58.2% vs. 54.4% (*P* = 0.03)	Very low
HbA_{1c}, LDL-C, SBP	3 studies (25;28;29)	Inconsistent findings across studies Subramanian et al (28) showed improvement (HbA_{1c}), deterioration (SBP), and no difference (LDL-C) Gladstone et al (29) reported small but statistically significant reductions in LDL-C but no other changes in clinical measures; the authors indicate this difference was not clinically important Sperl-Hillen et al (25) showed improved control for HbA_{1c} and LDL-C	Very low
CAD/CHD Population			
Hospitalizations	1 study (24)	Significant reduction in hospitalization rates: % with 1+ admission (all-cause), pre vs. post = 58.4% vs. 57.3% (*P* = 0.002)	Very low
ED visits	1 study (24)	No significant change in ED visit rates: % with 1+ ED visits, pre vs. post = 51.5% vs. 50.9% (*P* = 0.07)	Very low
LOS	1 study (24)	Significant reduction in % of patients with LOS > 3 days, pre vs. post = 55.7% vs. 51.9% (*P* = 0.003)	Very low
HbA_{1c}, LDL-C, SBP	1 study (29)	Inconsistent findings Small but statistically significant reductions in LDL-C, but no other changes in clinical measures; the authors indicate this difference was not clinically important	Very low
Geriatric Population			
Patient satisfaction	1 study (18)	55% of a convenience sample (n = 125) of patients preferred advanced access scheduling to traditional scheduling (no statistical tests were reported)	Very low

Abbreviations: CAD, coronary artery disease; CHD, coronary heart disease; ED, emergency department; HbA_{1c}, hemoglobin A_{1c}; LDL-C, low-density lipoprotein cholesterol; LOS, length of stay; OA, open access; SBP, systolic blood pressure.

Conclusions

Advanced Access in a Diabetes Population

- There were no significant changes in hospitalization rates for patients with diabetes; the quality of the evidence was low.
- There were no significant changes in ED visit rates for patients with diabetes; the quality of the evidence was very low.
- There was inconsistent evidence of changes in combined ED/urgent care visits for patients with diabetes. One study found no reduction, while the second study reported a significant reduction; the quality of the evidence was very low.
- There was a significant reduction in the proportion of patients with diabetes admitted to hospital whose length of stay was greater than 3 days; the quality of the evidence was very low.
- There was inconsistent evidence of changes in chronic disease clinical measures (HbA_{1c}, LDL-C, systolic blood pressure) for patients with diabetes; the quality of the evidence was very low.

Advanced Access in a CAD/CHD Population

- There was a significant reduction in hospitalization rates for patients with CHD; the quality of the evidence was very low.
- There were no significant changes in ED visit rates for patients with CHD; the quality of the evidence was very low.
- There was a significant reduction in the proportion of patients with CHD admitted to hospital whose length of stay was greater than 3 days; the quality of the evidence was very low.
- There was inconsistent evidence of changes in chronic disease clinical measures (HbA_{1c}, LDL-C, systolic blood pressure) for patients with CAD/CHD; the quality of the evidence was very low.

Advanced Access in a Geriatric Population

- The authors reported that a majority of patients (55%) were satisfied with an advanced access scheduling system over traditional appointment scheduling systems, but no statistical analysis was conducted, and the quality of the evidence was very low.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: January 29th, 2012
Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination.

Limits: no year limit; English; NOT comments, editorials, letters

Database: Ovid MEDLINE(R) <1946 to January Week 3 2012>, Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations <January 27, 2012>, Embase <1980 to 2012 Week 04>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212075
2	exp Myocardial Infarction/ use mesz	133578
3	exp heart infarction/ use emez	216992
4	(coronary artery disease or cad or heart attack).ti.	44463
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149559
6	or/1-5	539975
7	exp Atrial Fibrillation/ use mesz	28093
8	exp heart atrium fibrillation/ use emez	55522
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73540
10	or/7-9	99451
11	exp heart failure/	300981
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234590
13	11 or 12	381953
14	exp Stroke/	178088
15	exp Ischemic Attack, Transient/ use mesz	16370
16	exp transient ischemic attack/ use emez	19680
17	exp stroke patient/ use emez	5637
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101006
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	281375
20	or/14-19	391798
21	exp Diabetes Mellitus, Type 2/ use mesz	68223
22	exp non insulin dependent diabetes mellitus/ use emez	101711
23	exp diabetic patient/ use emez	12920
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	765351
25	or/21-24	790292
26	exp Skin Ulcer/	72073
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28723

28	(decubitus or bedsore*).ti,ab.	8532
29	or/26-28	90816
30	exp Pulmonary Disease, Chronic Obstructive/ use mesz	17049
31	exp chronic obstructive lung disease/ use emez	54779
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54491
33	(copd or coad).ti,ab.	45716
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37444
36	exp chronic bronchitis/ use emez	6985
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50848
38	or/30-37	159366
39	exp Chronic Disease/	340792
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	220217
41	39 or 40	506604
42	exp Comorbidity/	143585
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	203652
44	42 or 43	284365
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2823779
46	*"Appointments and Schedules"/ use mesz	3033
47	*Health Services Accessibility/ use mesz	19867
48	*Patient-Centered Care/ use mesz	4514
49	((patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) adj2 (access* or appointment* or booking? or schedul*)).ti,ab.	218
50	((advanced adj2 access*) or (enhanc* adj access*) or ((advanc* access or open access) adj (appointment* or schedul*))).ti,ab.	1613
51	*Health Care Access/ use emez	4305
52	Patient Scheduling/ use emez	736
53	or/46-49,51-52	32391
54	(45 and 53) or 50	3971
55	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use mesz	2912209
56	Case Report/ or Editorial/ or Letter/ use emez	4609309
57	54 not (55 or 56)	3672
58	limit 57 to english language	3529
59	remove duplicates from 58 Ovid MEDLINE(R) <1946 to January Week 3 2012> (1518) Ovid MEDLINE(R) In-Process and Other Non-Indexed Citations <January 27, 2012> (31) Embase <1980 to 2012 Week 04> (1208)	2757

CINAHL

#	Query	Limiters/Expanders	Results
S43	(S34 AND S41) OR S40	Limiters - English Language; Exclude MEDLINE records Search modes - Boolean/Phrase	560
S42	(S34 AND S41) OR S40	Search modes - Boolean/Phrase	1883
S41	S35 OR S36 OR S37 OR S38 OR S39	Search modes - Boolean/Phrase	22053
S40	(advanced N2 access*) OR (enhanc* N1 access*) OR ((advanc* access OR open access) N1 (appointment* OR schedul*))	Search modes - Boolean/Phrase	379
S39	(patient-driven OR patientdriven OR patient-centered OR patientcentered OR patient-centred OR patientcentred OR same-day OR sameday) N2 (access* OR appointment* OR booking? OR schedul*)	Search modes - Boolean/Phrase	59
S38	(MM "Patient Centered Care")	Search modes - Boolean/Phrase	4423
S37	(MM "Health Services Accessibility+")	Search modes - Boolean/Phrase	14763
S36	(MM "Appointment and Scheduling Information Systems")	Search modes - Boolean/Phrase	69
S35	(MM "Appointments and Schedules+")	Search modes - Boolean/Phrase	2997
S34	S5 OR S8 OR S11 OR S15 OR S19 OR S22 OR S27 OR S30 OR S33	Search modes - Boolean/Phrase	221088
S33	S31 OR S32	Search modes - Boolean/Phrase	28945
S32	comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* N1 patient*) OR "patient* with multiple" OR (multiple N2 (condition* OR disease*))	Search modes - Boolean/Phrase	28945
S31	(MH "Comorbidity")	Search modes - Boolean/Phrase	16646
S30	S28 OR S29	Search modes - Boolean/Phrase	43734
S29	(chronic* N2 disease*) OR (chronic* N2 ill*)	Search modes - Boolean/Phrase	43734
S28	(MH "Chronic Disease")	Search modes - Boolean/Phrase	23647
S27	S23 OR S24 OR S25 OR S26	Search modes - Boolean/Phrase	8774
S26	chronic N2 bronchitis OR emphysema	Search modes - Boolean/Phrase	1820
S25	(MH "Emphysema")	Search modes - Boolean/Phrase	885
S24	chronic obstructive N2 disease* OR chronic obstructive N2 disorder* OR copd OR coad	Search modes - Boolean/Phrase	7349

S23	(MH "Pulmonary Disease, Chronic Obstructive+")	Search modes - Boolean/Phrase	5342
S22	S20 OR S21	Search modes - Boolean/Phrase	16179
S21	pressure N1 ulcer* OR bedsore* OR bed N1 sore* OR skin N1 ulcer* OR pressure N1 wound* OR decubitus	Search modes - Boolean/Phrase	9574
S20	(MH "Skin Ulcer+")	Search modes - Boolean/Phrase	14845
S19	S16 OR S17 OR S18	Search modes - Boolean/Phrase	70185
S18	diabetes OR diabetic* OR niddm OR t2dm	Search modes - Boolean/Phrase	70185
S17	(MH "Diabetic Patients")	Search modes - Boolean/Phrase	3536
S16	(MH "Diabetes Mellitus, Type 2")	Search modes - Boolean/Phrase	18233
S15	S12 OR S13 OR S14	Search modes - Boolean/Phrase	38210
S14	stroke OR tia OR transient ischemic attack OR cerebrovascular apoplexy OR cerebrovascular accident OR cerebrovascular infarct* OR brain infarct* OR CVA	Search modes - Boolean/Phrase	37713
S13	(MH "Cerebral Ischemia, Transient")	Search modes - Boolean/Phrase	1903
S12	(MH "Stroke") OR (MH "Stroke Patients")	Search modes - Boolean/Phrase	25676
S11	S9 OR S10	Search modes - Boolean/Phrase	18862
S10	myocardi* failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation OR cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	Search modes - Boolean/Phrase	18850
S9	(MH "Heart Failure+")	Search modes - Boolean/Phrase	14393
S8	S6 OR S7	Search modes - Boolean/Phrase	8072
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	Search modes - Boolean/Phrase	8072
S6	(MH "Atrial Fibrillation")	Search modes - Boolean/Phrase	6490
S5	S1 OR S2 OR S3 OR S4	Search modes - Boolean/Phrase	30133
S4	TI myocardi* N2 infarct* OR TI heart N2 infarct* OR TI cardiac N2 infarct* OR TI coronary N2 infarct* OR TI arterioscleros* OR TI atheroscleros*	Search modes - Boolean/Phrase	9643
S3	coronary artery disease OR cad OR heart attack*	Search modes - Boolean/Phrase	7706
S2	(MH "Myocardial Infarction+")	Search modes -	19219

S1	(MH "Coronary Arteriosclerosis")	Boolean/Phrase Search modes - Boolean/Phrase	4646

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor Coronary Artery Disease explode all trees	2183
#2	MeSH descriptor Myocardial Infarction explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor Atrial Fibrillation explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor Heart Failure explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor Stroke explode all trees	3899
#9	MeSH descriptor Ischemic Attack, Transient explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor Diabetes Mellitus, Type 2 explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor Skin Ulcer explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor Pulmonary Disease, Chronic Obstructive explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor Emphysema explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	(Chronic Disease):ti	4464
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor Comorbidity explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	61123
#27	MeSH descriptor Appointments and Schedules, this term only	295
#28	MeSH descriptor Health Services Accessibility, this term only	410

#29	MeSH descriptor Patient-Centered Care explode all trees	203
#30	(patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) NEAR/2 (access* or appointment* or booking? or schedul*):ti,ab,kw	13
#31	(advanced NEAR/2 access*) or (enhanc* NEXT access*) or ((advanc* access or open access) NEXT (appointment* or schedul*)):ti,ab,kw	26
#32	(#27 OR #28 OR #29 OR #30)	902
#33	((#26 AND #32) OR #31)	119

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Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	224
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	168
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	280
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	622
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1223
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	219
19	(copd or coad):TI	108

20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	252
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4656
28	MeSH DESCRIPTOR Appointments and Schedules EXPLODE ALL TREES	84
29	MeSH DESCRIPTOR Health Services Accessibility EXPLODE ALL TREES	197
30	MeSH DESCRIPTOR Patient-Centered Care EXPLODE ALL TREES	40
31	((patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) adj2 (access* or appointment* or booking? or schedul*)):TI	2
32	((advanced adj2 access*) or (enhanc* adj1 access*) or ((advanc* access or open access) adj1 (appointment* or schedul*))):TI	2
33	#28 OR #29 OR #30 OR #31	310
34	#27 AND #33	24
35	#32 OR #34	26

Appendix 2: GRADE Tables and Risk of Bias Assessment

Table A1: GRADE Evidence Profile for Advanced Access in a Diabetes Population

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Hospitalization							
2 (observational, 1 with concurrent controls)	No serious limitations	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Emergency Department/Urgent Care Visits							
2 (observational, 1 with concurrent controls)	No serious limitations	Serious limitations (-1)	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Length of Stay							
1 (observational)	Serious limitations (-1)[a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
HbA_{1c}							
3 (observational, 1 with concurrent controls)	No serious limitations	Serious limitations (-1)	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
LDL-C							
3 (observational, 1 with concurrent controls)	No serious limitations	Serious limitations (-1)	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Blood Pressure							
2 (observational, 1 with concurrent controls)	No serious limitations	Serious limitations (-1)	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low

Abbreviations: HbA_{1c}, hemoglobin A_{1c}; LDL-C, low-density lipoprotein cholesterol; NA, not applicable.

[a]Measure used (percent of patients admitted for greater than 3 days) was not explained and may not be valid.

Table A2: GRADE Evidence Profile for Advanced Access in a CAD/CHD Population

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Hospitalization							
1 (observational)	Serious limitations (-1) [a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Emergency Department Visits							
1 (observational)	Serious limitations (-1) [a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Length of Stay							
1 (observational)	Serious limitations (-1)[a,b]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
LDL-C							
1 (observational)	Serious limitations (-1)[a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low
Blood Pressure							
1 (observational)	Serious limitations (-1)[a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low

Abbreviations: CAD, coronary artery disease; CHD, coronary heart disease; LDL-C, low-density lipoprotein cholesterol; NA, not applicable.
[a]Study included patients in multiple cohorts, with attribution of outcomes to all in outcome assessment.
[b]Measure used (percent of patients admitted for greater than 3 days) was not explained and may not be valid.

Table A3: GRADE Evidence Profile for Advanced Access in a Geriatric Population

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Patient Satisfaction							
1 (observational)	Very serious limitations (-2)[a]	NA	No serious limitations	No serious limitations	Undetected	None	⊕ Very Low

Abbreviation: NA, not applicable.
[a]Intervention was altered part way through study, and no statistical analyses are reported.

Table A4: EPOC Risk of Bias Assessment—Observational Study With Contemporaneous Controls

Study	Allocation	Baseline Outcome Measurement	Baseline Characteristics	Incomplete Data	Intervention Allocation Concealed	Management of Missing Data	Free from Selective Outcome Reporting	Other Sources of Bias
Subramanian et al (28)	No *Sites self-selected participation in intervention or control*	Unclear *These were reported, but no statistical tests provided*	No *Intervention and control sites differed significantly on a number of clinic and patient characteristics*	No	Unclear *Not reported. Outcomes assessed using administrative data, but unclear whether those assessing outcomes were aware of intervention status*	Yes	Yes	Yes

Abbreviations: EPOC, Effective Practice and Organization of Care.

Table A5: EPOC Risk of Bias Assessment—Observational Studies With Historical Controls

Study	Independent of Other Changes	Intervention Effect Prespecified	Intervention Affected Data Collection	Incomplete Data Addressed	Free from Selective Outcome Reporting	Other Sources of Bias
Solberg et al (24); Sperl-Hillen et al (25)	No *Authors reported the implementation of a diabetes care program during the same period*	Yes	No	Unclear *Sample sizes varied across time (cohorts differ) and the authors did not discuss use of services outside of the system*	Yes	Yes
Gladstone et al (29)	Unclear *Authors did not account for other changes occurring in the practice*	Yes	No	Unclear *Authors did not report on missing data and excluded people who were not seen after implementation*	Yes	Yes
Cherniack et al (18)	Unclear *Authors did not discuss other initiatives that may have been underway*	No *There was a change in clinic structure part way through the intervention*	Unclear *Data collection was based on the appointment system and may have changed with implementation*	Unclear *Authors did not report rates by patient and did not report missing data rates*	Yes	Yes

Abbreviations: EPOC, Effective Practice and Organization of Care.

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Abstract

Background

Depression is the leading cause of disability and the fourth leading contributor to the global burden of disease. In Canada, the 1-year prevalence of major depressive disorder was approximately 6% in Canadians 18 and older. A large prospective Canadian study reported an increased risk of developing depression in people with chronic diseases compared with those without such diseases.

Objectives

To systematically review the literature regarding the effectiveness of screening for depression and/or anxiety in adults with chronic diseases in the community setting.

To conduct a non-systematic, post-hoc analysis to evaluate whether a screen-and-treat strategy for depression is associated with an improvement in chronic disease outcomes.

Data Sources

A literature search was performed on January 29, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, OVID PsycINFO, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002 until January 29, 2012.

Review Methods

No citations were identified for the first objective. For the second, systematic reviews and randomized controlled trials that compared depression management for adults with chronic disease with usual care/placebo were included. Where possible, the results of randomized controlled trials were pooled using a random-effects model.

Results

Eight primary randomized controlled trials and 1 systematic review were included in the post-hoc analysis (objective 2)—1 in people with diabetes, 2 in people with heart failure, and 5 in people with coronary artery disease. Across all studies, there was no evidence that managing depression improved chronic disease outcomes. The quality of evidence (GRADE) ranged from low to moderate. Some of the study results (specifically in coronary artery disease populations) were suggestive of benefit, but the differences were not significant.

Limitations

The included studies varied in duration of treatment and follow-up, as well as in included forms of depression. In most of the trials, the authors noted a significant placebo response rate that could be attributed to spontaneous resolution of depression or mild disease. In some studies, placebo groups may have had access to care as a result of screening, since it would be unethical to withhold all care.

Conclusions

There was no evidence to suggest that a screen-and-treat strategy for depression among adults with chronic diseases resulted in improved chronic disease outcomes.

Plain Language Summary

People with chronic diseases are more likely to have depression than people without chronic diseases. This is a problem because depression may make the chronic disease worse or affect how a person manages it. Discovering depression earlier may make it easier for people to cope with their condition, leading to better health and quality of life. We reviewed studies that looked at screening and treating for depression in people with chronic diseases. In people with diabetes, treatment of depression did not affect clinical measures of diabetes management. In people with heart failure and coronary artery disease, treatment of depression did not improve heart failure management or reduce rates of heart attacks or death. At present, there is no evidence that screening and treating for depression improves the symptoms of chronic diseases or lead to use of fewer health care services.

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List of Abbreviations

BDI	Beck Depression Inventory
CAD	Coronary artery disease
CBT	Cognitive behavioural therapy
CHF	Congestive heart failure
CI	Confidence interval(s)
CIDI	Composite International Diagnostic Interview
COPD	Chronic obstructive pulmonary disease
DISH	Depression Interview and Structured Hamilton
DSM	*Diagnostic and Statistical Manual of Mental Disorders*
ECG	Electrocardiogram
GAD	Generalized anxiety disorder
HADS	Hospital Anxiety and Depression Scale
HbA1c	Hemoglobin A1c
HRSD	Hamilton Rating Scale for Depression
ITT	Intention-to-treat
LOCF	Last observation carried forward
LVEF	Left ventricular ejection fraction
M-H	Mantel-Haenszel
MI	Myocardial infarction
NR	Not reported
NYHA	New York Heart Association
PRIME-MD	Primary Care Evaluation of Mental Disorders
RCT	Randomized controlled trial
SSRI	Selective serotonin reuptake inhibitor

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

1. To systematically review the literature regarding the effectiveness of screening for depression and/or anxiety in adults with chronic diseases in the community setting.
2. To conduct a non-systematic, post-hoc analysis to evaluate whether a screen-and-treat strategy for depression is associated with an improvement in chronic disease outcomes.

Clinical Need and Target Population

Description of Disease/Condition

Depression

Depressive illness can have a variety of presentations, ranging in both severity and chronicity. (1) According to criteria of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, (2) major depressive disorder is the most severe form, and it consists of an episode of at least 2 weeks in which an individual has 5 of 9 specific depressive symptoms. One of these symptoms must be depressed mood or anhedonia (loss of interest or pleasure). (1) Also, these symptoms must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning—a requirement that emphasizes the marked disability resulting from depressive illness.

Depression is recognized by the World Health Organization as the leading cause of disability and the fourth leading contributor to the global burden of disease. (3) Projections suggest that by 2020, depression will be second only to cardiovascular disease as a public health concern. (4) Despite this, depression continues to be under-recognized and undertreated. (4)

Anxiety

Anxiety disorders are usually characterized by excessive fear and subsequent avoidance, typically in response to a specific object or situation and in the absence of true danger. (5;6) Anxiety, like all emotions, has cognitive, neurobiological, and behavioural components. Although it is often comorbid with depressive mood, anxiety is a distinct emotion. (5) Anxiety becomes alarming and burdensome when it increases or persists to such a degree that the individual can no longer function effectively in everyday life; at this stage, anxiety can have negative consequences. Anxiety disorders include panic disorder, phobic anxiety, generalized anxiety disorder, anxiety reactions, and chronic anxiety. (5)

Prevalence

Depression and anxiety are frequently encountered in primary care. The 1994/95 National Population Health Survey (a Canadian longitudinal study that included household residents from all provinces) reported that the 1-year prevalence of major depressive disorder was about 6% for Canadians aged 18 and older. (7) In the United States, point prevalence estimates of major depression range from 4.8% to 8.6% in primary care settings. (1) Anxiety disorders have a high prevalence as well; in the United States, the 12-month rate is 17.2%, and the lifetime rate is about 25%. (8)

In a large prospective Canadian community-based study, (9) Patten and colleagues found an increased risk of major depression in subjects with chronic medical disorders compared to those without such disorders. A total of 4% (95% confidence interval [CI] 3.3–4.7) of those with 1 or more medical conditions developed major depression over a 2-year period, compared to 2.8% (95% CI 2.2–3.4) of those without medical conditions. (9)

The 2005 Canadian Community Health Survey, cycle 3.1, (10) measured the prevalence of comorbid mood disorders among individuals with various chronic medical conditions in Ontario. The highest prevalence was seen among those who had had a stroke (15.5%), followed by those with cardiovascular disease (9.8%) and diabetes mellitus (9.3%). (10)

The estimated prevalence of anxiety and/or depression varies by the type and severity of chronic disease, and by the setting and methodology of screening and diagnosis. Nevertheless, rates are consistently higher across most chronic disease populations compared to the general population, especially for people with stroke, cardiovascular disease, and diabetes. Table 1 provides a range of prevalence estimates based on the literature and survey data.

Table 1: Depression and Anxiety Associated With Selected Chronic Diseases in Ontario

Comorbid Medical Illness	Prevalence, % Canadian Survey Data, Mood Disorders	Prevalence, % Literature	
		Depression	Anxiety
General population	6%[a] (7)	10.3%[a] (8)	17.2%[a] (8)
Stroke	15.5% (10)	5–44% (11) 6–34% (12) 30–36% (13)	GAD: 6–13% (12)
CAD	9.8% (10)	15–20% (14) 20–28% (15)	Panic disorder: 10–50% (16)
Diabetes	9.3% (10)	Self-reported: 26% (17) Diagnostic interview: 9% (17)	GAD: 14% (18)
Heart failure	—	14–26% (19) 25–30% (15)	—
COPD	—	Stable: 10–42% (20) Severe: 37–71% (20)	Stable: 10–19% (20) Severe: 50–75% (20)
Chronic wounds[b]	—	27% (21)	26% (21)

Abbreviations: CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; GAD, generalized anxiety disorder.
[a]1-year prevalence rate.
[b]Chronic venous ulceration.

Technology/Technique

Depression Screening Instruments

Screening is defined as the systematic testing of asymptomatic individuals to detect a potential disease or condition. (22) The purpose of screening is to prevent or delay the development of advanced disease by promoting early detection and treatment in people with preclinical disease. (22)

Screening for depression identifies patients with these conditions, allowing them to access care earlier in the course of their illness. However, despite the potential benefit of screening, it is infrequently conducted; primary care physicians fail to identify an estimated 30% to 50% of patients with depression. (1)

Several depression screening instruments are available for use in the primary care setting; they differ with respect to the time frame they are applied to, the time it takes to administer them, and the discernment of

levels of depression, (23) but most have an adequate level of sensitivity and specificity. They are composed of standardized questions that assess the number and severity depression symptoms and they have been designed for administration in a variety of ways by a range of healthcare providers. A positive screening result requires further diagnostic questioning to establish an appropriate diagnosis and initiate treatment and follow-up. (24)

Depression Screening for Adults With Chronic Diseases

Given the prevalence of depression, a number of clinical groups have developed recommendations for screening practices, for both the general population and disease-specific groups: diabetes, chronic obstructive pulmonary disease (COPD), stroke, and coronary artery disease (CAD) (see Existing Guidelines for Depression Screening, page 26).

Evidence-Based Analysis

Research Questions

Question 1 (Initial Review)

What is the effectiveness of screening for depression and/or anxiety in adults with chronic diseases in the community setting?

Question 2 (Post-Hoc Review)

In a chronic disease population, is a screen-and-treat strategy for depression associated with an improvement in chronic disease outcomes?

Research Methods

Literature Search (Initial Review)

Search Strategy

A literature search was performed on January 29, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, OVID PsycINFO, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002, until January 29, 2012. A 10-year interval was selected to better reflect current screening and treatment protocols. Titles and abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

English language full-reports

- addressing 1 or more chronic illnesses:
  - atrial fibrillation
  - CAD
  - chronic wounds
  - COPD
  - diabetes
  - heart failure
  - stroke
- community or outpatient setting
- adult population (aged 18 and older)
- published between January 1, 2002, and January 29, 2012 (10-year interval)
- randomized controlled trials (RCTs), systematic reviews, meta-analyses, and observational studies

Exclusion Criteria

- psychiatric conditions: bipolar disorder, obsessive-compulsive disorder, post-traumatic stress disorder, psychotic symptoms, active substance abuse, and active suicidal ideation
- developmental or acquired neuropsychological impairment
- child and adolescent populations
- abstracts, letters, editorials, case series, case reports, comments

Outcomes of Interest

Patient-Specific Outcomes

- disease-specific clinical outcomes (e.g., hemoglobin A1c [HbA1c], cholesterol)
- health-related quality of life
- functional status
- patient satisfaction
- survival/mortality

Health System Outcomes

- acute care hospital admissions and readmissions
- emergency department visits
- length of stay in hospital long-term care admissions

Revised Search (Post-Hoc Review)

For the post-hoc review, the initial search strategy was used, but it was limited to a 5-year publication interval (January 1, 2007, to January 29, 2012). A 5-year interval was chosen because of recent developments and enhancements in screening tools for depression, and because of the substantial body of literature on depression management.

RCTs, systematic reviews, and meta-analyses were included in which participants were screened using a validated tool; deemed to have to have significant levels of depression; and then received some form of depression treatment.

Statistical Analysis

Question 1 (Initial Review)

No studies were found that addressed question 1.

Question 2 (Post-Hoc Review)

Data from clinical trials were available for 3 disease populations: adults with diabetes (1 study), adults with heart failure (2 studies), and adults with CAD (5 studies and 1 systematic review). Outcomes were analyzed by disease-specific subpopulation. Descriptive analyses were reported for clinical outcomes in the diabetes and heart failure populations and for some outcomes in the CAD population. Rates of recurrent myocardial infarction (MI) and death in the CAD population underwent meta-analysis. Meta-analyses were performed using Review Manager 5.1.7 (25) and a random-effects model.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (26) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that RCTs are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations or serious limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (26) For more detailed information, please refer to the latest series of GRADE articles. (26)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

Question 1 (Initial Review)

Eligible articles assessing the effect of depression and/or anxiety screening on chronic disease outcomes included RCTs and observational studies that compared chronic disease outcomes between patients who underwent depression and/or anxiety screening and patients who did not undergo screening.

The database search yielded 6,267 citations published between January 1, 2002, and January 29, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

No articles met the eligibility criteria, and no unpublished studies were identified.

Studies were excluded because of population, intervention, study outcomes, lack of use of a validated screening tool, and study type.

Question 2 (Post-Hoc Review)

Eligible articles assessed the effect of a screen-and-treat strategy for depression on chronic disease outcomes in a chronic disease population. RCTs were included where all patients were screened for

depression using a validated instrument and then randomized to depression treatment or placebo/usual care. Since the intention behind the review was to determine whether management of depression could affect chronic disease outcomes in a chronic disease population, outcomes that could have been directly improved with management of depression (e.g., quality of life) were excluded from the analysis.

The revised database search yielded 1,588 citations published between January 1, 2007, and January 29, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

Seven studies (6 RCTs and 1 systematic review) met the inclusion criteria. The reference lists of the included studies and health technology assessment websites were hand searched to identify any additional potentially relevant studies, and 2 additional studies (RCTs) were included, for a total of 9 included citations.

The 2 additional studies came from the systematic review on depression management in a CAD population. These studies preceded the early cut-off date but were included because they were considered to be seminal studies in the area.

Studies were excluded because of population, setting, intervention, study outcomes, study type, lack of initial screening for depression, and treatment for chronic disease (not for depression).

The remainder of this report focuses on the findings of the post-hoc analysis. For each included study, the study design was identified and is summarized below in Table 2, which is a modified version of a hierarchy of study design by Goodman. (27)

Table 2: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	1
Large RCT[a]	5
Small RCT	3
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	9

Abbreviation: RCT, randomized controlled trial.
[a]Large RCT was defined as a trial with more than 100 patients.

Study Descriptions

One systematic review (28) and 8 primary studies (29-36) evaluated the impact of depression management on chronic disease outcomes.

The systematic review (28) evaluated the potential benefits of depression screening in patients with CAD. The authors assessed the accuracy of screening instruments and the effect of depression screening and treatment on cardiac outcomes.

Of the 8 primary studies, 1 was in a diabetes population, (29) 2 were in heart failure populations, (30;31) and 5 were in CAD populations. (32-36) Four of the studies explored changes in depression status, (30;31;35;36) and the other 4 evaluated the effect of depression management on chronic disease measures (including clinical measures and event rates). (29;32-34) Appendix 2 presents a full description of the included primary studies.

Study Results

Diabetes

One study evaluated the effect on glycemic control (HbA1c) of depression management using paroxetine. (29) Three months after commencing treatment, there was a significantly greater improvement in glycemic control in the treated group compared to the control group, but the difference between groups was not significant at 6 months (Table 3). The between-group difference at 3 months was not adjusted for baseline differences.

The authors also measured changes in depression status from baseline (using the Hospital Anxiety and Depression Scale [HADS]). Differences between the treatment and placebo groups at 3 and 6 months were not significant, suggesting that treatment with paroxetine was not better than placebo at improving depression status. (29)

Table 3: Diabetes and Depression Outcomes at Baseline, 3, and 6 Months

Follow-up Interval	Mean Difference, Placebo vs. Treatment (*P* value)	
	Glycemic Control, HbA1c	Depression Outcome, HADS score
Baseline	0.5 (0.17)	1.8 (0.33)
3 months	0.6 (0.02)	2.8 (0.07)
6 months	0.1 (0.70)	1.9 (0.35)

Abbreviations: HbA1c, hemoglobin A1c; HADS, Hospital Anxiety and Depression Scale.
Source: Paile-Hyvarinen et al, 2003(29).

For patients with diabetes and mild depression, medication management of depression did not significantly improve clinical measures of either diabetes or depression (quality of evidence: low).

Heart Failure

Two studies evaluated the safety and efficacy of depression management in patients with heart failure. One measured the safety and tolerability of citalopram using changes in cardiopulmonary performance and oxygen consumption. (31) The other used a composite measure of cardiac status[1] and evaluated change in status from baseline as well as reporting individual event rates for participants. (30) Both measured change in depression status using the Hamilton Rating Scale for Depression (HRSD).

Neither study was able to demonstrate that depression treatment had a significant effect on either heart failure or depression outcomes (Table 4). Both reported significant improvements in depression scores compared to baseline in both the treatment and control arms (suggestive of high placebo response rates).

Table 4: Heart Failure and Depression Outcomes

Study	Heart Failure Outcomes	Depression Outcome
Fraguas et al, 2009 (31)[a]	No difference between treatment and placebo arms at baseline or end of treatment in terms of cardiopulmonary performance on exercise test or peak oxygen consumption (*P* = NR)	HRSD scores improved for treatment (–9.7) and control (–9.2), but the between-group difference was not significant (*P* = 0.80) 68% of patients in the treatment arm and 56% of patients in the placebo arm were in remission; remission status did not differ between arms (*P* = 0.46)
O'Conner et al, 2010 (30)	Change in cardiac status did not differ between arms (*P* = 0.78) Cardiovascular events: • End of treatment (12 weeks) o All-cause mortality: treatment 7.7%, placebo 6.8% (*P* = 0.58) o Nonfatal cardiovascular event: treatment 20.1%, placebo 23.0% (*P* = 0.39) • Long-term follow-up (minimum 6 months) o All cause mortality: treatment 29.1%, placebo 26% (*P* = NR)	HRSD scores improved significantly for treatment (–7.1) and control (–6.8) (*P* < 0.001), but the between-group difference was not significant (*P* = 0.89)

Abbreviations: HRSD, Hamilton Rating Scale for Depression; NR, not reported.
[a]This was a safety study; heart failure outcomes were assessed to identify adverse events. (31)

Both studies offered some form of counselling support to the treatment and control arms, and both studies reported high placebo response rates, which may have been due to accompanying counselling or suggestive of tractable illness. Both studies included patients with mild depression; their depression may have not been severe enough to respond to pharmacotherapy, or their acute episode may have resolved more readily.

For patients with heart failure and depression (including mild depression), medication management of depression did not significantly improve clinical measures of heart failure or reduce mortality or morbidity rates (quality of evidence for hospitalization or death: moderate; quality of evidence for cardiopulmonary performance: low).

[1]Composite cardiovascular status measured as (30):

- worsened (any of): all-cause death, occurrence of a primary cardiovascular event, complications of cardiac medications or procedures, discontinuation of trial drugs for cardiovascular reasons, or increase (worsening) in New York Heart Association functional class
- improved: no worsening and at least 1 of improvement in New York Heart Association functional class or improvement in heart failure status based on Clinical Global Impression scale
- unchanged

Coronary Artery Disease

Systematic Review

Thombs et al (28) published a systematic review of depression screening and patient outcomes in a CAD population. Their objective was to evaluate the potential benefits of screening in patients with CAD by assessing the following:

- the accuracy of depression screening instruments
- the effect of depression screening on both depression and cardiac outcomes
- the effect of depression treatment on both depression and cardiac outcomes

The review did not report findings related to the sensitivity of depression screening instruments.

The authors identified 6 depression treatment trials in a CAD population, but no studies that evaluated the effects of depression screening on cardiac outcomes. They found that depression treatment with medication or cognitive behavioural therapy resulted in modest reductions in depressive symptoms (effect size 0.20–0.38; r^2 1%–4%), but there was no evidence that depression treatment improved cardiac outcomes. (28)

Primary Studies

Five studies evaluated the effect of depression management on CAD outcomes (Table 5).

Table 5: CAD Outcomes Reported in Primary Studies

Author, Year	LVEF	Composite Cardiac Outcome[a]	Death	MI	ECG
ENRICHD, 2003 (34)		X	X	X	
Glassman et al, 2002 (32)	X	X	X	X	
Honig et al, 2007 (35)					X
Lesperance et al, 2007 (36)		X		X	X
Van Melle et al, 2007 (33)		X			

Abbreviations: CAD, coronary artery disease; ECG, electrocardiogram; LVEF, left ventricular ejection fraction; MI, myocardial infarction.

[a]The ENRICHD study included a composite outcome measure of death or nonfatal MI; Glassman et al included a composite measure of death, MI, heart failure, stroke, and angina; Lesperance et al included a composite measure of serious adverse events, including MI, heart failure, worsening angina, stroke, and other CAD-related events; van Melle et al included a comparison of composite cardiac event rates, including cardiac death, recurrent MI, revascularization, heart failure, ischemia, and arrhythmia.

One study measured changes in left ventricular ejection fraction (LVEF) as the primary cardiac outcome. (32) After 16 weeks of treatment with sertraline or placebo, the authors reported no significant difference in either change in LVEF from baseline or the proportion of patients with an LVEF < 30% (*P* values not reported) (quality of evidence: moderate). (32)

Two studies measured changes in electrocardiogram (ECG) findings from baseline as the primary cardiac outcome. (35;36) Lesperance et al (36) evaluated the safety of citalopram versus placebo for patients with CAD and reported the change in ECG findings after 12 weeks of treatment. The authors included a number of measures of cardiac safety and reported no significant differences between the treatment and placebo groups (*P* values ranged from 0.15 to 0.80) (quality of evidence: low). Similarly, Honig et al, (35) in their evaluation of the safety of mirtazapine, included ECG safety measures and also reported no significant changes from baseline (*P* values not reported) (quality of evidence: low).

Four of the 5 studies (32-34;36) reported a composite measure of cardiac outcomes, but no 2 studies reported the same set of outcomes, precluding meta-analysis. Event rates varied based on differences in

definitions and follow-up intervals, but confidence intervals from the 4 studies overlapped. One study reported an odds ratio that was suggestive of an overall protective effect with depression treatment, (32) and 1 reported an odds ratio indicative of increased risk of adverse events with treatment. (33) The other 2 reported odds ratios of 1.0 for the composite outcomes. (34;36) Table 6 describes the composite outcome measures, follow-up intervals, and event rates from each study.

Table 6: Composite Cardiac Outcome Measures for CAD Patients Screened and Treated for Depression

Author, Year	Composite Measure	Follow-up	Event Rate, % (n)		Odds Ratio
			Treatment	Control	
ENRICHD, 2003 (34)	MI, death	18 months (minimum) 29 months (mean)	24.2 (1,238)	24.1 (1,243)	1.0 (0.9–1.2)
Glassman et al, 2002[a] (32)	MI, heart failure, stroke, angina, death	24 weeks	17.2 (186)	22.4 (183)	0.8 (0.5–1.2)
Lesperance et al, 2007[a] (36)	MI, heart failure, stroke, worsening angina, other CAD-related events	12 weeks	4.2 (142)	4.2 (142)	1.0 (0.3–3.2)
Van Melle et al, 2007[a] (33)	MI, heart failure, ischemia, arrhythmia, revascularization, cardiac death	18 months	13.8 (196)	12.7 (118)	1.1 (0.6–2.2)

Abbreviations: CAD, coronary artery disease; MI, myocardial infarction.
[a]Proportion with at least 1 event.

Data on MI rates were available for 3 studies and a total of 1,566 participants. (32;34;36) The results of the meta-analysis (Figure 1) suggest a protective effect of depression management, but the difference between groups was not significant (quality of evidence: moderate).

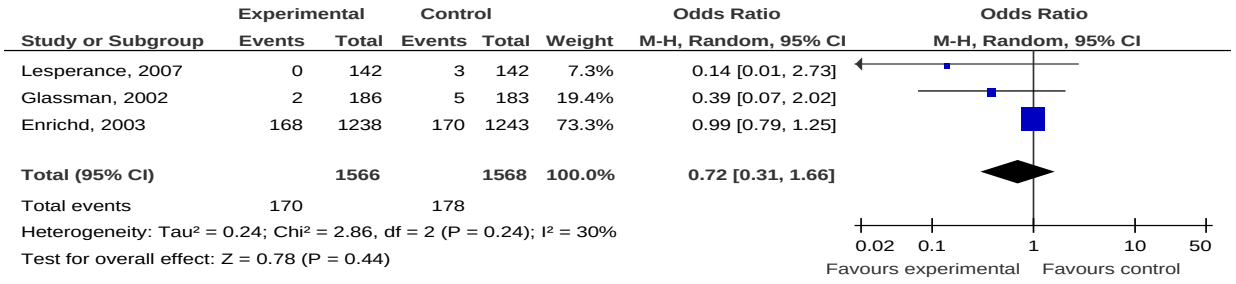

Figure 1: Myocardial Infarction Rates for Treatment Versus Placebo Arms

Abbreviations: CI, confidence interval; M-H, Mantel-Haenszel.

Data on mortality were available for 2 studies and a total of 1,424 participants. (32;34) The results of the meta-analysis (Figure 2) suggest a slight protective effect of depression management, but the difference between groups was not significant (quality of evidence: moderate).

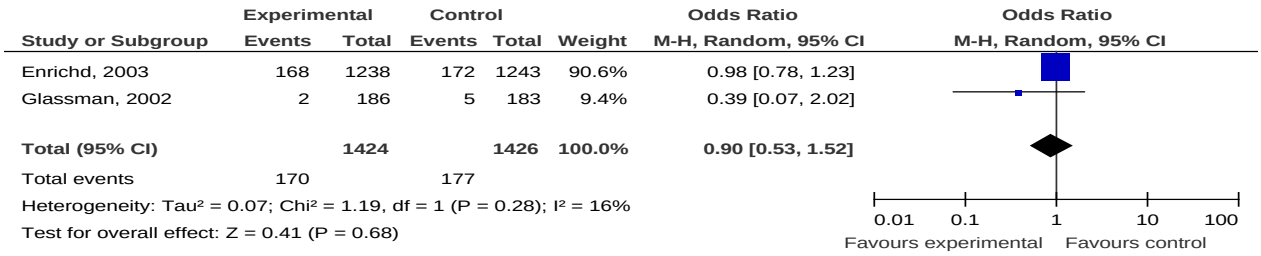

Figure 2: Mortality Rates for Treatment Versus Placebo Arms

Abbreviations: CI, confidence interval; M-H, Mantel-Haenszel.

For patients with CAD and depression (including mild depression), medication management of depression did not significantly affect clinical measures of cardiac status, MI rates, or mortality compared to placebo or usual care (quality of evidence: low to moderate).

Conclusions

Question 1 (Initial Review)

This systematic review did not identify any studies that investigated the effect of depression and/or anxiety screening on chronic disease outcomes in a chronic disease population.

Question 2 (Post-Hoc Review)

- For patients with diabetes and mild depression, medication management of depression did not significantly improve clinical measures (HbA1c) of diabetes; the quality of the evidence was low.
- For patients with heart failure and depression (including mild depression), medication management of depression did not significantly affect (improve or worsen) the following:
    - ECG findings; the quality of the evidence was low
    - cardiac event rates; the quality of the evidence was moderate
    - mortality; the quality of the evidence was moderate
- For patients with CAD and depression (including mild depression), medication management of depression did not significantly affect (improve or worsen) the following:
    - ECG findings; the quality of the evidence was low
    - the percentage of patients with reduced LVEF (< 30%); the quality of the evidence was moderate
- For patients with CAD and depression (including mild depression), medication management of depression appeared to have a potentially protective (although not statistically significant) effect on the following:
    - MI rates; the quality of evidence was moderate
    - mortality; the quality of evidence was moderate

Existing Guidelines for Depression Screening

Population	Organization, Year	Recommendations
Adults in primary care	Canadian Task Force on Preventive Health Care, 2005 (37)	• There is fair evidence to recommend screening adults in the general population for depression in primary care settings that have integrated programs for feedback to patients and access to case management or mental health care • There is insufficient evidence to recommend for or against screening adults in the general population for depression in primary care settings where effective follow-up and treatment are not available
Adults with diabetes	Canadian Diabetes Association, 2008 (38)	• Individuals with diabetes should be regularly screened for subclinical psychological distress and psychiatric disorders (e.g., depressive and anxiety disorders) by interview or with a standardized questionnaire • Patients diagnosed with depression, anxiety, or eating disorders should be referred to mental health professionals who are either part of the diabetes team or are in the community. Those diagnosed with depression should be offered treatment with CBT and/or antidepressant medication • Multidisciplinary team members with required expertise should offer CBT-based techniques, such as stress management strategies and coping skills training, family behaviour therapy, and case management to improve glycemic control and/or psychological outcomes in individuals with suboptimal self-care behaviours, suboptimal glycemic control and/or psychological distress
Adults with COPD	Global Initiative for Chronic Obstructive Lung Disease, 2007 (39)	• New COPD patients should have a detailed medical history including an "assessment of feelings of depression or anxiety"
Adults with stroke	American Heart Association/ American Stroke Association, 2005 (40)	*Assessment* • The Working Group recommends using a structured inventory to assess specific psychiatric symptoms and monitor symptom change over time *Treatment* • The Working Group strongly recommends that patients with a diagnosed depressive disorder be given a trial of antidepressant medication, if no contraindication exists; side effect profiles suggest that SSRIs may be favoured in this patient population. There is insufficient evidence to recommend for or against the use of individual psychotherapy alone in the treatment of post-stroke depression • Routine use of prophylactic antidepressants is not recommended in post-stroke rehabilitation • Recommend that mood disorders causing persistent distress or worsening disability be managed by, or with the advice of, an experienced clinical psychologist or psychiatrist
Adults with CAD or heart failure	American Heart Association, 2008 (41)	• Routine screening for depression in patients with CAD in various settings, including the hospital, physician's office, clinic, and cardiac rehabilitation centre • Patients with positive screening results should be evaluated by a professional qualified in the diagnosis and management of depression

Abbreviations: CAD, coronary artery disease; CBT, cognitive behavioural therapy; COPD, chronic obstructive pulmonary disease; SSRI, selective serotonin reuptake inhibitor.

Acknowledgements

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: January 29th, 2012
Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, OVID PsycINFO, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination

Limits: 2002-current; English; Human; NOT comments, editorials, letters, conference abstracts (Embase)

Database: Ovid MEDLINE(R) <1946 to January Week 3 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 27, 2012>, Embase <1980 to 2012 Week 04>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212075
2	exp Myocardial Infarction/ use mesz	133578
3	exp heart infarction/ use emez	216992
4	(coronary artery disease or cad or heart attack).ti.	44463
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149559
6	or/1-5	539975
7	exp Atrial Fibrillation/ use mesz	28093
8	exp heart atrium fibrillation/ use emez	55522
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73540
10	or/7-9	99451
11	exp heart failure/	300981
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234590
13	11 or 12	381953
14	exp Stroke/	178088
15	exp Ischemic Attack, Transient/ use mesz	16370
16	exp transient ischemic attack/ use emez	19680
17	exp stroke patient/ use emez	5637
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101006
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	281375
20	or/14-19	391798
21	exp Diabetes Mellitus, Type 2/ use mesz	68223
22	exp non insulin dependent diabetes mellitus/ use emez	101711
23	exp diabetic patient/ use emez	12920
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	765351
25	or/21-24	790292
26	exp Skin Ulcer/	72073
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28723
28	(decubitus or bedsore*).ti,ab.	8532
29	or/26-28	90816
30	exp Pulmonary Disease, Chronic Obstructive/ use mesz	17049
31	exp chronic obstructive lung disease/ use emez	54779

32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54491
33	(copd or coad).ti,ab.	45716
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37444
36	exp chronic bronchitis/ use emez	6985
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50848
38	or/30-37	159366
39	exp Chronic Disease/	340792
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	220217
41	39 or 40	506604
42	exp Comorbidity/	143585
43	(comorbid* or comorbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti.	36006
44	42 or 43	165120
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2731842
46	exp *Depression/ use mesz	35805
47	exp *Depressive Disorder/ use mesz	53384
48	exp *Depression/ use emez	135637
49	(depression* or depressive*).ti.	161961
50	exp *Anxiety/ use mesz	22426
51	exp *Anxiety Disorders/ use mesz	44663
52	exp *Anxiety/ or exp *Anxiety Disorder/ use emez	112134
53	anxiety.ti.	56051
54	or/46-53	388835
55	*Mass Screening/ use mesz	36995
56	exp *Psychological Tests/ use mesz	50572
57	exp *Psychiatric Status Rating Scales/ use mesz	7863
58	exp *Interview, Psychological/ use mesz	2348
59	*Severity of Illness Index/ use mesz	9347
60	*Diagnostic Self Evaluation/ use mesz	147
61	exp *Screening/ use emez	91617
62	exp *Psychologic Test/ use emez	40337
63	*Self Evaluation/ use emez	3049
64	((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	84893
65	case-finding.ti.	1646
66	or/55-65	318547
67	45 and 54 and 66	9461
68	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	127
69	67 or 68	9553
70	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use mesz	2912209
71	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5806576
72	or/70-71	5911444
73	69 not 72	8769
74	limit 73 to english language	7907
75	limit 74 to human	7706
76	limit 75 to humans	7706

77	from 74 keep 3919-4050	132
78	76 or 77	7838
79	limit 78 to yr="2002 - Current"	5896
80	remove duplicates from 79 Ovid MEDLINE(R) <1946 to January Week 3 2012> (2780) Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 27, 2012> (121) Embase <1980 to 2012 Week 04> (1098)	3999

Database: Ovid PsycINFO <2002 to January Week 4 2012>
Search Strategy:

#	Searches	Results
1	exp heart disorders/	5124
2	(coronary artery disease or cad or heart attack).ti.	233
3	((myocardi* or heart or cardiac or coronary) adj2 (atherosclerosis* or arteriosclerosis* or infarct*)).ti.	545
4	or/1-3	5197
5	"fibrillation (heart)"/	203
6	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	341
7	or/5-6	407
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	1410
9	cerebrovascular accidents/	7280
10	exp cerebral ischemia/	1853
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	11207
12	or/9-11	12555
13	diabetes mellitus/	1919
14	(diabetes or diabetic* or niddm or t2dm).ti,ab.	10497
15	or/13-14	10530
16	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).mp.	312
17	(decubitus or bedsore*).mp.	48
18	or/16-17	354
19	exp chronic obstructive pulmonary disease/	372
20	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	781
21	(copd or coad).ti,ab.	556
22	chronic airflow obstruction.ti,ab.	1
23	((chronic adj2 bronchitis) or emphysema).ti,ab.	128
24	or/19-23	1000
25	exp chronic illness/	10726
26	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	8934
27	or/25-26	16734
28	comorbidity/	12514
29	(comorbid* or comorbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti.	4442
30	or/28-29	13151
31	4 or 7 or 8 or 12 or 15 or 18 or 24 or 27 or 30	54577
32	exp "depression (emotion)"/	3561
33	(depression* or depressive*).ti.	30687
34	or/32-33	32592

35	exp anxiety/	18060
36	exp anxiety disorders/	26934
37	anxiety.ti.	13893
38	or/35-37	42510
39	exp screening/	8742
40	exp screening tests/	1707
41	exp psychological screening inventory/	16
42	exp psychological assessment/	14264
43	exp psychiatric evaluation/	2459
44	exp psychodiagnosis/	3503
45	exp psychodiagnostic interview/	588
46	self evaluation/	2247
47	((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).mp.	56141
48	case-finding.ti.	47
49	or/39-48	84741
50	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	30
51	(31 and (34 or 38) and 49) or 50	3131
52	limit 51 to (human and english language)	2880
	limit 52 to yr="2002 -Current"	
53		2877

PsycINFO 2002 to January Week 5 2012

#	Searches	Results
1	exp heart disorders/	5156
2	(coronary artery disease or cad or heart attack).ti.	234
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	546
4	or/1-3	5229
5	"fibrillation (heart)"/	208
6	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	344
7	or/5-6	413
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	1419
9	cerebrovascular accidents/	7321
10	exp cerebral ischemia/	1867
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	11269
12	or/9-11	12627
13	diabetes mellitus/	1920
14	(diabetes or diabetic* or niddm or t2dm).ti,ab.	10532
15	or/13-14	10565
16	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).mp.	313
17	(decubitus or bedsore*).mp.	48
18	or/16-17	355
19	exp chronic obstructive pulmonary disease/	373
20	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	782

21	(copd or coad).ti,ab.	556
22	chronic airflow obstruction.ti,ab.	1
23	((chronic adj2 bronchitis) or emphysema).ti,ab.	128
24	or/19-23	1001
25	exp chronic illness/	10757
26	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	8955
27	or/25-26	16783
28	comorbidity/	12556
29	(comorbid* or comorbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti.	4457
30	or/28-29	13198
31	4 or 7 or 8 or 12 or 15 or 18 or 24 or 27 or 30	54791
32	exp "depression (emotion)"/	3565
33	(depression* or depressive*).ti.	30769
34	or/32-33	32677
35	exp anxiety/	18097
36	exp anxiety disorders/	26977
37	anxiety.ti.	13914
38	or/35-37	42585
39	exp screening/	8771
40	exp screening tests/	1708
41	exp psychological screening inventory/	16
42	exp psychological assessment/	14316
43	exp psychiatric evaluation/	2470
44	exp psychodiagnosis/	3506
45	exp psychodiagnostic interview/	590
46	self evaluation/	2256
47	((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).mp.	56357
48	case-finding.ti.	47
49	or/39-48	85043
50	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	30
51	(31 and (34 or 38) and 49) or 50	3138
52	limit 51 to (human and english language)	2887
53	limit 52 to yr="2002 -Current"	2884

CINAHL

#	Query	Limiters/Expanders	Results
S54	S51 or S52	Limiters - Published Date from: 20020101-20121231; English Language; Exclude MEDLINE records; Human Search modes - Boolean/Phrase	343
S53	S51 or S52	Search modes - Boolean/Phrase	4354
S52	((((cardiovascular or cardio-vascular) N1 (care or disease*)) or heart disease*) N5 (depression* or depressive* or anxiety or anxieties) N5 (assessment* or detect* or diagnos* or inventor* or scale* or screen* or self-assessment* or test*))	Search modes - Boolean/Phrase	32

S51	S34 and S40 and S50	Search modes - Boolean/Phrase	4329
S50	S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49	Search modes - Boolean/Phrase	85757
S49	TI case-finding	Search modes - Boolean/Phrase	99
S48	((depression* OR depressive* OR anxiety OR anxieties) N2 (assessment* OR detect* OR diagnos* OR inventor* OR scale* OR screen* OR self-assessment* OR test*))	Search modes - Boolean/Phrase	21939
S47	(MH "Self Assessment")	Search modes - Boolean/Phrase	3943
S46	(MH "Severity of Illness Indices+")	Search modes - Boolean/Phrase	16574
S45	(MH "Hamilton Rating Scale for Depression") OR (MH "Self-Rating Anxiety Scale") OR (MH "Self-Rating Depression Scale")	Search modes - Boolean/Phrase	1281
S44	(MH "Neuropsychological Tests") OR (MH "Psychological Tests")	Search modes - Boolean/Phrase	44945
S43	(MH "Health Screening (Iowa NIC)")	Search modes - Boolean/Phrase	2
S42	(MH "Mental Health Care (Saba CCC)+")	Search modes - Boolean/Phrase	5
S41	(MH "Health Screening")	Search modes - Boolean/Phrase	14895
S40	S35 or S36 or S37 or S38 or S39	Search modes - Boolean/Phrase	57836
S39	TI anxiety	Search modes - Boolean/Phrase	5561
S38	(MH "Anxiety Disorders+")	Search modes - Boolean/Phrase	12833
S37	(MH "Anxiety+")	Search modes - Boolean/Phrase	12572
S36	TI depression* OR depressive*	Search modes - Boolean/Phrase	21304
S35	(MH "Depression+")	Search modes - Boolean/Phrase	36357
S34	S5 OR S8 OR S11 OR S15 OR S19 OR S22 OR S27 OR S30 OR S33	Search modes - Boolean/Phrase	221088
S33	S31 OR S32	Search modes - Boolean/Phrase	28945
S32	comorbid* OR comorbid* OR multimorbid* OR multi-morbid* OR (complex* N1 patient*) OR "patient* with multiple" OR (multiple N2 (condition* OR disease*))	Search modes - Boolean/Phrase	28945
S31	(MH "Comorbidity")	Search modes - Boolean/Phrase	16646
S30	S28 OR S29	Search modes - Boolean/Phrase	43734
S29	(chronic* N2 disease*) OR (chronic* N2 ill*)	Search modes - Boolean/Phrase	43734
S28	(MH "Chronic Disease")	Search modes - Boolean/Phrase	23647
S27	S23 OR S24 OR S25 OR S26	Search modes - Boolean/Phrase	8774
S26	chronic N2 bronchitis OR emphysema	Search modes - Boolean/Phrase	1820
S25	(MH "Emphysema")	Search modes - Boolean/Phrase	885
S24	chronic obstructive N2 disease* OR chronic obstructive N2 disorder* OR copd OR coad	Search modes - Boolean/Phrase	7349
S23	(MH "Pulmonary Disease, Chronic Obstructive+")	Search modes - Boolean/Phrase	5342
S22	S20 OR S21	Search modes - Boolean/Phrase	16179
S21	pressure N1 ulcer* OR bedsore* OR bed N1 sore* OR skin N1 ulcer* OR pressure N1 wound* OR decubitus	Search modes - Boolean/Phrase	9574
S20	(MH "Skin Ulcer+")	Search modes - Boolean/Phrase	14845
S19	S16 OR S17 OR S18	Search modes - Boolean/Phrase	70185
S18	diabetes OR diabetic* OR niddm OR t2dm	Search modes - Boolean/Phrase	70185
S17	(MH "Diabetic Patients")	Search modes - Boolean/Phrase	3536

S16	(MH "Diabetes Mellitus, Type 2")	Search modes - Boolean/Phrase	18233
S15	S12 OR S13 OR S14	Search modes - Boolean/Phrase	38210
S14	stroke OR tia OR transient ischemic attack OR cerebrovascular apoplexy OR cerebrovascular accident OR cerebrovascular infarct* OR brain infarct* OR CVA	Search modes - Boolean/Phrase	37713
S13	(MH "Cerebral Ischemia, Transient")	Search modes - Boolean/Phrase	1903
S12	(MH "Stroke") OR (MH "Stroke Patients")	Search modes - Boolean/Phrase	25676
S11	S9 OR S10	Search modes - Boolean/Phrase	18862
S10	myocardi* failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation OR cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	Search modes - Boolean/Phrase	18850
S9	(MH "Heart Failure+")	Search modes - Boolean/Phrase	14393
S8	S6 OR S7	Search modes - Boolean/Phrase	8072
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	Search modes - Boolean/Phrase	8072
S6	(MH "Atrial Fibrillation")	Search modes - Boolean/Phrase	6490
S5	S1 OR S2 OR S3 OR S4	Search modes - Boolean/Phrase	30133
S4	TI myocardi* N2 infarct* OR TI heart N2 infarct* OR TI cardiac N2 infarct* OR TI coronary N2 infarct* OR TI arterioscleros* OR TI atherosclerosis*	Search modes - Boolean/Phrase	9643
S3	coronary artery disease OR cad OR heart attack*	Search modes - Boolean/Phrase	7706
S2	(MH "Myocardial Infarction+")	Search modes - Boolean/Phrase	19219
S1	(MH "Coronary Arteriosclerosis")	Search modes - Boolean/Phrase	4646

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atherosclerosis* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669

#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	MeSH descriptor **Chronic Disease** explode all trees	9875
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR comorbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	68126
#27	MeSH descriptor **Depression** explode all trees	4309
#28	MeSH descriptor **Depressive Disorder** explode all trees	6395
#29	MeSH descriptor **Anxiety** explode all trees	4337
#30	MeSH descriptor **Anxiety Disorders** explode all trees	4159
#31	(depression* OR depressive*):ti or (anxiety):ti	15300
#32	(#27 OR #28 OR #29 OR #30 OR #31)	24777
#33	MeSH descriptor **Mass Screening** explode all trees	4120
#34	MeSH descriptor **Psychological Tests** explode all trees	9194
#35	MeSH descriptor **Psychiatric Status Rating Scales** explode all trees	7297
#36	MeSH descriptor **Interview, Psychological** explode all trees	459
#37	MeSH descriptor **Severity of Illness Index** explode all trees	11790
#38	MeSH descriptor **Diagnostic Self Evaluation** explode all trees	15
#39	(depression* OR depressive* OR anxiety OR anxieties) NEAR/2 (assessment* OR detect* OR diagnos* OR inventor* OR scale* OR screen* OR self-assessment* OR test*):ti or (case-finding):ti	486
#40	(#33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39)	30235
#41	(((cardiovascular OR cardio-vascular) NEXT (care OR disease*)) OR heart disease*) NEAR/5 (depression* OR depressive* OR anxiety OR anxieties) NEAR/2 (assessment* OR detect* OR diagnos* OR inventor* OR scale* OR screen* OR self-assessment* OR test*):ti	0
#42	(#26 AND #32 AND #40)	670
#43	(#26 AND #32 AND #40), from 2002 to 2012	439

Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	224
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225

5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	168
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	280
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	622
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1223
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	219
19	(copd or coad):TI	108
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	252
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR comorbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4656
28	MeSH DESCRIPTOR Depression EXPLODE ALL TREES	286
29	MeSH DESCRIPTOR Depressive Disorder EXPLODE ALL TREES	572
30	MeSH DESCRIPTOR Anxiety EXPLODE ALL TREES	134
31	MeSH DESCRIPTOR Anxiety Disorders EXPLODE ALL TREES	255
32	(depression* or depressive*):TI OR (anxiety):TI	869
33	#28 OR #29 OR #30 OR #31 OR #32	1290

34	MeSH DESCRIPTOR Mass Screening EXPLODE ALL TREES	1704
35	MeSH DESCRIPTOR Psychological Tests EXPLODE ALL TREES	139
36	MeSH DESCRIPTOR Psychiatric Status Rating Scales EXPLODE ALL TREES	171
37	MeSH DESCRIPTOR Interview, Psychological EXPLODE ALL TREES	15
38	MeSH DESCRIPTOR Severity of Illness Index EXPLODE ALL TREES	575
39	((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)):TI OR (case-finding):TI	34
40	#34 OR #35 OR #36 OR #37 OR #38 OR #39	2533
41	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)):TI	0
42	#27 AND #33 AND #40	13
43	#41 OR #42	13

Appendix 2: Study Descriptions

Table A1: Study Descriptions

Author, Year, Setting	Objective	Design	Population	Depression Screening	Treatment Period, Follow-up Period	Treatment, Control, n	Depression Measure	Chronic Disease Measures
Diabetes								
Paile-Hyvarinen et al, 2003 (29) Finland	To evaluate whether antidepressant drug therapy (paroxetine) improves metabolic control, quality of life, and mental health in patients (aged 50–70) with diabetes (and depression)	Single-blinded RCT; per-protocol analysis	Primary care population aged 50–70 years with type 2 diabetes, non-optimal glycemic control, and mild depression	HADS	6 months 6 months	Paroxetine (24) Placebo (24)	HADS	HbA1c
Heart Failure								
Fraguas et al, 2009 (31) Brazil	To evaluate the efficacy and safety of citalopram in elderly subjects with CHF and major depressive disorder	Double-blind placebo-controlled RCT; ITT analysis with LOCF	Patients aged 65+ with CHF and LVEF < 50% and with major depressive disorder (HRSD score 18+); onset of depression was post-cardiac symptoms	PRIME-MD	8 weeks 8 weeks	Citalopram (19) Placebo (18)	HRSD-17	Cardiopulmonary performance; maximum oxygen consumption
O'Conner et al, 2012 (30) United States	To evaluate the safety and efficacy of sertraline in patients with heart failure and depression	Double-blind placebo-controlled RCT; ITT analysis with LOCF	Patients aged 45 and older, LVEF ≤ 45%, NYHA class II–IV, and clinical depression	Psychiatric consultation using DSM criteria	12 weeks 6 months (minimum)	Sertraline (234) Placebo (235)	HRSD-17	Change in CAD status (worsened, improved, unchanged) and cardiac event rates
Coronary Artery Disease								
ENRICHD, 2003 (34) United States	To determine whether treating depression and increasing social support as soon as possible after acute MI reduces the risk of recurrent nonfatal MI and death	RCT (blind outcome assessment); ITT analysis with LOCF	Patients with an acute MI admitted to hospital and with clinical depression (and not receiving treatment); protocol changed in 1998 to include patients who were on antidepressants but still depressed	DISH (includes HRSD)	6 months 29 months (mean)	CBT with or without addition of pharmacotherapy (as needed) (1,238) Usual care (could also include pharmacotherapy) (1,243)	BDI, DISH (includes HRSD)	Recurrent MI or death from any cause and cardiac events (revascularization, CAD hospitalizations)

Glassman et al, 2002 (32) Multiple countries	To evaluate the efficacy of sertraline in patients diagnosed with major depression in the immediate period after hospitalization for MI or unstable angina	Double-blind placebo-controlled RCT; stratified by LVEF and depression score; ITT analysis with LOCF	Patients who were hospitalized for MI or unstable angina and had a current episode of major depression	BDI, HRSD	24 weeks 24 weeks	Sertraline (186) Placebo (183)	BDI, HRSD (up to 16 weeks), and CGI (up to 24 weeks)	LVEF and cardiac event rates (MI, stroke, severe angina, heart failure and, death)
Honig et al, 2007 (35) Netherlands	To evaluate the safety and efficacy of mirtazapine treatment for major or minor depression in patients post-MI	Nested RCT in MIND-IT study	Patients post-MI; included patients at least 3 months post-MI diagnosed with a post-MI depressive episode	BDI, CIDI	6 months 6 months	Mirtazapine (47) Placebo (44)	BDI, HRSD	Hospitalization rates, ECG findings
Lesperance et al, 2007 (36) Canada	To evaluate the short-term efficacy and tolerability of 2 depression treatments in patients with CAD: antidepressants and/or interpersonal psychotherapy	2x2 factorial design, parallel-group RCT (medication management was blinded and placebo-controlled); ITT analysis with LOCF	Patients aged 18+ with CAD (based on hospital chart) and current major depression	HRSD	12 weeks 12 weeks	Citalopram (142) Placebo (142)	BDI, HRSD	Cardiac events, ECG findings
Van Melle et al, 2007 (33) Netherlands	To evaluate whether active treatment for depression post-MI improves long-term depression status and cardiovascular prognosis	RCT; per-protocol analysis	Patients hospitalized with an MI and who had a depressive episode at least 3 months post-MI; included patients who were identified as having a current depressive episode on interview	BDI, CIDI	6 months 6 months	Any treatment modality (209) Care as usual; psychiatric treatment outside of study was recorded (122)	HRSD	Cardiac event (cardiac death, recurrent MI, revascularization, heart failure, ischemia, arrhythmia)

Abbreviations: BDI, Beck Depression Inventory; CAD, coronary artery disease; CBT, cognitive behavioural therapy; CGI, Clinical Global Impression; CHF, congestive heart failure; CIDI, Composite International Diagnostic Interview; DISH, Depression Interview and Structured Hamilton; DSM, *Diagnostic and Statistical Manual of Mental Disorders;* ECG, electrocardiogram; HADS, Hospital Anxiety and Depression Scale; HbA1c, hemoglobin A1c; HRSD, Hamilton Rating Scale for Depression; ITT, intention to treat; LOCF, last observation carried forward; LVEF, left ventricular ejection fraction; MI, myocardial infarction; NYHA, New York Heart Association; PRIME-MD, Primary Care Evaluation of Mental Disorders; RCT, randomized controlled trial.

Appendix 3: GRADE Tables

Table A2: GRADE Evidence Profile for Comparison of Depression Treatment and Usual Care/Placebo

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Diabetes: HbA1c							
1 (RCT)	Serious limitations (–1)[a]	Not applicable	No serious limitations	Serious limitations (–1)[b]	Undetected	None	⊕⊕ Low
Heart Failure: Hospitalization or Death							
1 (RCT)	No serious limitations	Not applicable	No serious limitations	Serious limitations (–1)[c]	Undetected	None	⊕⊕⊕ Moderate
Heart Failure: Cardiopulmonary Performance							
1 (RCT)	Serious limitations (–1)[d]	Not applicable	No serious limitations	Serious limitations (–1)[b]	Undetected	None	⊕⊕ Low
CAD: Nonfatal MI (Recurrent or MI Post-CAD Diagnosis)							
3 (RCTs)	No serious limitations	No serious limitations	No serious limitations	Serious limitations (–1)[e]	Undetected	None	⊕⊕⊕ Moderate
CAD: Death							
2 (RCTs)	No serious limitations	No serious limitations	No serious limitations	Serious limitations (–1)[e]	Undetected	None	⊕⊕⊕ Moderate
CAD: Change in LVEF							
1 (RCT)	Serious limitations (–1)[f]	Not applicable	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
CAD: Change in ECG Findings							
2 (RCTs)	Serious limitations (–1)[g]	Not applicable[g]	Serious limitations (–1)[h]	No serious limitations	Undetected	None	⊕⊕ Low

Abbreviations: CAD, coronary artery disease; ECG, electrocardiogram; HbA1c, hemoglobin A1c; LVEF, left ventricular ejection fraction; MI, myocardial infarction; No., number; RCT, randomized controlled trial.
[a]Authors completed a per-protocol analysis with unequal dropout rates (intervention 4%, control 36%).
[b]Study was underpowered based on authors' own power calculations.
[c]Authors reported a high placebo response rate, which reduced power to detect a difference.
[d]Authors completed a per-protocol analysis of patients who were originally randomized; because of a high placebo response rate during the washout period, a number of patients were excluded.
[e]Low event rates leading to wide confidence intervals and potentially reduced power.
[f]Authors conducted a per-protocol analysis for evaluation of LVEF.
[g]Study by Honig et al was assessing safety of treatment and did not report individual findings but rather stated that there were no significant changes.
[h]Both studies were assessing the safety of treatment and so used limited clinical measures to assess CAD outcomes.

Table A3: Risk of Bias Among Randomized Controlled Trials for the Comparison of Depression Treatment and Usual Care/Placebo

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
ENRICHD, 2003 (34)	No limitations	Unclear[a]	No limitations	No limitations	No limitations
Fraguas et al, 2009 (31)	Unclear[b]	No limitations	No limitations	No limitations	No limitations
Glassman et al, 2002 (32)	Unclear[b]	No limitations	No limitations	No limitations	No limitations
Honig et al, 2007 (35)	Unclear[b]	No limitations	No limitations	No limitations	No limitations
Lesperance et al, 2007 (36)	No limitations	No limitations	No limitations	No limitations	No limitations
O'Conner et al, 2010 (30)	Unclear[b]	No limitations	No limitations	No limitations	No limitations
Paile-Hyvarinen et al, 2003 (29)	No limitations	No limitations	Limitations[c]	No limitations	No limitations
Van Melle et al, 2007 (33)	No limitations	No limitations	Limitations[d]	No limitations	No limitations

[a]Intervention was cognitive behavioural therapy, so patients and providers could not be blinded to allocation. Authors indicated that outcome assessors were "blinded as much as possible," but did not clarify what was done to ensure blinding of outcome assessment.

[b]Not reported in paper.

[c]Authors completed a per-protocol analysis with unequal dropout rates (intervention 4%, control 36%).

[d]Authors completed a per protocol analysis, but dropout rates were low (intervention 6.2% [13/209], control 3.3% [4/122]).

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Abstract

Background

Self-management support interventions such as the Stanford Chronic Disease Self-Management Program (CDSMP) are becoming more widespread in attempt to help individuals better self-manage chronic disease.

Objective

To systematically assess the clinical effectiveness of self-management support interventions for persons with chronic diseases.

Data Sources

A literature search was performed on January 15, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database for studies published between January 1, 2000, and January 15, 2012. A January 1, 2000, start date was used because the concept of non–disease-specific/general chronic disease self-management was first published only in 1999. Reference lists were examined for any additional relevant studies not identified through the search.

Review Methods

Randomized controlled trials (RCTs) comparing self-management support interventions for general chronic disease against usual care were included for analysis. Results of RCTs were pooled using a random-effects model with standardized mean difference as the summary statistic.

Results

Ten primary RCTs met the inclusion criteria (n = 6,074). Nine of these evaluated the Stanford CDSMP across various populations; results, therefore, focus on the CDSMP.

- Health status outcomes: There was a small, statistically significant improvement in favour of CDSMP across most health status measures, including pain, disability, fatigue, depression, health distress, and self-rated health (GRADE quality low). There was no significant difference between modalities for dyspnea (GRADE quality very low). There was significant improvement in health-related quality of life according to the EuroQol 5-D in favour of CDSMP, but inconsistent findings across other quality-of-life measures.
- Healthy behaviour outcomes: There was a small, statistically significant improvement in favour of CDSMP across all healthy behaviours, including aerobic exercise, cognitive symptom management, and communication with health care professionals (GRADE quality low).
- Self-efficacy: There was a small, statistically significant improvement in self-efficacy in favour of CDSMP (GRADE quality low).

- Health care utilization outcomes: There were no statistically significant differences between modalities with respect to visits with general practitioners, visits to the emergency department, days in hospital, or hospitalizations (GRADE quality very low).
- All results were measured over the short term (median 6 months of follow-up).

Limitations

Trials generally did not appropriately report data according to intention-to-treat principles. Results therefore reflect "available case analyses," including only those participants whose outcome status was recorded. For this reason, there is high uncertainty around point estimates.

Conclusions

The Stanford CDSMP led to statistically significant, albeit clinically minimal, short-term improvements across a number of health status measures (including some measures of health-related quality of life), healthy behaviours, and self-efficacy compared to usual care. However, there was no evidence to suggest that the CDSMP improved health care utilization. More research is needed to explore longer-term outcomes, the impact of self-management on clinical outcomes, and to better identify responders and non-responders.

Plain Language Summary

Self-management support interventions are becoming more common as a structured way of helping patients learn to better manage their chronic disease. To assess the effects of these support interventions, we looked at the results of 10 studies involving a total of 6,074 people with various chronic diseases, such as arthritis and chronic pain, chronic respiratory diseases, depression, diabetes, heart disease, and stroke. Most trials focused on a program called the Stanford Chronic Disease Self-Management Program (CDSMP). When compared to usual care, the CDSMP led to modest, short-term improvements in pain, disability, fatigue, depression, health distress, self-rated health, and health-related quality of life, but it is not possible to say whether these changes were clinically important. The CDSMP also increased how often people undertook aerobic exercise, how often they practiced stress/pain reduction techniques, and how often they communicated with their health care practitioners. The CDSMP did not reduce the number of primary care doctor visits, emergency department visits, the number of days in hospital, or the number of times people were hospitalized. In general, there was high uncertainty around the quality of the evidence, and more research is needed to better understand the effect of self-management support on long-term outcomes and on important clinical outcomes, as well as to better identify who could benefit most from self-management support interventions like the CDSMP.

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CAD	Coronary artery disease
CDSMP	Chronic Disease Self-Management Program
CES-D	Center for Epidemiologic Studies–Depression
CHF	Congestive heart failure
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
EPP	Expert Patients Programme
EQ-5D	EuroQoL 5D
HAQ	Health Assessment Questionnaire
HIOH	Homing in on Health
HR-QOL	Health-related quality of life
ICD-9	*International Classification of Diseases,* 9th Edition
ITT	Intention-to-treat
IV	Instrumental variables
LHIN	Local Health Integration Network
OPSMN	Ontario Patient Self-Management Network
RCT	Randomized controlled trial
SD	Standard deviation
SMD	Standardized mean difference
WMD	Weighted mean difference

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

To systematically assess the clinical effectiveness of self-management support interventions for persons with chronic diseases.

Clinical Need and Target Population

Managing a chronic disease is a complex process that typically requires individuals to manage a number of health-related factors themselves; some diseases, such as diabetes, require near total self-care. As a result, patient programs have been developed to provide support to individuals with chronic diseases and help them self-manage their condition as effectively as possible. This support can be collectively viewed as "self-management support." With prevalence rates of chronic diseases expected to rise as Ontario's population ages, there is increasing need and demand for self-management support.

The target population of this review is adults (> 18 years of age) with chronic disease. While there are many self-management interventions that are developed for specific chronic diseases, this review focuses on interventions meant to support the self-management of chronic disease in general (i.e., interventions that are not disease-specific).

Technique

Self-Management Support

In simplest terms, *self-management* describes what a person does to manage his/her disease, and *self-management support* describes what health care professionals, health care practices, and the health care system provide to assist patients in their self-management. (1) In practice and in peer-reviewed literature, however, the term *self-management* is often used interchangeably with concepts such as self-care, patient education, patient empowerment, health coaching, motivational interviewing, integrated disease management, and others.

For the purpose of this review, *self-management support* is defined in accordance with the Institute of Medicine as "the systematic provision of education and supportive interventions by health care staff to increase patients' skills and confidence in managing their health problems, including regular assessment of progress and problems, goal setting, and problem-solving support." (2)

Not only does this definition highlight the fact that self-management support is more than just education, it also helps to illustrate the primary causal mechanism underlying many modern self-management support programs: that such programs lead primarily to changes in self-efficacy (i.e., an individual's confidence in managing his/her condition), and changes in health care behaviour are secondary. It is believed that changes in self-efficacy directly influence health status, which in turn affects health care utilization. (3)

The Stanford Chronic Disease Self-Management Program

The Stanford Chronic Disease Self-Management Program (CDSMP) is a community-based self-management support program first described by Lorig. (4) It is based on Bandura's self-efficacy theory, a social cognitive theory that states that successful behaviour change requires confidence in one's ability to carry out an action (i.e., self-efficacy) and the expectation that a specific goal will be achieved (i.e., outcome expectancy). The CDSMP incorporates strategies suggested by Bandura to enhance self-efficacy.

The content and methodology of the CDSMP was based on 2 needs assessments: a literature review of existing disease-specific patient education programs, and focus groups including participants aged 40 years or older with chronic disease. (4)

The exact methodology of the CDSMP differs depending on how it is implemented, but the program typically consists of 6 weekly sessions of 2½ hours each. Sessions involve groups of 10 to 15 participants and are often conducted in community settings such as churches, senior's centres, libraries, or hospitals. Sessions are led by 2 trained volunteer laypersons (typically with chronic diseases themselves) who act more as facilitators rather than as lecturers. Rather than prescribing specific behaviour changes, leaders assist participants in making their own disease management choices to reach self-selected goals. (4)

Topics covered in the CDSMP include exercise; use of cognitive symptom management (cognitive stress/pain reduction techniques such as positive thinking or progressive muscle relaxation); use of community resources; use of medications; dealing with emotions of fear, anger, and depression; communication with others, including health professionals; problem-solving; and decision-making. (4) Exact content, however, may vary depending on how the CDSMP is implemented or adapted. Modified versions of the CDSMP—such as the culturally tailored Hispanic Tomando Control de su Salud or an Internet-based version of the CDSMP—have been successfully implemented and evaluated in clinical trials. These modified programs may translate the material of the original CDSMP into different languages, or they may add, remove, or tailor specific components to facilitate implementation for a specified user base. Modifications, however, are typically minor.

Licensing and training are required in order for external organizations to implement the CDSMP. Licensing fees range from $500 (US) to $1500 (US) (depending on the number of participants and leaders). Training fees range from $900 (US) to $1600 (US) for on-site training, up to $16,000 (US) for off-site training.

Ontario Context

As of January 2010, there were 52 licences for the CDSMP in Ontario. Involvement at the local level through Local Health Integrated Networks (LHINs) has been variable, although most LHINs have identified self-management as a priority. In the Greater Toronto Area, the Ontario Patient Self-Management Network (OPSMN) helps to coordinate patient self-management activities and provides momentum for this approach to be more widely accepted in Ontario health care. The OPSMN is made up of various Toronto-based organizations, associations, and hospitals.

Evidence-Based Analysis

Research Question

What is the effectiveness of self-management support interventions for persons with chronic disease compared to usual care?

Research Methods

Literature Search

Search Strategy

A literature search was performed on January 15, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database for studies published between January 1, 2000, and January 15, 2012. A January 1, 2000, start date was used because the concept of non–disease-specific/general chronic disease self-management was refined and first published only in 1999. (4) Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

English language full-reports

- published between January 1, 2000, and January 15, 2012
- randomized controlled trials (RCTs), systematic reviews, and meta-analyses
- trial participants 18 years or older
- general chronic disease population (i.e., trial included a population of individuals with 1 or more of at least 3 different chronic diseases) (subjective determination)
- self-management intervention as defined by the Australian state government of Victoria's *Self-Management Mapping Guide*[1] (5)
- intervention performed on the patient
- control group given usual care (defined as care provided by the usual care provider)

Exclusion Criteria

- non-English studies
- non-primary reports

[1]Because of the challenges of defining *self-management support* for the purposes of systematic review, the intervention under evaluation had to meet specific criteria as outlined by the State Government of Victoria's *Self-Management Mapping Guide* to be included in this review. (5) Specifically, any intervention that promoted the development of 3 or more of the 5 skills described in Wagner's Chronic Care Model (problem solving, decision making, resource utilization, patient-provider relationship, and/or taking action) or 3 or more of the 5 client outcomes as described in the Flinders Model (know their condition and various treatment options, negotiate a plan of care, engage in activities that protect and promote health, monitor and manage the symptoms and signs of the condition(s), and manage the impact of the condition on physical functioning, emotions and interpersonal relationships) was considered a self-management support intervention.

Outcomes of Interest

- disease-specific outcomes
- health care utilization
- health-related quality of life
- health status measures
- mortality
- patient satisfaction
- self-efficacy

Statistical Analysis

Measures of Treatment Effect

All outcomes across included trials were obtained from validated self-report questionnaires. Because similar outcomes were often measured using different questionnaires, the standardized mean difference (SMD) of change from baseline was used as the preferred summary statistic.

To interpret the resulting SMDs in this report, one may follow Cohen's suggested convention that an SMD of 0.2 be interpreted as a small effect, an SMD of 0.5 as a medium effect, and an SMD of 0.8 as a large effect. (6) This approach has been suggested in a previous systematic review of self-management support interventions. (7) Still, such judgements may not be appropriate for self-report outcomes such as those reported in this review. Cohen's convention should therefore be viewed as a guidance rather than as a rule. To aid interpretation, SMDs were back-transformed to weighted mean differences (WMDs) where interpretation on the original scale would be easy or where minimally clinically important differences had been established.

Meta-Analyses

Meta-analyses were performed using Review Manager 5.1.7 (8) according to a random effects model. Intention-to-treat (ITT) data were used when available, but few reported results according to ITT principles. The majority instead reported "available case analyses," which included only participants whose outcome status was recorded. For this review, ITT analysis was taken to mean that participants were compared within the groups to which they were originally randomized, regardless of whether they received the treatment, withdrew, or deviated from the study protocol. (9)

When primary data for meta-analysis were not available from trial publications, they were obtained from a recent systematic review, (7) in which the authors contacted trial authors to obtain primary data or ITT data.

For meta-analyses involving the trial by Jerant et al, (10) the standard deviation of the difference in mean change from baseline between the self-management and control arms was calculated using a range of imputed correlation coefficients in a sensitivity analysis (0.5, 0.6, 0.7, 0.8, 0.9, and 0.95). Across all meta-analyses incorporating data from this trial, the summary SMD was not significantly impacted by varying the correlation coefficient. Reported base case analyses assumed a conservative correlation coefficient estimate of 0.5. Additional sensitivity analyses were conducted across each outcome by removing certain studies when justified (as indicated in Appendix 4). Removal of these studies rarely impacted the SMD. Six-month (rather than 12-month) data were used for this trial across meta-analyses to ensure consistency with other trials.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (11) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (11) For more detailed information, please refer to the latest series of GRADE articles. (11)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

The database search yielded 6,147 citations published between January 1, 2000, and January 15, 2012 (with duplicates removed). Articles were excluded based on information in the title and/or abstract (assessed simultaneously). The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded in the analysis.

Eighteen studies (9 primary RCTs and 9 secondary analyses of RCTs) (10;12-28) and 1 systematic review (7) met the inclusion criteria. The reference lists of the included studies and non-systematic reviews were hand-searched to identify any additional potentially relevant studies, and 1 additional citation (primary RCT) (4) was included, for a total of 20 included citations.

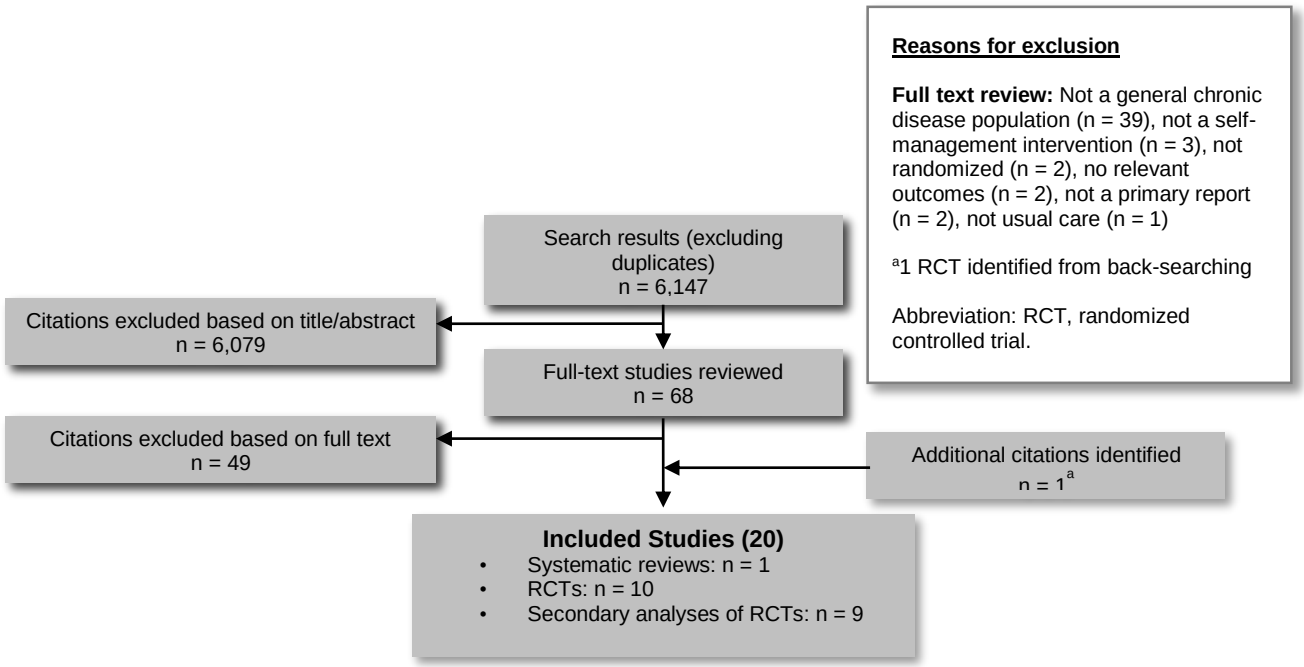

Figure 1: Citation Flow Chart

For each included study, the study design was identified and is summarized below in Table 1, which is a modified version of a hierarchy of study design by Goodman. (29)

Table 1: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	1
Large RCT	10[a]
Small RCT	
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	11[a]

Abbreviation: RCT, randomized controlled trial.
[a]Nine additional publications reported secondary analyses of the 10 primary RCTs.

One systematic review was identified for inclusion. The review, by Foster et al, (7) was published by the Cochrane Collaboration and evaluated self-management education programs by lay leaders for people with chronic conditions. It was published in 2009 but reported on publications dated up to July 28, 2006. It included studies of self-management programs in both disease-specific and general chronic disease populations, and thus its conclusions do not apply to this review, but some of the data were used for meta-analysis (see Statistical Analysis, above).

Study Descriptions

Ten primary RCTs were identified for inclusion, including a total of 6,074 people with chronic diseases. (4;10;12-19) Study design characteristics, participant characteristics, and intervention characteristics are summarized in the text below and fully described in Appendix 2 (Tables A1, A2, and A3).

Nine additional secondary analyses of the primary RCTs were also identified. (20-28) The results of these trials are described briefly.

Intervention

Nine of the 10 primary RCTs evaluated the Stanford CDSMP across various populations. (4;10;12;14-19) The remaining trial investigated the Making the Most of Your Healthcare intervention, a patient engagement intervention that met the definition of self-management support for this review. (13) This review will focus on papers investigating the Stanford CDSMP.

All trials, except for the original CDSMP trial by Lorig et al, (4) modified the original CDSMP to tailor the program to a specific user base. Six trials modified the CDSMP to account for cultural/language

differences, (12;15-19) 1 trial employed an Internet-based version of the CDSMP, (14) and 1 trial employed a home-based version of the CDSMP. (10)

Setting

Four of the 9 CDSMP trials were conducted in the United States, (4;10;14;15) 2 in the United Kingdom, (12;19) 1 in the Netherlands, (18) 1 in China, (17) and 1 in Australia. (16)

Recruitment

Seven of the 9 CDSMP trials recruited participants from the community via an advertising campaign employing flyers, newsletters, magazine ads, and other community outreach methods (i.e., patients therefore self-selected themselves for study). (4;10;12;14-17) Three studies recruited from primary care/outpatient clinics via direct invitation. (10;18;19)

Participants

The mean age of participants across all 9 CDSMP trials was 60.0 years. (4;10;12;14-19) Participants were largely female (mean 69.9%, number of studies [N] = 9), (4;10;12;14-19) married (mean 66.6%, N = 8), (4;10;12;14-17;19) and living with more than 1 chronic condition (mean number of conditions 2.07, N = 4). (4;15-17) Among the trials in a non-minority population that reported race, participants were largely white (mean 86.6%, N = 4). (4;10;12;14) Lastly, 2 trials reported that participants had more than 15 years of education, (4;14) and 3 trials reported that participants had fewer than 10 years of education. (12;16;17)

Chronic Conditions

Most trials specified a set number of defined conditions as eligible chronic diseases. Only 2 trials did not define eligible chronic diseases. (12;16) Six trials required physician-confirmed diagnosis of disease, (4;14-17;19), 2 trials required only patient-reported diagnosis, (10;12) and in 1 trial, disease confirmation was unclear. (18)

Results by Health Status Outcome

Across all health status outcomes but dyspnea, there was a statistically significant benefit in favour of self-management compared to usual care (see Appendices 3 and 4).

Pain

Data on change in pain from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A1). Meta-analysis showed a small statistically significant reduction in pain in favour of CDSMP (SMD, −0.11; 95% confidence interval [CI], −0.17, −0.04; $P = 0.001$). (4;12;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P = 0.001$). The GRADE score for this body of evidence was low.

Disability

Data on change in disability from baseline were available for 5 studies (Appendix 3 and Appendix 4, Figure A2). Meta-analysis showed a small statistically significant reduction in disability in favour of CDSMP (SMD, −0.14; 95% CI, −0.24, −0.05, $P = 0.004$). (4;10;14;17) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found no statistically significant difference between the CDSMP and usual care ($P = 0.43$), but the direction of benefit favoured CDSMP. The GRADE score for this body of evidence was low.

Fatigue

Data on change in fatigue from baseline were available for 6 studies (Appendix 3 and Appendix 4, Figure A3). Meta-analysis showed a small statistically significant reduction in fatigue in favour of CDSMP (SMD, −0.15; 95% CI, −0.22, −0.08; $P < 0.001$). (4;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P = 0.02$). The GRADE score for this body of evidence was low.

Dyspnea

Data on change in shortness of breath from baseline were available for 5 studies (Appendix 3 and Appendix 4, Figure A4). Meta-analysis showed a non-significant trend towards reduction in shortness of breath in favour of CDSMP (SMD, −0.10; 95% CI, −0.21, 0.01; $P = 0.08$). (4;14;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found no statistically significant difference between CDSMP and usual care ($P = 0.67$), but the direction of benefit favoured CDSMP. The GRADE score for this body of evidence was very low.

Depression

Data on change in depression from baseline were available for 6 studies (Appendix 3 and Appendix 4, Figure A5). Meta-analysis showed a small statistically significant reduction in depression in favour of CDSMP (SMD, −0.15; 95% CI, −0.28, −0.03; $P = 0.01$). (4;10;12;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found no statistically significant difference between CDSMP and usual care ($P = 0.42$), but the direction of benefit favoured CDSMP. The GRADE score for this body of evidence was low.

Health Distress

Data on change in health distress from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A6). Meta-analysis showed a small statistically significant reduction in health distress in favour of CDSMP (SMD, −0.20; 95% CI, −0.29, −0.12; $P < 0.001$). (4;12;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P = 0.04$). The GRADE score for this body of evidence was low.

Self-Rated Health

Data on change in self-rated health from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A7). Meta-analysis showed a small statistically significant reduction (lower is better) in self-rated health in favour of CDSMP (SMD, −0.24; 95% CI, −0.40, −0.07; $P = 0.006$). (4;12;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P < 0.001$). The GRADE score for this body of evidence was low.

Health-Related Quality of Life

Data on health-related quality of life were sparsely reported and difficult to interpret collectively.

Two studies showed no significant difference between CDSMP and usual care for mean change from baseline scores on the Physical Component Summary and Mental Component Summary ($P > 0.05$) of the SF-36 (GRADE score very low). (10;18)

One study found a significant benefit in mean change from baseline scores for the EuroQOL Visual Analogue Scale in favour of CDSMP ($P = 0.03$) (GRADE score low). (10)

Finally, 3 studies reported on change from baseline scores on the EuroQoL 5D (EQ-5D). (10;12;19) A meta-analysis including all 3 studies showed a non-significant trend towards benefit in favour of CDSMP

(SMD, 0.13; 95% CI, −0.05, 0.30; $P = 0.15$) (GRADE score very low) (Appendix 3 and Appendix 4, Figure A8); however, sensitivity analysis removing the study by Griffiths et al (conducted in a minority Bangladeshi population for which the EQ-5D may not apply) (19) revealed a statistically significant benefit in favour of CDSMP (SMD, 0.22; 95% CI, 0.09, 0.35; $P = 0.001$ / WMD, 0.05; 95% CI, 0.00, 0.10; $P = 0.04$) (GRADE score moderate).

Evaluating the evidence of EQ-5D separately should also be considered, since inclusion of the study by Jerant et al (10) in the meta-analysis required imputation. This study found no significant difference between home-based CDSMP and usual care ($P > 0.05$) (GRADE score very low), whereas the study by Kennedy et al, (12) a large pragmatic RCT conducted in the United Kingdom, found a significant benefit in favour of a culturally adapted group-based CDSMP compared to usual care (SMD, 0.24; 95% CI, 0.08, 0.40; $P = 0.003$ / WMD, 0.08; 95% CI, 0.03, 0.13; $P = 0.003$) (GRADE score moderate). Minimally important differences of 0.10 and 0.07 have been suggested for United Kingdom–based and United States–based EQ-5D scores, respectively, for individuals with cancer. (30)

Results by Healthy Behaviour Outcome

Aerobic Exercise

Data on change in aerobic exercise from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A9). Meta-analysis showed a small statistically significant increase in aerobic exercise in favour of CDSMP (SMD, 0.16; 95% CI, 0.09, 0.23; $P < 0.001$). (4;12;14;15;17) Two trials were not included in the meta-analysis. The first trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P = 0.005$). The second trial, by Elzen et al, (18) found no significant difference between CDSMP and usual care ($P = 0.47$). The GRADE score for this body of evidence was low.

Cognitive Symptom Management

Data on change in cognitive symptom management from baseline were available for 5 studies (Appendix 3 and Appendix 4, Figure A10). Meta-analysis showed a small statistically significant increase in cognitive symptom management (higher is better) in favour of CDSMP (SMD, 0.34; 95% CI, 0.20, 0.47; $P < 0.001$). (4;17;19) Two trials were not included in the meta-analysis. The first trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P < 0.001$). The second trial, by Elzen et al, (18) found no significant difference between CDSMP and usual care ($P = 0.14$). The GRADE score for this body of evidence was low.

Communication With Health Care Professionals

Data on change in communication from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A11). Meta-analysis showed a small statistically significant increase in communication (higher is better) in favour of CDSMP (SMD, 0.11; 95% CI, 0.02, 0.21; $P = 0.02$). (4;12;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Elzen et al, (18) found no significant difference between CDSMP and usual care ($P = 0.48$). The GRADE score for this body of evidence was low.

Results on Self-Efficacy

Data on change in self-efficacy from baseline were available for 8 studies (Appendix 3 and Appendix 4, Figure A12). Meta-analysis showed a small statistically significant increase in self-efficacy (higher is better) in favour of CDSMP (SMD, 0.25; 95% CI, 0.12, 0.39; $P = 0.002$). (10;12;14;15;17;19) Two trials were not included in the meta-analysis. The first trial, by Swerissen et al, (16) found a statistically significant benefit in favour of CDSMP ($P < 0.001$). The second trial, by Elzen et al, (18) found no significant difference between CDSMP and usual care ($P = 0.06$). The GRADE score for this body of evidence was low.

Results by Health Care Utilization Outcome

Visits With General Practitioners

Data on change in general practitioner visits from baseline were available for 7 studies (Appendix 3 and Appendix 4, Figure A13). Meta-analysis showed no significant difference between the CDSMP and usual care (SMD, −0.03; 95% CI, −0.09, 0.04; *P* = 0.41). (4;12;14;15;17;19) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found no significant difference between CDSMP and usual care (*P* = 0.24). The GRADE score for this body of evidence was very low.

Visits to the Emergency Department

Data on change in emergency department visits from baseline were available for 5 studies (Appendix 3 and Appendix 4, Figure A14). Meta-analysis showed no significant difference between the CDSMP and usual care (SMD, −0.05; 95% CI, −0.18, 0.09; *P* = 0.49). (4;14;15;17) One trial was not included in the meta-analysis; this trial, by Swerissen et al, (16) found no significant difference between the CDSMP and usual care (*P* = 0.68). The GRADE score for this body of evidence was very low.

Days in Hospital

Data on change in days in hospital from baseline were available for 5 studies (Appendix 3 and Appendix 4, Figure A15). Meta-analysis showed no significant difference between the CDSMP and usual care (SMD, −0.06; 95% CI, −0.13, 0.02; *P* = 0.14 / WMD, −0.27; 95% CI, −0.75, 0.20; *P* = 0.26). (4;12;14;15;17) However, sensitivity analyses removing the Internet-based CDSMP study by Lorig et al (14) revealed a minor statistically significant reduction in favour of CDSMP for the SMD (SMD, −0.09; 95% CI, −0.16, −0.01; *P* = 0.02), but not for the WMD (WMD, −0.42; 95% CI, −0.97, 0.13; *P* = 0.14). The GRADE score for this body of evidence was very low.

Hospitalizations

Data on change in hospitalizations visits from baseline were available for 3 studies (Appendix 3 and Appendix 4, Figure A16). Meta-analysis showed no significant difference between the CDSMP and usual care (SMD, −0.09; 95% CI, −0.24, 0.05; *P* = 0.20). (4;17) One trial was not included in the meta-analysis; this trial, by Jerant et al, (10) found no significant difference between CDSMP and usual care (*P* = NR). The GRADE score for this body of evidence was very low.

Secondary Analyses (Who Benefits From Self-Management?)

Nine studies conducted secondary analyses of the data from several of the primary RCTs. (20-28) Many of these studies attempted to identify moderators or predictors of response to the CDSMP. In general, analyses were not identified *a priori*, no adjustments were made for multiple comparisons, and results were inconsistent across studies and varied according by outcome. The data were therefore difficult to interpret and should be viewed as hypothesis-generating only. Future trials that prospectively stratify patients based on hypothesized predictors of response should be conducted to better confirm these findings.

Conclusions

- Low quality evidence showed that the Stanford CDSMP led to statistically significant, albeit clinically minimal, short-term (median 6 months) improvements across a number of health status measures, in healthy behaviours, and self-efficacy compared to usual care.
- Very low quality evidence showed no significant difference between the CDSMP and usual care in short-term (median 6 months) health care utilization and across some health-related quality of life scales.
- Moderate quality evidence showed that the CDSMP led to statistically significant, albeit clinically minimal, short-term (median 6 months) improvement in EQ-5D score compared to usual care.
- More research is needed to explore the long-term (12 months and greater) effect of self-management across outcomes and to explore the impact of self-management on clinical outcomes.
- Exploratory evidence suggests that some subgroups of persons with chronic conditions may respond better to the CDSMP; however, there is considerable uncertainty, and more research is needed to better identify responders and non-responders.

Acknowledgements

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
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Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
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Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: January 15th, 2012
Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination.

Limits: 2000-present; English; NOT comments, editorials, letters, conference abstracts (Embase); MA/SR/HTA filter

Database: Ovid MEDLINE(R) <1946 to January Week 1 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 13, 2012>, Embase <1980 to 2012 Week 02>
Search Strategy:

Search run 2012Jan15

#	Searches	Results
1	exp Coronary Artery Disease/	211560
2	exp Myocardial Infarction/ use mesz	133322
3	exp heart infarction/ use emez	216531
4	(coronary artery disease or cad or heart attack).ti.	44367
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149359
6	or/1-5	538869
7	exp Atrial Fibrillation/ use mesz	27983
8	exp heart atrium fibrillation/ use emez	55357
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73222
10	or/7-9	99066
11	exp heart failure/	300018
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	233907
13	11 or 12	380815
14	exp Stroke/	177469
15	exp Ischemic Attack, Transient/ use mesz	16352
16	exp transient ischemic attack/ use emez	19630
17	exp stroke patient/ use emez	5626
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	100838
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	280281
20	or/14-19	390464
21	exp Diabetes Mellitus, Type 2/ use mesz	67951
22	exp non insulin dependent diabetes mellitus/ use emez	101327
23	exp diabetic patient/ use emez	12828
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	763121
25	or/21-24	787988
26	exp Skin Ulcer/	71910
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28604

28	(decubitus or bedsore*).ti,ab.	8513
29	or/26-28	90561
30	exp Pulmonary Disease, Chronic Obstructive/ use mesz	16974
31	exp chronic obstructive lung disease/ use emez	54556
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54256
33	(copd or coad).ti,ab.	45380
34	chronic airflow obstruction.ti,ab.	1062
35	exp Emphysema/	37368
36	exp chronic bronchitis/ use emez	6962
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50761
38	or/30-37	158839
39	exp Chronic Disease/	340238
40	(chronic*adj2 disease* or (chronic* adj2 ill*)).ti,ab.	32284
41	39 or 40	358737
42	exp Comorbidity/	143035
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	202574
44	42 or 43	283057
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2703456
46	exp Self Care/ use mesz	33960
47	Self-Help Groups/ use mesz	7150
48	exp Consumer Participation/ use mesz	27930
49	Self Efficacy/ use mesz	9213
50	exp Self Care/ use emez	39454
51	Self Concept/ use emez	49189
52	Self Injection/ use emez	709
53	Self Monitoring/ use emez	2895
54	Patient Participation/ use emez	13365
55	Empowerment/ use emez	1619
56	(selfadminist* or selfcar* or selfinject* or selfmanag* or selfmeasur* or selfmedicat* or selfmonitor* or selfregulat* or selftest* or selftreat*).ti,ab.	1197
57	(self-administ* or self-car* or self-inject* or self-manag* or self-measur* or self-medicat* or self-monitor* or self-regulat* or self-test*OR self-treat*).ti,ab.	106600
58	(selfactivation or selfdevelop* or selfintervention).ti,ab.	11
59	(self-activation or self-develop* or self-intervention).ti,ab.	1876
60	((patient? or consumer?) adj3 (activation or coach* or empowerment or involv* or participat*)).ti,ab.	115250
61	health coach*.ti,ab.	200
62	((behaviour* adj (coach* or modif*)) or (behavior* adj (coach* or modif*))).ti,ab.	6962
63	(dsmp or cdsmp or dsme or smp or sme or smt).ti,ab.	5738
64	(medication? adherence adj5 self*).ti,ab.	497
65	or/46-64	375121
66	45 and 65	56078
67	exp Technology Assessment, Biomedical/ or exp Evidence-based Medicine/ use mesz	63340

68	exp Biomedical Technology Assessment/ or exp Evidence Based Medicine/ use emez	522432
69	(health technology adj2 assess*).ti,ab.	3053
70	exp Random Allocation/ or exp Double-Blind Method/ or exp Control Groups/ or exp Placebos/ use mesz	378960
71	Randomized Controlled Trial/ or exp Randomization/ or exp RANDOM SAMPLE/ or Double Blind Procedure/ or exp Triple Blind Procedure/ or exp Control Group/ or exp PLACEBO/ use emez	900130
72	(random* or RCT).ti,ab.	1252730
73	(placebo* or sham*).ti,ab.	413329
74	(control* adj2 clinical trial*).ti,ab.	35016
75	meta analysis/ use emez	58505
76	(meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab.	251967
77	or/67-76	2160203
78	limit 66 to (controlled clinical trial or meta analysis or randomized controlled trial)	6134
79	66 and 77	12038
80	or/78-79	12410
81	limit 80 to yr="2000 -Current"	10499
82	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use mesz	2907283
83	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5789547
84	or/82-83	5893868
85	81 not 84	9453
86	limit 85 to english language Ovid MEDLINE(R) <1946 to January Week 1 2012> (3625) Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 13, 2012> (193) Embase <1980 to 2012 Week 02> (5011)	8829

CINAHLSearch run 2012Jan15

#	Query	Limiters/Expanders	Results
S53	S34 and S48 and S51	Limiters - Published Date from: 20000101-20121231; English Language; Exclude MEDLINE records Search modes - Boolean/Phrase	296
S52	S34 and S48 and S51	Search modes - Boolean/Phrase	1889
S51	S49 or S50	Search modes - Boolean/Phrase	156231
S50	random* or sham*or rct* or health technology N2 assess* or meta analy* or metaanaly* or pooled analysis or (systematic* N2 review*) or published studies or medline or embase or data synthesis or data extraction or cochrane or control* N2 clinical trial*	Search modes - Boolean/Phrase	148184
S49	(MH "Random Assignment") or (MH "Random Sample+") or (MH "Meta Analysis") or (MH "Systematic Review") or (MH "Double-Blind Studies") or (MH "Single-Blind Studies") or (MH "Triple-Blind Studies") or (MH "Placebos") or (MH "Control (Research)")	Search modes - Boolean/Phrase	82924
S48	S35 or S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47	Search modes - Boolean/Phrase	60430
S47	medication? adherence N5 self*	Search modes - Boolean/Phrase	39
S46	dsmp OR cdsmp OR dsme OR smp OR sme OR smt	Search modes - Boolean/Phrase	278
S45	(behaviour* N1 (coach* OR modif*)) OR (behavior* N1 (coach* OR modif*))	Search modes - Boolean/Phrase	1893
S44	health coach*	Search modes - Boolean/Phrase	171
S43	(patient? OR consumer?) N3 (activation OR coach* OR empowerment OR involv* OR participat*)	Search modes - Boolean/Phrase	8663
S42	self-activation OR self-develop* OR self-intervention	Search modes - Boolean/Phrase	231
S41	selfactivation OR selfdevelop* OR selfintervention	Search modes - Boolean/Phrase	2
S40	self-administ* OR self-car* OR self-inject* OR self-manag* OR self-measur* OR self-medicat* OR self-monitor* OR self-regulat* OR self-test*OR self-treat*	Search modes - Boolean/Phrase	30327
S39	selfadminist* OR selfcar* OR selfinject* OR selfmanag* OR selfmeasur* OR selfmedicat* OR selfmonitor* OR selfregulat* OR selftest* OR selftreat*	Search modes - Boolean/Phrase	184
S38	(MH "Self-Actualization") OR (MH "Self-Efficacy")	Search modes - Boolean/Phrase	6981
S37	(MH "Consumer Participation")	Search modes - Boolean/Phrase	8416
S36	(MH "Support Groups")	Search modes - Boolean/Phrase	5563
S35	(MH "Self Care+")	Search modes - Boolean/Phrase	19424
S34	S5 OR S8 OR S11 OR S15 OR S19 OR S22 OR S27 OR S30 OR S33	Search modes - Boolean/Phrase	213351
S33	S31 OR S32	Search modes - Boolean/Phrase	28632
S32	comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* N1 patient*) or "patient* with multiple" or (multiple N2 (condition* or disease*))	Search modes - Boolean/Phrase	28632
S31	MH "Comorbidity"	Search modes - Boolean/Phrase	16495
S30	S28 OR S29	Search modes - Boolean/Phrase	28085
S29	chronic*N2 disease* OR chronic* N2 ill*	Search modes - Boolean/Phrase	7551
S28	MH "Chronic Disease"	Search modes - Boolean/Phrase	23522
S27	S23 OR S24 OR S25 OR S26	Search modes - Boolean/Phrase	8672
S26	chronic N2 bronchitis OR emphysema	Search modes - Boolean/Phrase	1803
S25	MH "Emphysema"	Search modes - Boolean/Phrase	879
S24	chronic obstructive N2 disease* OR chronic obstructive N2 disorder* OR copd OR coad	Search modes - Boolean/Phrase	7262
S23	MH "Pulmonary Disease, Chronic Obstructive+"	Search modes - Boolean/Phrase	5272
S22	S20 OR S21	Search modes - Boolean/Phrase	16060
S21	pressure N1 ulcer* OR bedsore* OR bed N1 sore* OR skin N1 ulcer* OR pressure N1 wound* OR decubitus	Search modes - Boolean/Phrase	9508

S20	MH "Skin Ulcer+"	Search modes - Boolean/Phrase	14728
S19	S16 OR S17 OR S18	Search modes - Boolean/Phrase	69574
S18	diabetes OR diabetic* OR niddm OR t2dm	Search modes - Boolean/Phrase	69574
S17	MH "Diabetic Patients"	Search modes - Boolean/Phrase	3491
S16	MH "Diabetes Mellitus, Non-Insulin-Dependent"	Search modes - Boolean/Phrase	18090
S15	S12 OR S13 OR S14	Search modes - Boolean/Phrase	38043
S14	stroke OR tia OR transient ischemic attack OR cerebrovascular apoplexy OR cerebrovascular accident OR cerebrovascular infarct* OR brain infarct* OR CVA	Search modes - Boolean/Phrase	37551
S13	MH "Cerebral Ischemia, Transient"	Search modes - Boolean/Phrase	1892
S12	(MH "Stroke") OR (MH "Stroke Patients")	Search modes - Boolean/Phrase	25516
S11	S9 OR S10	Search modes - Boolean/Phrase	19135
S10	myocardi* failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation OR cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	Search modes - Boolean/Phrase	19123
S9	MH "Heart Failure+"	Search modes - Boolean/Phrase	14335
S8	S6 OR S7	Search modes - Boolean/Phrase	7966
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	Search modes - Boolean/Phrase	7966
S6	MH "Atrial Fibrillation"	Search modes - Boolean/Phrase	6441
S5	S1 OR S2 OR S3 OR S4	Search modes - Boolean/Phrase	30356
S4	TI myocardi* N2 infarct* OR TI heart N2 infarct* OR TI cardiac N2 infarct* OR TI coronary N2 infarct* OR TI arterioscleros* OR TI atheroscleros*	Search modes - Boolean/Phrase	9573
S3	coronary artery disease OR cad OR heart attack*	Search modes - Boolean/Phrase	7885
S2	MH "Myocardial Infarction+"	Search modes - Boolean/Phrase	19390
S1	MH "Coronary Arteriosclerosis"	Search modes - Boolean/Phrase	4639

Wiley Cochrane
Search run 2012Jan15
Avoidable Hospitalization - Self-Management: KC

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2104
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7637
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8384
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2056
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2268
#6	MeSH descriptor **Heart Failure** explode all trees	4620
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5180
#8	MeSH descriptor **Stroke** explode all trees	3791
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	459
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9821
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6799
#12	(diabetes or diabetic* or niddm or t2dm):ti	16337
#13	MeSH descriptor **Skin Ulcer** explode all trees	1555
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	662
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1714
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2397
#18	(copd or coad):ti	3303
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	90
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1180
#22	MeSH descriptor **Chronic Disease** explode all trees	9770
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1643
#24	MeSH descriptor **Comorbidity** explode all trees	1902
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	638
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	67251
#27	MeSH descriptor **Self Care** explode all trees	2973
#28	MeSH descriptor **Self-Help Groups**, this term only	495
#29	MeSH descriptor **Consumer Participation** explode all trees	840
#30	MeSH descriptor **Self Efficacy** explode all trees	1136
#31	(selfadminist* OR selfcar* OR selfinject* OR selfmanag* OR selfmeasur* OR selfmedicat* OR selfmonitor* OR selfregulat* OR selftest* OR selftreat*):ti or (self-administ* OR self-car* OR self-inject* OR self-manag* OR self-measur* OR self-medicat* OR self-monitor* OR self-regulat* OR self-test*OR self-treat*):ti or (selfactivation OR selfdevelop* OR selfintervention):ti or (self-activation OR self-develop* OR self-intervention):ti or (patient? OR consumer?) NEAR/3 (activation OR coach* OR empowerment OR involv* OR participat*):ti	2031

#32	(health coach*):ti or (behaviour* NEXT (coach* OR modif*)) OR (behavior* NEXT (coach* OR modif*)):ti or (dsmp OR cdsmp OR dsme OR smp OR sme OR smt):ti or (medication? adherence NEAR/5 self*):ti	186
#33	(#27 OR #28 OR #29 OR #30 OR #31 OR #32)	6380
#34	(#26 AND #33)	1381
#35	(#26 AND #33), from 2000 to 2012	1155

Centre for Reviews and Dissemination

Search run 2012Jan15

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	211
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	223
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	167
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	279
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	621
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1220
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	218
19	(copd or coad):TI	107
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	(chronic*adj2 disease* or (chronic* adj2 ill*)):TI	21
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22

27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4571
28	MeSH DESCRIPTOR Self Care EXPLODE ALL TREES	326
29	MeSH DESCRIPTOR Self-Help Groups	57
30	MeSH DESCRIPTOR Consumer Participation EXPLODE ALL TREES	76
31	MeSH DESCRIPTOR Self Efficacy	25
32	(selfadminist* OR selfcar* OR selfinject* OR selfmanag* OR selfmeasur* OR selfmedicat* OR selfmonitor* OR selfregulat* OR selftest* OR selftreat*):TI OR (self-administ* OR self-car* OR self-inject* OR self-manag* OR self-measur* OR self-medicat* OR self-monitor* OR self-regulat* OR self-test*OR self-treat*):TI OR (selfactivation OR selfdevelop* OR selfintervention):TI OR (self-activation OR self-develop* OR self-intervention):TI OR ((patient? OR consumer?) ADJ3 (activation OR coach* OR empowerment OR involv* OR participat*)):TI	26
33	(health coach*):TI OR ((behaviour* ADJ1 (coach* OR modif*)) OR (behavior* ADJ1 (coach* OR modif*))):TI OR (dsmp OR cdsmp OR dsme OR smp OR sme OR smt):TI OR (medication? adherence ADJ5 self*):TI	2
34	#28 OR #29 OR #30 OR #31 OR #32 OR #33	468
35	#27 AND #34	155
36	#27 AND #34 FROM 2000 TO 2012	146

Appendix 2: Study and Patient Characteristics

Table A1: Study Design Characteristics

Study, Year	Country	Design	Arms, n	Attrition, %	Recruitment	Length of Follow-up	Patient Eligibility Criteria	Control
Lorig et al, 1999 (4)	United States	Single-blind RCT	*Randomized* Total: 1,140 SM: 664 UC: 476 *Completed* Total: 952 SM: 561 UC: 391	15.1 SM 17.9 UC	• Self-selection • Community • Public service announcements, flyers, posters, newsletters, and referrals from government employers	6 months	*Chronic diseases*: physician-confirmed asthma, CAD, CHF, chronic arthritis, chronic bronchitis, emphysema, or stroke *Inclusion criteria*: 1 or more of above chronic diseases *Exclusion criteria*: compromised mentation; received chemotherapy or radiation within past year for cancer; < 40 years age	Waiting-list control
Fu et al, 2003 (17)	China	Single-blind RCT	*Randomized* Total: 954 SM: 526 UC: 428 *Completed* Total: 779 SM: 430 UC: 349	18.3 SM 18.5 UC	• Self-selection • Community • Public service announcements, flyers, posters, interpersonal persuasion	6 months	*Chronic diseases:* medical record-confirmed arthritis, asthma, CAD, CHF, chronic bronchitis, diabetes, emphysema, hypertension, or stroke *Inclusion criteria:* 1 or more of above chronic diseases; ≥ 20 years age *Exclusion criteria:* compromised mentation; received chemotherapy or radiation within past year for cancer; patients for whom problems could be expected with compliance or follow-up; participation in another study in previous 30 days; stroke with severe physical disability ;< 20 years of age	Waiting-list control
Lorig et al, 2003 (15)	United States	Single-blind RCT	*Randomized* Total: 551 SM: 327 UC: 224 *Completed* Total: 443 SM: 265 UC: 178	19.0 SM 20.5 UC	• Self-selection • Community • Outreach	4 months	*Chronic diseases:* physician-confirmed (self-reported if physician unavailable) heart disease, lung disease, or type 2 diabetes *Inclusion criteria:* 1 or more of above chronic diseases *Exclusion criteria:* treated for cancer in last year	Waiting-list control

Griffiths et al, 2005 (19)	United Kingdom	Double-blind RCT	*Randomized* Total: 476 SM: 238 UC: 238 *Completed* Total: 439 SM: 221 UC: 218	7.1 SM 8.4 UC	• Direct invitation • General practice registry • Letters followed by telephone calls	4 months	*Chronic diseases:* registry-confirmed arthritis, cardiovascular disease, diabetes, or respiratory disease *Inclusion criteria:* 1 or more of above chronic diseases; Bangladeshi; > 20 years age	Waiting-list control
Lorig et al, 2006 (14)	United States	Non-blind RCT	*Randomized* Total: 958 SM: 457 UC: 501 *Completed* Total: 780 SM: 354 UC: 426	22.5 SM 17.6 UC	• Self-selection • Community • Links to study website, calendar announcements, and articles in newspapers	12 months	*Chronic diseases:* physician-confirmed chronic lung disease, heart disease, or type 2 diabetes *Inclusion criteria:* 1 or more of above chronic diseases; ≥ 18 years age; no active treatment for cancer; not ever participated in small-group CDSMP; access to a computer; agreed to 1–2 hours per week of log-on time spread over at least 3 sessions per week for 6 weeks; able to complete online questionnaire	Care from usual provider
Swerissen et al, 2006 (16)	Australia	Non-blind RCT	*Randomized* Total: 728 SM: 467 UC: 261 *Completed* Total: 474 SM: 320 UC: 154	31.5 SM 41.0 UC	• Self-selection • Community • Public service announcements, posters, brochures, newsletters, community festivals, open days, local presentations, referrals from health professionals	6 months	*Chronic diseases:* physician-confirmed chronic illness (not defined) or chronic pain *Inclusion criteria:* 1 or more of above chronic diseases; ≥ 18 years age; Italian, Greek, Vietnamese, or Chinese; live within municipal areas of Boroondara, Darebin, Hume, Greater Dandenong, Yarra, or Whittlesea *Exclusion criteria:* < 18 years age; primary illness psychological or advanced neurological disorder	Waiting-list control

Elzen et al, 2007 (18)	Netherlands	Non-blind RCT	*Randomized* Total: 144 SM: 70 UC: 74 *Completed* Total: 129 SM: 67 UC: 62	4.3 SM 16.2 UC	• Direct invitation/ self-selection • Outpatient clinic • Public service announcements, magazine ads	6 months	*Chronic diseases:* angina pectoris, arthritis, asthma, CHF, COPD, diabetes (unclear how diagnosis confirmed) *Inclusion criteria:* 1 or more of the above chronic diseases; ≥59 years of age; ability to communicate in Dutch; availability to attend a 6-week course *Exclusion criteria:* life expectancy of less than 1 year; already attending a disease-specific self-management program; participating in another study; permanent residents of a nursing home	Waiting-list control
Kennedy et al, 2007 (12)	United Kingdom	Non-blind RCT	*Randomized* Total: 629 SM: 313 UC: 316 *Completed* Total: 521 SM: 248 UC: 273	20.8 SM 13.6 UC	• Self-selection • Community • Recruitment through EPP, primary care trust staff, press releases, and EPP web page	6 months	*Chronic diseases:* self-reported chronic condition (not defined) *Inclusion criteria:* 1 or more self-reported chronic condition	Waiting-list control
Jerant et al, 2009 (10)	United States	Non-blind RCT	*Randomized* Total: 415 Intervention A: 138 Intervention B: 139 UC: 138 *Completed* Total: 415 Intervention A: 138 Intervention B: 139 UC: 138	15.9 SM 14.4 T 7.2 UC	• Self-selection/direct invitation • Primary care • Announcements and telephone calls	12 months	*Chronic diseases:* physician-confirmed arthritis, asthma, COPD, CHF, depression, or diabetes *Inclusion criteria:* 1 or more of above chronic disease; ≥40 years age; ability to speak and read in English; residence in a private home with active telephone; eyesight and hearing adequate; at least 1 activity impairment assessed by the HAQ and/or a score of ≥4 on the 10-item CES-D	Care from their usual provider

Hochhalter et al, 2010 (13)	United States	Single-blind RCT	*Randomized* Total: 79 SM: 26 Safety group: 27 UC: 26 *Completed* Total: 64 SM: 20 Safety group: 23 UC: 21	23.1 SM 14.8 S 19.2 UC	• Direct invitation • Primary care clinic • Letters	6 months	*Chronic diseases:* ICD-9 diagnosis arthritis, depression, diabetes, heart disease, hypertension, lung disease, or osteoporosis *Inclusion criteria:* received treatment for at least 2 of the above chronic conditions in the previous 12 months; ≥ 65 years age; can communicate in English; has access to telephone; expected to receive most of their care within the health care system for at least 8 months prior to baseline *Exclusion criteria:* diagnosed with dementia; receiving hospice care; unable to travel to clinic; living outside of the recruitment area	Care from usual care provider

Abbreviations: CAD, coronary artery disease; CDSMP, Chronic Disease Self-Management Program; CES-D, Center for Epidemiologic Studies–Depression; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; EPP, Expert Patient Programme; HAQ, Health Assessment Questionnaire; ICD-9, *International Classification of Diseases,* 9th Edition; RCT, randomized controlled trial; S, safety arm; SM, self-management arm; T, telephone arm; UC, usual care arm.

Table A2: Patient Characteristics

Study, Year	Minority Population (Country)	Chronic Disease	Confirmed Diagnosis	Mean Diseases, n	Mean Age, years	Female, %	White, %	Married, %	Mean Education, years
Lorig et al, 1999 (4)	General population (United States)	≥ 1of 7 defined conditions	Yes	2.2 SM 2.3 UC	65.6 SM 65.0 UC	65.0 SM 64.0 UC	91.4 SM 88.7 UC	54.0 SM 55.1 UC	15.0 SM 15.0 UC
Fu et al, 2003 (17)	General population (China)	≥ 1of 9 defined conditions	Yes	2.1 SM 2.0 UC	64.2 SM 63.9 UC	73.3 SM 69.1 UC	—	82.3 SM 79.4 UC	9.5 SM 9.9 UC
Lorig et al, 2003 (15)	Hispanic population (United States)	≥ 1of 3 defined conditions	Yes	1.9 SM 1.7 UC	56.6 SM 56.1 UC	79.5 SM 79.5 UC	—	56.9 SM 52.7 UC	—
Griffiths et al, 2005 (19)	Bangladeshi population (United Kingdom)	≥ 1of 4 defined conditions	Yes	—	48.9 SM 48.0 UC	55.9 SM 58.4 UC	—	85.7 SM 87.4 UC	—
Lorig et al, 2006 (14)	General population (United States)	≥ 1of 3 defined conditions	Yes	—	57.6 SM 57.4 UC	71.6 SM 71.2 UC	88.7 SM 87.2 UC	63.6 SM 67.8 UC	15.8 SM 15.4 UC
Swerissen et al, 2006 (16)	Italian, Greek, Vietnamese, or Chinese (Australia)	≥ 1of 2 defined conditions[a]	Yes	2.2 SM 2.00 UC	66.4 SM 65.4 UC	72.8 SM 79.2 UC	—	72.2 SM 76.6 UC	7.1 SM 6.2 UC
Elzen et al, 2007 (18)	General population (Netherlands)	≥ 1of 6 defined conditions	Unclear	—	68.2 SM 68.5 UC	63.2 SM 63.2 UC	—	—	—
Kennedy et al, 2007 (12)	General population (United Kingdom)	1 defined condition[b]	No	—	55.5 SM 55.3 UC	70.0 SM 69.6 UC	95.2 SM 94.6 UC	60.1 SM 60.1 UC	7.8 SM 7.5 UC
Jerant et al, 2009 (10)	General population (United States)	≥ 1of 6 defined conditions	No	—	59.8 SM 61.2 T 60.1 UC	78.3 SM 78.4 T 75.4 UC	74.6 SM 79.1 T 83.3 UC	57.2 SM 56.8 T 55.0 UC	—
Hochhalter et al, 2010 (13)	General population (United States)	≥ 1of 7 defined conditions	Yes	3.6 SM 3.3 safety 3.8 UC	76.0 SM 73.0 S 73.0 UC	65.4 SM 66.7 S 65.4 UC	—	—	—

Abbreviations: S, safety arm; SM, self-management arm; T, telephone arm; UC, usual care arm.

[a]Chronic diseases defined as *chronic pain* and *chronic illness* (both were defined as written and thus encompassed many different chronic conditions).

[b]Chronic diseases defined as *self-reported long-term health condition* (thus encompassed many different chronic conditions).

Table A3: Intervention Characteristics

Study, year	Name of Intervention	Setting	Intensity (number of episodes/ duration of episode, min/total duration, weeks)	Delivery	Content	Provider	Tailored to Initial Assessment[a]	Follow-up Assessment and Modification[b]	Baseline Supplement[c]
Lorig et al, 1999 (4)	CDSMP	Group Patient with family	7/150/7	Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders	No	Yes	No
Fu et al, 2003 (17)	Modified CDSMP	Group	7/150/7	Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders Other	No	Yes	No
Lorig et al, 2003 (15)	Tomando Control de su Salud (modified CDSMP)	Group Patient with family	6/150/6	Audio Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders	No	Yes	No

Griffiths et al, 2005 (19)	Modified CDSMP	Group	6/180/6	Face-to-face Video	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Self-management Social support (6 of 8)	Lay leaders	No	Yes	No
Lorig et al, 2006 (14)	Internet-based CDSMP	Individual	18/90/6	Internet Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders	No	Yes	No
Swerissen et al, 2006 (16)	Modified CDSMP	Group	6/150/6	Audio Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders	No	Yes	No
Elzen et al, 2007 (18)	Modified CDSMP	Group	6/150/6	Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Psychologist	No	Yes	No

Kennedy et al, 2007 (12)	Modified-CDSMP (EPP)	Group	6/150/6	Face-to-face Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders	No	Yes	No
Jerant et al, 2009 (10)	Home-based CDSMP (HIOH)	Individual	6/120/6	Face-to-face Telephone Written	Communication with providers Lifestyle (diet, exercise) Medication management Psychological Symptom management Self-management Social support (7 of 8)	Lay leaders Nurse	No	Yes	No
Hochhalter et al, 2010 (13)	Making the Most of Your Healthcare	Group	1/120/1	Face-to-face Telephone	Communication with providers Self-management Social support (3 of 8)	Research staff	No	Yes	No

Abbreviations: CDSMP, Chronic Disease Self-Management Program; EPP, Expert Patient Programme; HIOH, Homing in on Health.
[a]Describes whether the intervention was personally tailored based on an initial assessment.
[b]Describes whether participants in the intervention were followed during the course of intervention or afterwards, and whether their treatment was modified according to follow-up assessments.
[c]Describes whether both intervention and control were provided with some form of baseline supplement.

Appendix 3: Summary of Meta-Analyses

Table A4: Meta-Analysis and Univariate Sensitivity Analyses for Comparison of Self-Management to Usual Care Across Various Outcomes

	# Studies Incl (Not Incl)	Population, n	Effect Size, SMD (95% CI)	*P* value	I^2, %	GRADE	Univariate Sensitivity Analyses, Effect Size, SMD (95% CI)	I^2, %
Health Status Outcomes								
Pain ↓	6 (1)	3854	**−0.11 (−0.17, −0.04)**	0.001	0	LOW	**−0.10 (−0.17, −0.03)**[a]	0
Disability ↓	4 (1)	2742	**−0.14 (−0.24, −0.05)**	0.004	36	LOW	**−0.17 (−0.29, −0.05)**[a] **−0.15 (−0.24, −0.06)**[b]	37 22
Fatigue ↓	5 (1)	3349	**−0.15 (−0.22, −0.08)**	< 0.001	0	LOW	**−0.14 (−0.23, −0.06)**[a]	16
Dyspnea ↓	4 (1)	2906	−0.10 (−0.21, 0.01)	0.08	57	VERY LOW	−0.09 (−0.25, 0.06)[a]	69
Depression ↓	5 (1)	2875	**−0.15 (−0.28, −0.03)**	0.01	61	LOW	**−0.23 (−0.39, −0.06)**[b] **−0.09 (−0.17, −0.01)**[c]	79 0
Health distress ↓	6 (1)	3809	**−0.20 (−0.29, −0.12)**	< 0.001	42	LOW	**−0.21 (−0.32, −0.11)**[a] **−0.23 (−0.30, −0.15)**[d]	53 22
Self-rated health ↓	6 (1)	3750	**−0.24 (−0.40, −0.07)**	0.006	84	LOW	**−0.28 (−0.47, −0.09)**[a] **−0.16 (−0.26, −0.06)**[e] **−0.27 (−0.43, −0.10)**[b]	84 51 84
HR-QOL (EQ-5D) ↑	3 (0)	1381	0.13 (−0.05, 0.30)	0.15	61	VERY LOW	—	—
	2 (1)	905	**0.22 (0.09, 0.35)** **0.05 (0.00, 0.10) WMD**	0.001 0.04	0 54	MODERATE	—	—
	1 (2)		**0.24 (0.08, 0.40)** **0.08 (0.03, 0.13) WMD**	0.003 0.003	—	MODERATE	—	—
Healthy Behaviour Outcomes								
Aerobic exercise ↑	5 (2)	3,420	**0.16 (0.09, 0.23)**	<0.001	0	LOW	**0.19 (0.11, 0.27)**[a]	0
Cognitive symptom management ↑	3 (2)	2,084	**0.34 (0.20, 0.47)**	<0.001	53	LOW	—	—
Communication with health care professionals ↑	6 (1)	3,818	**0.11 (0.02, 0.21)**	0.02	52	LOW	**0.13 (0.01, 0.24)**[a] **0.14 (0.06, 0.22)**[f]	58 18

Self-Efficacy								
Self-efficacy ↑	6 (2)	3,119	**0.25 (0.12, 0.39)**	0.002	71	LOW	**0.29 (0.14, 0.43)[a]** **0.19 (0.11, 0.26)[c]** **0.24 (0.11, 0.37)[g]** **0.32 (0.15, 0.50)[b]**	68 0 70 83
Health Care Utilization Measures								
Visits with general practitioners ↓	6 (1)	3,901	−0.03 (−0.09, 0.04)	0.41	0	VERY LOW	−0.04 (−0.11, 0.03)[a] −0.02 (−0.10, 0.06)[h]	0 0
Visits to the emergency department ↓	4 (1)	2,954	−0.05 (−0.18, 0.09)	0.49	68	VERY LOW	−0.09 (−0.24, 0.05)[a] 0.01 (−0.07, 0.09)[e]	63 1
Days in hospital ↓	5 (0)	3,472	−0.06 (−0.13, 0.02)	0.14	19	VERY LOW	**−0.09 (−0.16, −0.01)[a]**	0
			−0.27 (−0.75, 0.20) WMD	0.26	37	VERY LOW	−0.42 (−0.97, 0.13)[a] WMD	39
Hospitalizations ↓	2 (1)	1,730	−0.09 (−0.24, 0.05)	0.20	56	VERY LOW	—	—-

Abbreviations: CDSMP, Chronic Disease Self-Management Program; CI, confidence interval; EQ-5D, EuroQol 5D; HR-QOL, health-related quality of life; SMD, standardized mean difference; WMD, weighted mean difference; ↑ = increase in outcome is better; ↓ = decrease in outcome is better.

[a]With Lorig et al, 2006 (14) study removed (internet-based CDSMP with 12-month follow-up).

[b]Base case analyses assumed a correlation coefficient of 0.5 for the study of Jerant et al 2009; (10) sensitivity analysis reported assumes a correlation coefficient of 0.95.

[c]With Kennedy et al, 2007 (12) study removed (outlier; removal otherwise unjustified).

[d]With Griffiths et al, 2005 (19) study removed (outcome was anxiety and not health distress).

[e]With Lorig et al, 2003 (15) study removed (outlier; removal otherwise unjustified).

[f]With Fu et al, 2003 (17) study removed (outlier; removal otherwise unjustified).

[g]In primary meta-analysis, data from Fu et al, 2003 (17) was for the outcome of self-efficacy for managing symptoms; sensitivity analysis utilized outcome data for self-efficacy for managing disease in general.

[h]With Lorig et al, 1999 (4) (outcome reflected general practitioner + emergency room visits) and Griffiths et al, 2005 (19) studies (outcome reflected general practitioner + practice nurse visits) removed.

Appendix 4: Forest Plots of Meta-Analyses

Study or Subgroup	Self-management Mean	SD	Total	Usual care Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Fu 2003	-0.04	2.38	412	0.34	2.31	326	19.2%	-0.16 [-0.31, -0.02]
Griffiths 2005	-0.31	0.94	221	-0.27	1.04	216	11.6%	-0.04 [-0.23, 0.15]
Kennedy 2007	-2.77	18.67	237	-0.25	17.86	267	13.3%	-0.14 [-0.31, 0.04]
Lorig 1999	-2.6	19.4	561	-2.2	17.6	391	24.4%	-0.02 [-0.15, 0.11]
Lorig 2003	-1.26	4.11	265	-0.463	3.95	178	11.2%	-0.20 [-0.39, -0.01]
Lorig 2006	-0.367	2.72	354	-0.047	2.46	426	20.4%	-0.12 [-0.26, 0.02]
Total (95% CI)			**2050**			**1804**	**100.0%**	**-0.11 [-0.17, -0.04]**

Heterogeneity: Tau² = 0.00; Chi² = 3.74, df = 5 (P = 0.59); I² = 0%
Test for overall effect: Z = 3.27 (P = 0.001)

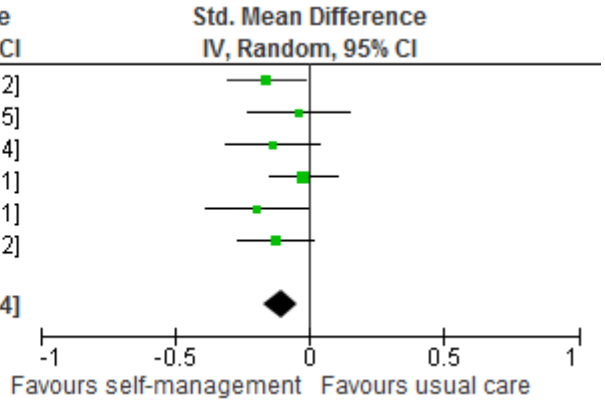

Figure A1: Change in Pain From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

Study or Subgroup	Self-management Mean	SD	Total	Usual care Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Fu 2003	-0.07	0.28	412	0.01	0.32	322	27.0%	-0.27 [-0.41, -0.12]
Jerant 2009	-0.04	0.68	138	-0.02	0.67	138	13.6%	-0.03 [-0.27, 0.21]
Lorig 1999	-0.02	0.32	561	0.03	0.36	391	31.2%	-0.15 [-0.28, -0.02]
Lorig 2006	-0.166	0.345	354	-0.142	0.32	426	28.2%	-0.07 [-0.21, 0.07]
Total (95% CI)			**1465**			**1277**	**100.0%**	**-0.14 [-0.24, -0.05]**

Heterogeneity: Tau² = 0.00; Chi² = 4.65, df = 3 (P = 0.20); I² = 36%
Test for overall effect: Z = 2.90 (P = 0.004)

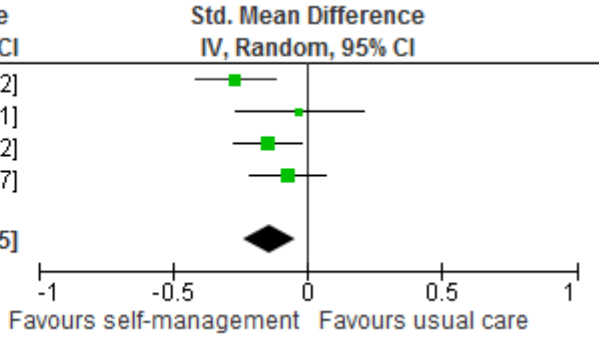

Figure A2: Change in Disability From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

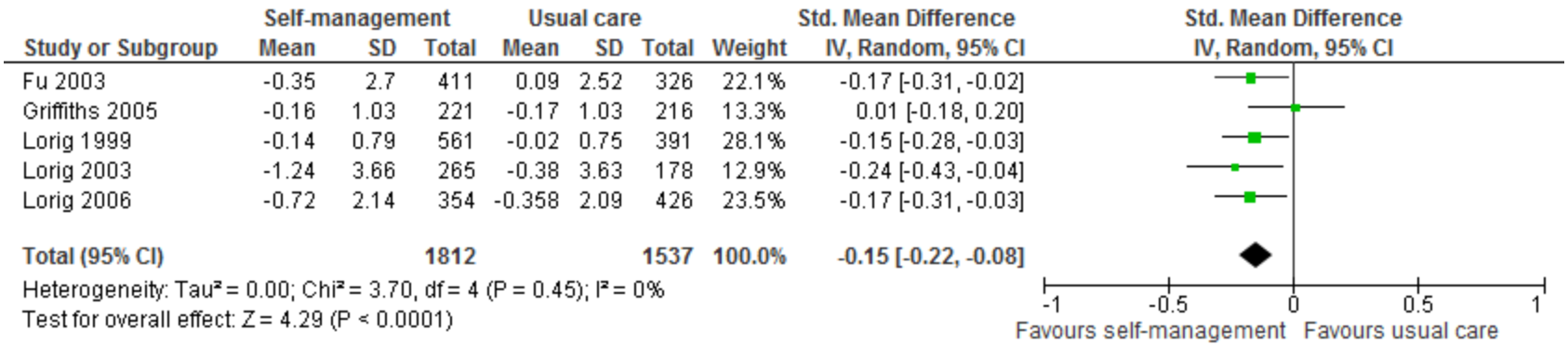

Figure A3: Change in Fatigue From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

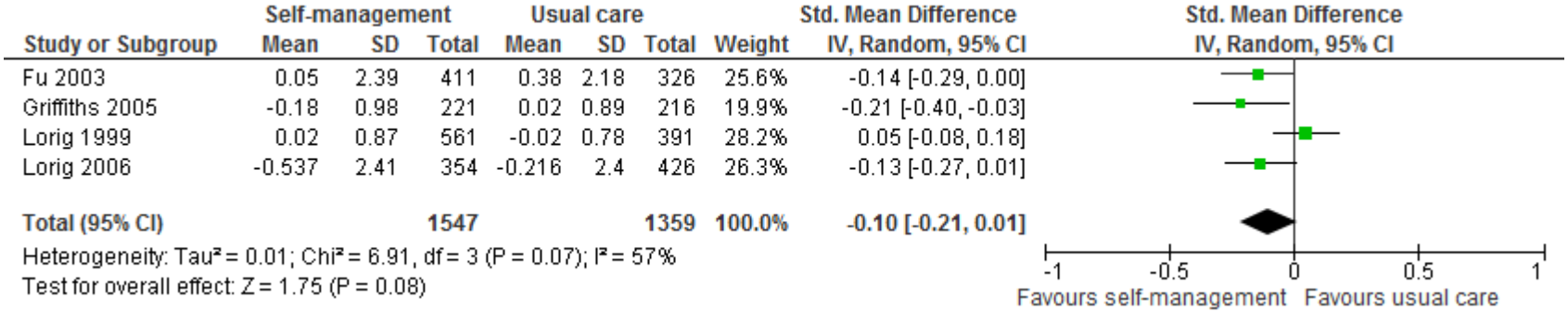

Figure A4: Change in Dyspnea From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

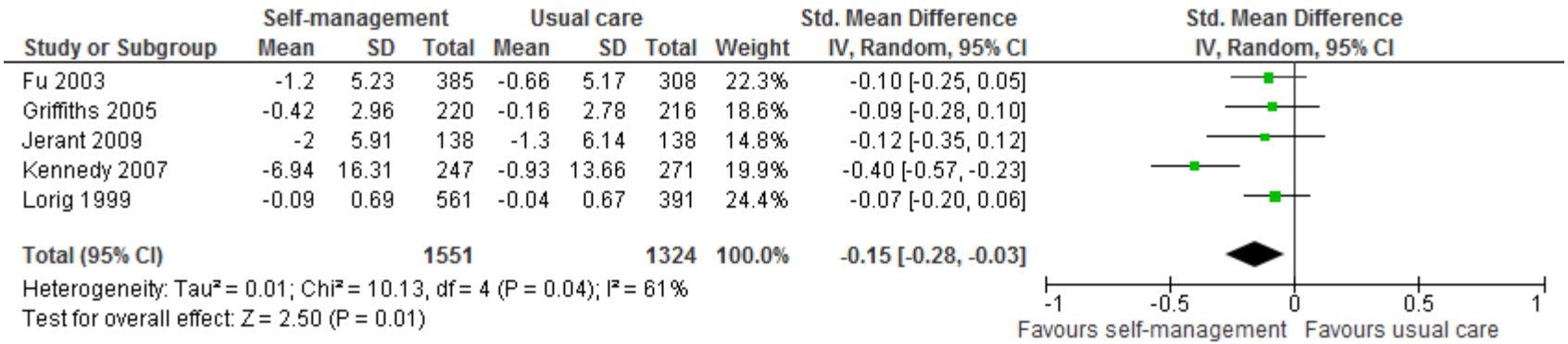

Figure A5: Change in Depression From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

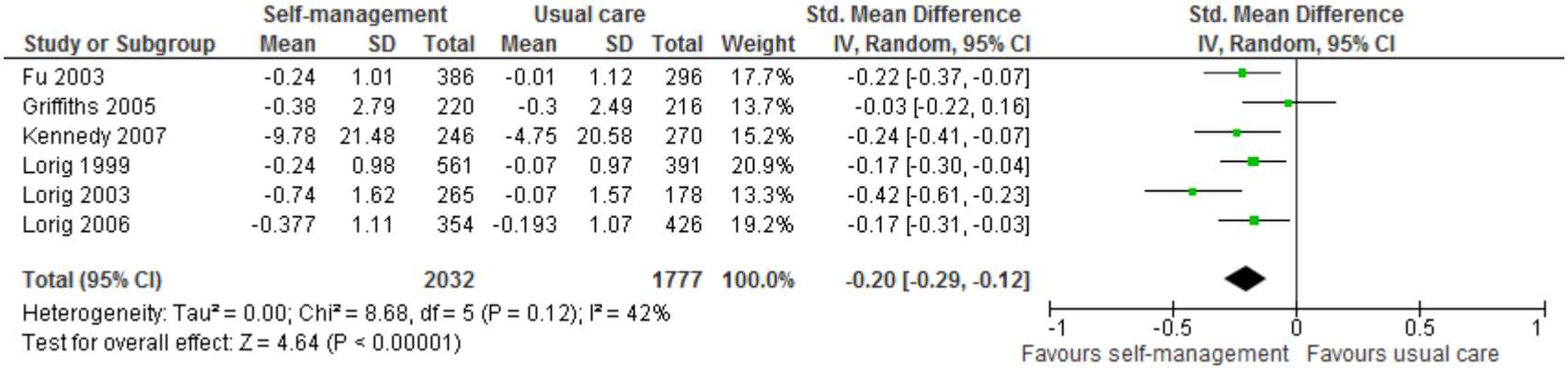

Figure A6: Change in Health Distress From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

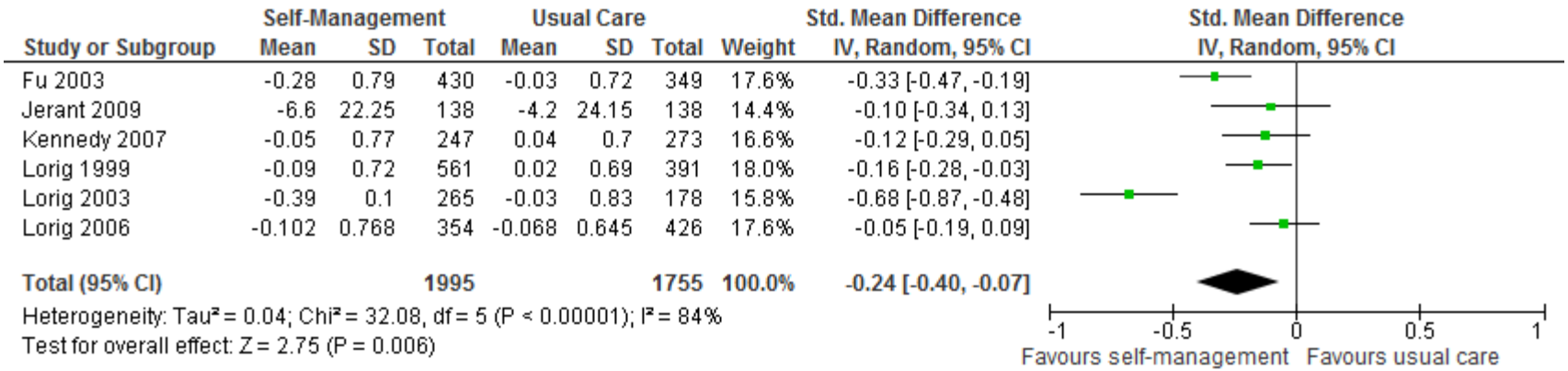

Figure A7: Change in Self-Rated Health From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

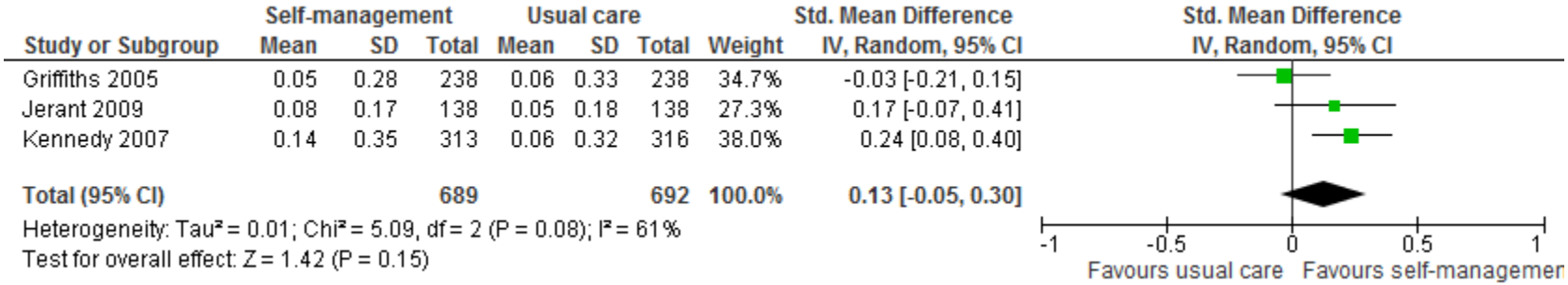

Figure A8: Change in HR-QOL (EQ-5D) From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; EQ-5D, EuroQoL-5D; HR-QOL, health-related quality of life; IV, instrumental variables; SD, standard deviation.

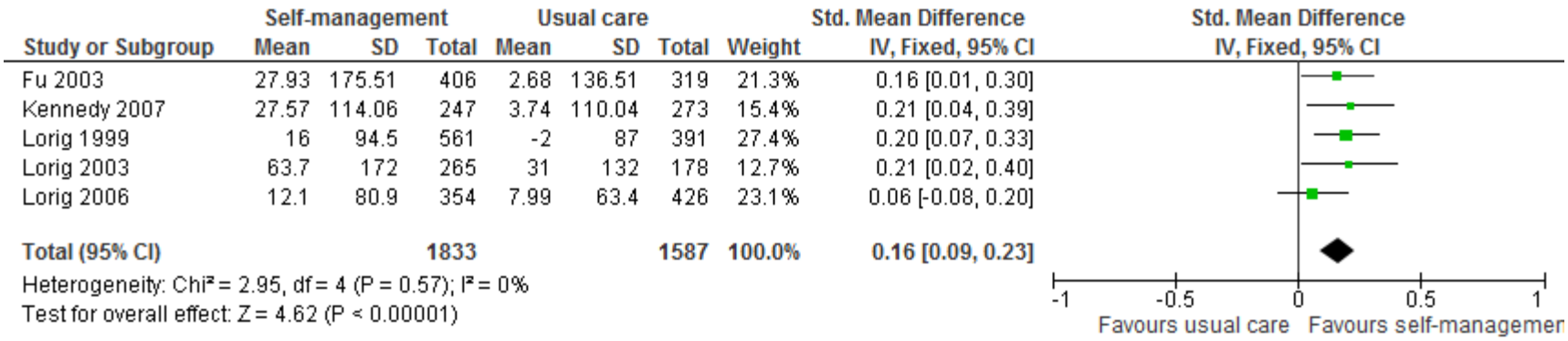

Figure A9: Change in Aerobic Exercise From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

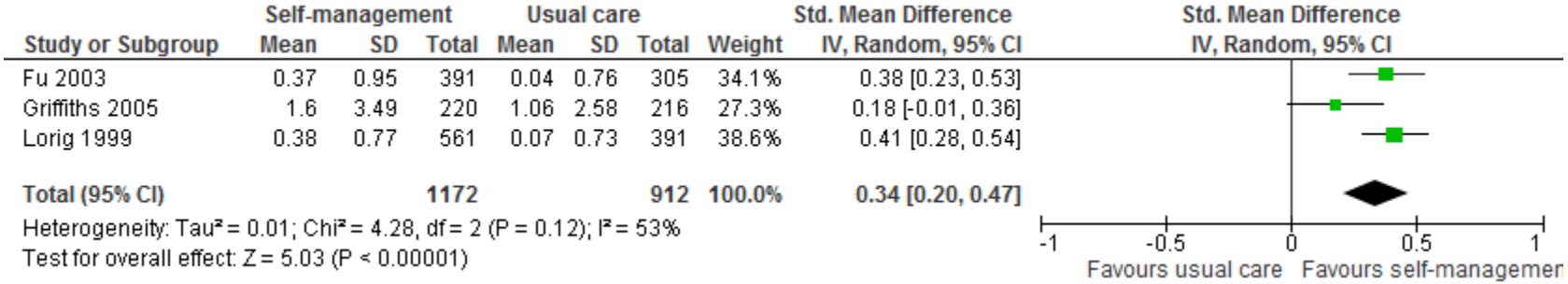

Figure A10: Change in Cognitive Symptom Management From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

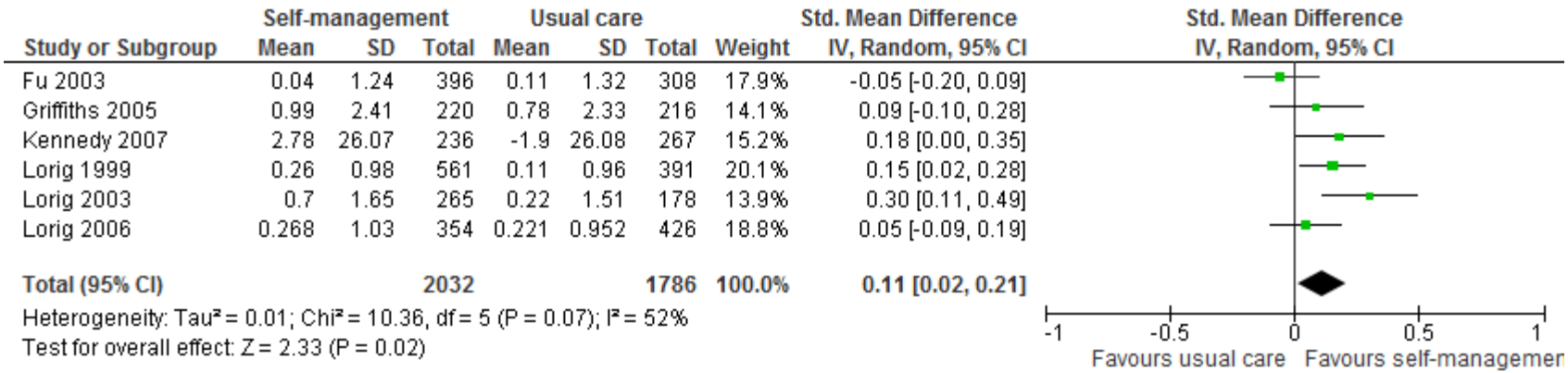

Figure A11: Change in Communication With Health Care Professionals From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

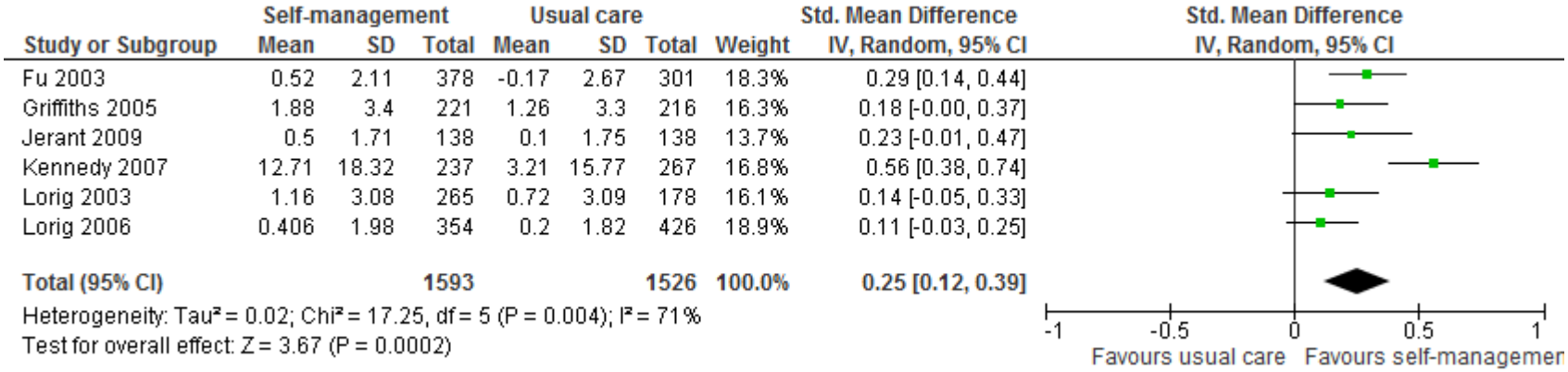

Figure A12: Change in Self-Efficacy From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

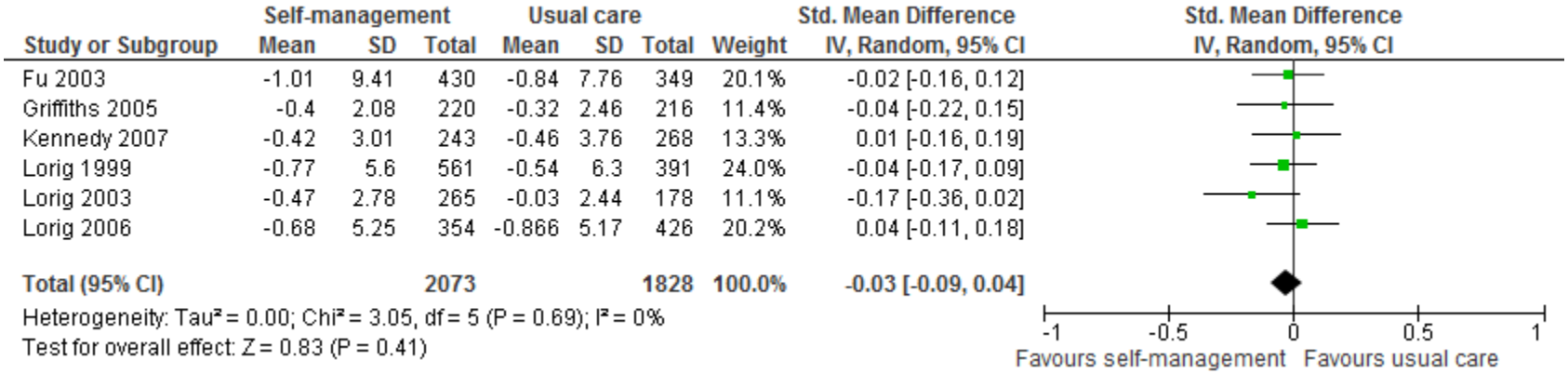

Figure A13: Change in Visits With General Practitioners From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

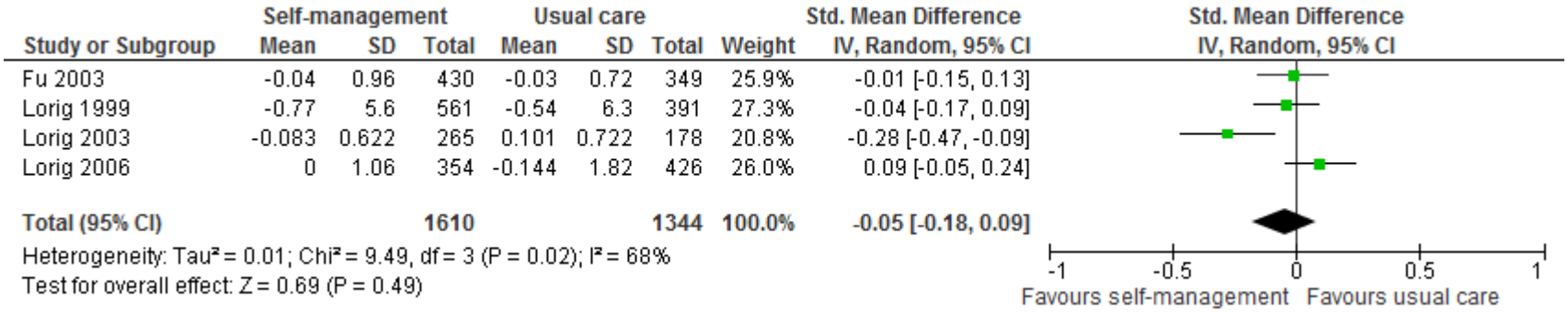

Figure A14: Change in Visits to the Emergency Department From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

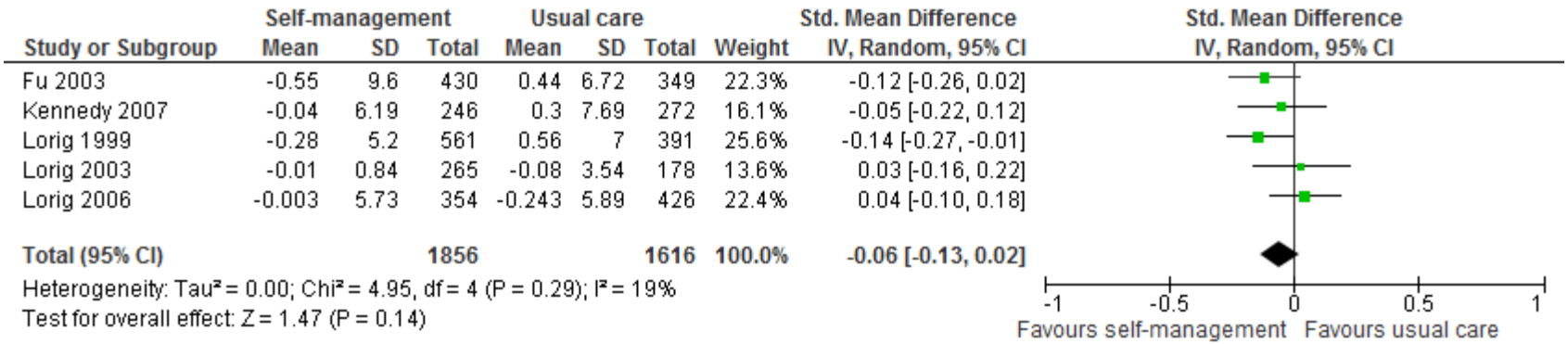

Figure A15: Change in Days in Hospital From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

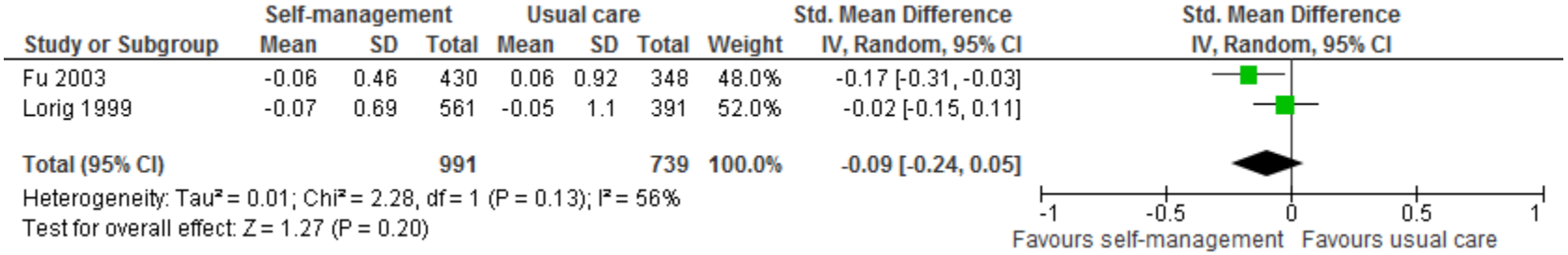

Figure A16: Change in Hospitalizations From Baseline for Self-Management Versus Usual Care

Abbreviations: CI, confidence interval; IV, instrumental variables; SD, standard deviation.

Appendix 5: GRADE Tables

Table A5: GRADE Evidence Profile for Comparison of Self-Management and Usual Care (Health Status Outcomes)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Pain							
7 (RCTs) (4;12;14-17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Disability							
5 (RCTs) (4;10;14;16;17)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Fatigue							
6 (RCTs) (4;14-17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Dyspnea							
5 (RCTs) (4;14;16;17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	Serious limitations (–1)[b]	Undetected	None	⊕ Very Low
Depression							
6 (RCTs) (4;10;12;16;17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Health Distress							
7 (RCTs) (4;12;14-17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Self-Rated Health							
7 (RCTs) (4;12;14-17;19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low

Abbreviations: CI, confidence interval; ITT, intention-to-treat; RCT, randomized controlled trial; SMD, standardized mean difference.

[a]Included trials suffered from lack of allocation concealment and blinding (recent evidence suggests that bias associated with lack of blinding and lack of concealment may be greater in trials with subjective outcomes such as patient-reported outcomes) (31) and lack of appropriate ITT analysis (see Table A9).

[b]Summary estimate confidence interval spanned from meaningful benefit to harm (SMD, 95% CI –0.21, 0.01).

Table A6: GRADE Evidence Profile for Comparison of Self-Management and Usual Care (Health Status Outcomes, Health-Related Quality of Life)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
EuroQol 5D							
3 (RCTs) (10;12;19)	Serious limitations (–1)[a]	Serious limitations (–1)[b]	No serious limitations	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low
2 (RCTs) (10;12)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
1 (RCTs) (12)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
EuroQol Visual Analogue Scale							
1 (RCTs) (10)	Very serious limitations (–2)[d]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None	⊕ Low
Physical Component Summary-36							
2 (RCTs) (10;18)	Very serious limitations (–2)[d]	No serious limitations	Serious limitations (–1)[e]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low
Mental Component Summary-36							
2 (RCTs) (10;18)	Very serious limitations (–2)[d]	No serious limitations	Serious limitations (–1)[e]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low

Abbreviations: CDSMP, Chronic Disease Self-Management Program; ITT, intention-to-treat; RCT, randomized controlled trial.

[a]Included trials suffered from lack of blinding (see Table A9).

[b]Findings from 1 trial were in opposite direction to other included trials; see Figure A8.

[c]Confidence intervals around estimates include the null values.

[d]Included trials suffered from lack of allocation concealment and blinding (recent evidence suggests that bias associated with lack of blinding and lack of concealment may be greater in trials with subjective outcomes such as patient-reported outcomes) (31) and lack of appropriate ITT analysis (see Table A9).

[e]The trial by Jerant et al (10) investigated a home-based CDSMP, while the trial by Elzen et al (18) was conducted in the Netherlands; there are potential intervention and population generalizability issues.

Table A7: GRADE Evidence Profile for Comparison of Self-Management and Usual Care (Healthy Behaviour Outcomes)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Aerobic Exercise							
7 (RCTs) (4;12;14-18)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Cognitive Symptom Management							
5 (RCTs) (4;16-19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low
Communication with Health Care Professionals							
7 (RCTs) (4;12;14;15;17-19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low

Abbreviations: ITT, intention-to-treat; RCT, randomized controlled trial.
[a]Included trials suffered from lack of allocation concealment and blinding (recent evidence suggests that bias associated with lack of blinding and lack of concealment may be greater in trials with subjective outcomes such as patient-reported outcomes) (31) and lack of appropriate ITT analysis (see Table A9).

Table A8: GRADE Evidence Profile for Comparison of Self-Management and Usual Care (Self-Efficacy)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Self-Efficacy							
8 (RCTs) (10;12;14-19)	Very serious limitations (–2)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low

Abbreviations: ITT, intention-to-treat; RCT, randomized controlled trial.
[a]Included trials suffered from lack of allocation concealment and blinding (recent evidence suggests that bias associated with lack of blinding and lack of concealment may be greater in trials with subjective outcomes such as patient-reported outcomes) (31) and lack of appropriate ITT analysis (see Table A9).

Table A9: GRADE Evidence Profile for Comparison of Self-Management and Usual Care (Health Care Utilization Outcomes)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Visits with General Practitioners							
7 (RCTs) (4;12;14-17;19)	Very serious limitations (–2)[a]	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low
Visits to the Emergency Department							
5 (RCTs) (4;14-17)	Very serious limitations (–2)[a]	Serious limitations (–1)[d]	Serious limitations (–1)[b]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low
Days in Hospital							
5 (RCTs) (4;12;14;15;17)	Very serious limitations (–2)[a]	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low
Hospitalizations							
3 (RCTs) (4;10;17)	Very serious limitations (–2)[a]	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	Undetected	None	⊕ Very Low

Abbreviations: ITT, intention-to-treat; RCT, randomized controlled trial.

[a]Included trials suffered from lack of allocation concealment and blinding (recent evidence suggests that bias associated with lack of blinding and lack of concealment may be greater in trials with subjective outcomes such as patient-reported outcomes) (31) and lack of appropriate ITT analysis (see Table A9).

[b]Outcomes of health care utilization were obtained from self-report and not from direct patient records or administrative databases.

[c]Confidence intervals around estimates include the null values.

[d]Findings from 1 trial were in opposite direction to other included trials; see Figure A14.

Table A10: Risk of Bias Among Randomized Controlled Trials for the Comparison of Self-Management and Usual Care

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Lorig et al, 1999 (4)	Limitations	Limitations[a]	Limitations[b]	No limitations	No limitations
Fu et al, 2003 (17)	Limitations	Limitations[a]	Limitations[b]	No limitations	No limitations
Lorig et al, 2003 (15)	Limitations	Limitations[a]	Limitations[b]	No limitations	No limitations
Griffiths et al, 2005 (19)	No limitations	Limitations[a,c]	No limitations[d]	No limitations	No limitations
Lorig et al, 2006 (14)	Limitations	Limitations[e]	Limitations[b]	No limitations	No limitations
Swerissen et al, 2006 (16)	Limitations	Limitations[e]	Limitations[b]	No limitations	No limitations
Elzen et al, 2007 (18)	Limitations	Limitations[e]	Limitations[b]	No limitations	No limitations
Kennedy et al, 2007 (12)	No limitations	Limitations[e]	No limitations[d,f]	No limitations	No limitations
Jerant et al, 2009 (10)	No limitations	Limitations[e]	Limitations[g]	No limitations	No limitations
Hochhalter et al, 2010 (13)	No limitations	Limitations[a]	Limitations[g]	No limitations	No limitations

Abbreviations: CDSMP, Chronic Disease Self-Management Program; CI, confidence interval; ITT, intention-to-treat.
[a]Blinding of outcome assessors.
[b]Primary analysis not ITT.
[c]Blinding of data analysts.
[d]Original publication did not provide ITT data; however, ITT data were obtained from a recent systematic review. (7)
[e]No blinding, or unclear whether trial was blinded.
[f]Differential dropout rates were noted between trial arms: 20.7% for CDSMP and 13.6% for usual care (difference = 7.2%; 95% CI 1.3–13%) (12)
[g]Unclear whether ITT analysis used (trial may have reported ITT analysis but did not report how missing data were managed or the number of patients being analyzed in order to appropriately confirm ITT).

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Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

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To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

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Abstract

Background

In response to the increasing demand for better chronic disease management and improved health care efficiency in Ontario, nursing roles have expanded in the primary health care setting.

Objectives

To determine the effectiveness of specialized nurses who have a clinical role in patient care in optimizing chronic disease management among adults in the primary health care setting.

Data Sources and Review Methods

A literature search was performed using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database. Results were limited to randomized controlled trials and systematic reviews and were divided into 2 models: Model 1 (nurse alone versus physician alone) and Model 2 (nurse and physician versus physician alone). Effectiveness was determined by comparable outcomes between groups in Model 1, or improved outcomes or efficiency in Model 2.

Results

Six studies were included. In Model 1, there were no significant differences in health resource use, disease-specific measures, quality of life, or patient satisfaction. In Model 2, there was a reduction in hospitalizations and improved management of blood pressure and lipids among patients with coronary artery disease. Among patients with diabetes, there was a reduction in hemoglobin A1c but no difference in other disease-specific measures. There was a trend toward improved process measures, including medication prescribing and clinical assessments. Results related to quality of life were inconsistent, but patient satisfaction with the nurse-physician team was improved. Overall, there were more and longer visits to the nurse, and physician workload did not change.

Limitations

There was heterogeneity across patient populations, and in the titles, roles, and scope of practice of the specialized nurses.

Conclusions

Specialized nurses with an autonomous role in patient care had comparable outcomes to physicians alone (Model 1) based on moderate quality evidence, with consistent results among a subgroup analysis of patients with diabetes based on low quality evidence. Model 2 showed an overall improvement in appropriate process measures, disease-specific measures, and patient satisfaction based on low to moderate quality evidence. There was low quality evidence that nurses working under Model 2 may reduce hospitalizations for patients with coronary artery disease. The specific role of the nurse in supplementing or substituting physician care was unclear, making it difficult to determine the impact on efficiency.

Plain Language Summary

Nurses with additional skills, training, or scope of practice may help improve the primary care of patients with chronic diseases. This review found that specialized nurses working on their own could achieve health outcomes that were similar to those of doctors. It also found that specialized nurses who worked with doctors could reduce hospital visits and improve certain patient outcomes related to diabetes, coronary artery disease, or heart failure. Patients who had nurse-led care were more satisfied and tended to receive more tests and medications. It is unclear whether specialized nurses improve quality of life or doctor workload.

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List of Abbreviations

ACE	Angiotensin-converting enzyme
APN	Advanced practice nurse
ARB	Angiotensin-receptor blocker
CAD	Coronary artery disease
CHF	Congestive heart failure
CI	Confidence interval(s)
COPD	Chronic obstructive pulmonary disease
ED	Emergency department
HbA1c	Hemoglobin A1c
HRQOL	Health-related quality of life
IQR	Interquartile range
LVSD	Left ventricular systolic dysfunction
MD	Mean difference
MI	Myocardial infarction
NP	Nurse practitioner
OR	Odds ratio
RCT	Randomized controlled trial
RN	Registered nurse
RR	Relative risk
SE	Standard error
SD	Standard deviation
SF-36	Short Form (36) Health Questionnaire

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this analysis was to determine the effectiveness of specialized nurses who have a clinical role in patient care in optimizing chronic disease management among adults in the primary health care setting. This evidence-based analysis is part of the larger mega-analysis on optimizing chronic disease management.

Clinical Need and Target Population

A significant increase in the number of patients with complex chronic disease has resulted in increased health care demands and pressures related to access and time constraints on physicians in the primary health care setting. Nurses working in specialized or enhanced roles may be a viable option to improve the management of chronic disease (specifically, congestive heart failure [CHF], coronary artery disease [CAD], chronic obstructive pulmonary disease [COPD], atrial fibrillation, type 2 diabetes, stroke, chronic wounds, or general chronic disease) in the primary health care setting. Specialized nurses working collaboratively with physicians may improve efficiency (by reducing physician demand), improve quality of care and patient outcomes, and reduce health care costs.

Specialized Nursing Practice

In this review, *specialized nursing practice* is used to define nurses with enhanced training, experience, and/or scope of clinical practice, or nurses with a primary clinical role in the care of patients with chronic disease. This includes registered nurses (RNs) with specific knowledge and skills for chronic disease management, or those providing disease-specific nurse-led interventions. Although not specialized in a particular chronic disease, primary health care nurse practitioners (NPs) were also considered to be specialized because they receive advanced, formal training in primary care.

Specialized nurses can supplement or substitute aspects of care provided by physicians in the primary health care setting. *Substitution* refers to specialized nurses providing the same services as physicians, with the intent of reducing physician workload and improving health care efficiency. *Supplementation* refers to specialized nurses providing services that may extend or complement care provided by physicians, thereby improving quality of care and outcomes.

Ontario Context

There is considerable variation between and within countries regarding the specific job titles, education, and experience of nurses. Table 1 summarizes the nursing titles regulated in Ontario, their level of training, and their authorized scope of practice. (1)

In Ontario, RNs receive training at the baccalaureate level. The Canadian Nurses Association defines specialization in nursing as "a focus on 1 field of nursing practice or health care that encompasses a level of knowledge and skill in a particular aspect of nursing greater than that acquired during basic nursing education." (2) Such specialties can be acquired via clinical experience and can often be validated through certification. For chronic disease management, this can include diabetes educators, respiratory nurse specialists, cardiac nurse specialists, or geriatric nurse specialists.

As well, 2 types of advanced practice nurses—clinical nurse specialists and NPs—have an advanced level of clinical nursing practice based on graduate-level education and in-depth knowledge and expertise in meeting the health care needs of individuals, families, groups, communities, and populations. (3) Clinical nurse specialists are RNs who receive additional training via a Master's in a clinical nursing speciality. Nurse practitioners are "registered nurses with additional educational preparation and experience who

possess and demonstrate the competencies to autonomously diagnose, order, and interpret diagnostic tests, prescribe pharmaceuticals, and perform specific procedures within their legislated scope of practice." (3) Primary health care NPs are family or all-ages NPs who work in the community setting.

Table 1: Nursing Specialties and Scope of Practice in Ontario

Regulated Nursing Groups and Specialties	Training	Scope of Practice (Authorized Controlled Acts[a])
Registered nurse	**Baccalaureate degree**	• Perform a procedure below the dermis or a mucous membrane • Administer a substance by injection or inhalation • Put an instrument, hand, or finger beyond the external ear canal, nasal passages, larynx, opening of the urethra, labia majora, anal verge, or artificial opening of body
Diabetes educator/ respiratory/heart failure/cardiac/ community/geriatric nurse	Certification in a nursing specialty	
Clinical nurse specialist[b]	Master's in nursing, with expertise in a clinical nursing specialty	
Nurse practitioner[b]	**Post-baccalaureate formal education and licensure**	• Communicate to a patient or patient's representative, a diagnosis made by the nurse practitioner identifying as the cause of the client's symptoms, a disease or disorder • Apply or order the application of prescribed form of energy • Set or cast a fracture of a bone or dislocation of a joint • Prescribe, dispense, sell, or compound a drug in accordance with regulations • Order x-rays and laboratory tests as appropriate for patient care • Admit and discharge hospital patients
Primary health care nurse practitioner	Family or all-ages nurse practitioners in community settings	
Adult and pediatric nurse practitioner (acute care nurse practitioner)	Advanced care across continuum of acute care services	

[a]Under the *Regulated Health Professions Act* and the *Nursing Act*. (1)
[b]Advanced-practice nurses.

Evidence-Based Analysis

Research Question

What is the effectiveness of specialized nursing practice in comparison to usual care in improving patient outcomes and health system efficiencies for chronic disease management in the primary health care setting?

Research Methods

Literature Search

Search Strategy

A literature search was performed on May 3, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for all studies indexed up to May 3, 2012. There were no limits placed on the start date. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

English language full-reports

- published before May 3, 2012
- randomized controlled trials (RCTs) and systematic reviews
- evaluating specialized nurses (i.e., nurses with additional training, enhanced scope of practice, or providing nurse-led interventions) with a clinical role in patient care
- evaluating nurses in the primary health care setting, including family practice, general practice, general or internal medicine clinics, or primary care clinics
- comparing specialized nursing practice to usual primary care
- in an adult population with chronic disease (i.e., CHF, CAD, COPD, atrial fibrillation, type 2 diabetes, stroke, chronic wounds, general "chronic disease," or where the average patient was indicated to have chronic disease)

Exclusion Criteria

- studies where the nursing role could not be isolated from the roles of other health care professionals, such as nutritionists, pharmacists, specialists, indirect nurse supervision by members outside the primary care setting, or other interventions (e.g., electronic medical records or web-based tools)
- nursing care primarily provided at home or over the telephone
- primary health care delivery in nursing homes and long-term care
- nurses solely providing patient education, self-management, care coordination, case management, or action plan interventions

Outcomes of Interest

- hospitalizations
- length of stay
- mortality
- emergency department (ED) visits
- specialist visits
- health-related quality of life (HRQOL)
- patient satisfaction
- disease-specific measures
- process measures
    - examinations or medication prescribing
- health-system efficiencies
    - number and length of primary health care visits
    - physician workload

Models of Nursing Care

Studies were stratified by the type of interaction between specialized nurses and primary care physicians based on study design.

Model 1: Nurse Versus Physician (Usual Care)

Studies that directly compared nurses providing autonomous patient care with physicians performing the same tasks (usual care) were classified as *Model 1*. Nurses working in this model were generally NPs who had the legislative authority to perform tasks similar to those of physicians. Studies evaluating this model of nursing care aimed to show comparable outcomes between nurses and physicians.

Model 2: Nurse and Physician Versus Physician (Usual Care)

Studies that compared nurses and physicians working in a partnership, or compared a nursing intervention as part of a primary health care practice with physicians working alone (or usual care), were classified as *Model 2*. Nurses working in this model could be substituting or supplementing aspects of physician care. Studies that compared nurses to physicians but required regular physician consultation were also classified as Model 2. Studies evaluating this model aimed to improve patient quality of care and patient outcomes while maintaining physician workload, or to show comparable patient outcomes while improving efficiency.

Statistical Analysis

Due to clinical heterogeneity in the study populations evaluated, and differences in provider roles and characteristics, the pooling of outcomes was thought to be inappropriate and a meta-analysis was not conducted. Outcomes were summarized descriptively, with significance accepted at $P < 0.05$.

When not provided directly by the authors, relative risks (RRs) for binary outcomes and mean differences (MDs) for continuous outcomes were calculated from raw data using Review Manager 5 version 5.0.25.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (4) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (4) For more detailed information, please refer to the latest series of GRADE articles. (4)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

The database search yielded 3,252 citations published before May 3, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded from the analysis.

Five studies (RCTs, published in 6 papers), met the initial inclusion criteria. The reference lists of the included studies were hand searched to identify any additional potentially relevant studies, and 1 additional citation (RCT, published in 2 papers) was identified, for a total of 6 studies (published in 8 papers). Three long-term follow-up studies of the original RCTs included were also identified, but these studies were excluded, as a significant rate of crossover and loss to follow-up had occurred. (5-7)

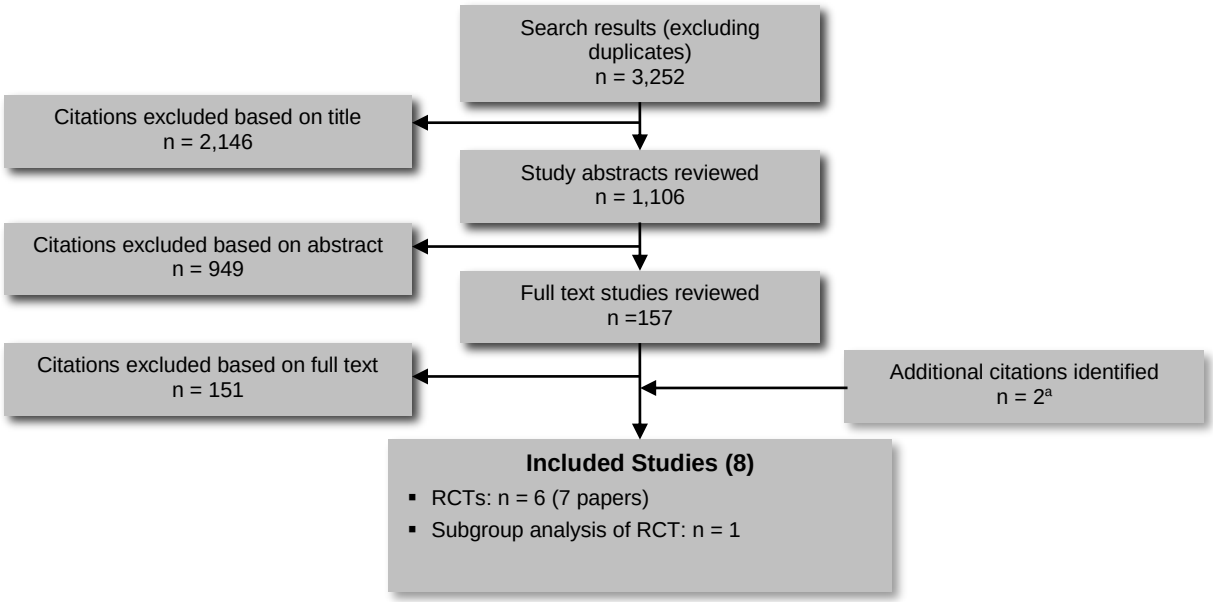

Figure 1: Citation Flow Chart

Abbreviation: RCT, randomized controlled trial.
[a]Additional studies identified via extensive back-searching of all systematic reviews and meta-analyses.

For each included study, the study design was identified and is summarized below in Table 2, a modified version of a hierarchy of study design by Goodman. (8)

Table 2: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	
Large RCT	3[a]
Small RCT	3
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	6[a]

Abbreviation: RCT, randomized controlled trial.

[a]One RCT published primary results in 2 publications and is counted as 1 eligible study; 1 RCT reported a subgroup analysis in a separate publication and is counted as 1 study.

Systematic Reviews and Meta-Analyses

No systematic reviews met the inclusion criteria. Thirteen systematic reviews and health technology assessments of primarily RCTs that focused on specialized nursing practice for chronic disease management, and/or that included studies of nurses in the primary health care setting, were found (8 through systematic review and 5 through manual searching), but these reviews were not included as they either concentrated on broader nursing interventions for unspecified conditions, were not limited to the primary health care setting, or included studies of nurses without a clinical role in patient care or who provided care primarily over the phone, in-home, or in combination with other health care professionals who were not part of the primary health care team. A summary of these reviews and their applicability to the current analysis is presented in Appendix 2.

Description of Included Studies

Six primary RCTs (8 papers) were identified for inclusion and are summarized in the text below. Campbell et al is referred to as 1 RCT, reporting primary outcomes in 1 paper (9) and secondary outcomes in another. (10) Similarly, Mundinger et al (11) published a secondary analysis among a subgroup of patients with diabetes, which is summarized separately whenever appropriate. (12) Table 3 presents an overview of study characteristics, and Tables 4 and 5 summarize methodological characteristics. Detailed descriptions of study methodologies and patient populations are presented in Appendix 3.

Setting

Two of the 6 RCTs were conducted in the United States, 2 in the United Kingdom, and 2 in the Netherlands. All studies were conducted in the primary health care setting. One was in a general internal medicine clinic in a United States hospital, 1 was in a large medical centre, and the remainder were identified generically as general or primary care practices.

Population

Four RCTs evaluated specific chronic diseases: 1 in a type 2 diabetes population, 1 in a type 2 diabetes plus hypertension population, 1 in a CAD population, and 1 in a combined CAD or CHF population. (9;10;13-15) The study by Mundinger et al (11) evaluated people within a general primary care population, but was included because the study oversampled individuals with asthma, diabetes, and/or hypertension, with 54% of enrolled patients having 1 or more of the chronic diseases of interest. A subgroup analysis was also included, focused only on patients with diabetes at baseline. (12) The study by Laurant et al (16) was conducted at the level of the general practitioner, so patients were not recruited or evaluated. However, NPs were responsible for targeting patients with chronic disease—specifically COPD, asthma, dementia, or cancer.

The mean age across studies ranged from 44.5 to 70.5 years, and 25% to 58% of patients were male. Mundinger et al included a primarily Hispanic population (88%) and Litaker et al had 59% of patients of African-American descent.

Study Design and Randomization

Three studies used parallel group randomization, whereby individual participants were randomly assigned to either the nursing intervention or to usual care. (9-11;15) Two studies used a cluster randomized study design, whereby nurses or nursing interventions were randomly assigned to groups of general practices. (14;16) Among the cluster RCTs, Khunti et al (14) first randomized primary care practices to the intervention or control group, followed by subsequent patient selection and consent to participate in the trial. Laurant et al (16) cluster randomized general practices to receive an NP or to usual care, but did not enrol or identify patients.

Sample sizes among the RCTs that evaluated patient-level data ranged from 157 to 1,981, with follow-up ranging from 6 to 18 months. The study by Laurant et al had a sample size of 48 physicians. (16)

Model of Nursing Care

Model 1

One RCT (2 papers) was classified as Model 1. (11;12) Both arms of the study were staffed with RNs and medical assistants.

Model 2

Five RCTs (6 papers) were classified as Model 2. (9;10;13-16) Nurses in these studies supplemented and/or substituted aspects of care provided by physicians.

Type and Role of Nurse

Titles, roles, and level of nurse training varied significantly across studies (Table 4 and Table 5). Nursing titles were maintained, as reported in the original papers.

In Model 1, specialized nurses were highly trained NPs who worked autonomously providing primary health care. Nurses could diagnose, prescribe, refer, and admit patients. Based on state law, physicians were required to respond to NPs if they needed consultation, but they were not required to be on site. All NPs were faculty from a university medical centre.

Two studies in Model 2 evaluated NPs, (15;16) and 3 studies evaluated RNs or practice nurses (PNs) with disease-specific training. The study by Litaker et al (15) included NPs who received additional training in study treatment algorithms. NPs in this study did not have the authority to broadly prescribe medications, but could prescribe and titrate under the approval of the physician. The education preparedness of NPs in the study by Laurant et al (16) was not provided. However, NPs had post-graduate experience with 2 weeks of training in study protocols prior to the study. NPs in the Laurant et al (16) study were not permitted to prescribe medications. The study by Khunti et al (14) included nurses trained in heart failure management who were not required to follow a protocol and were permitted to prescribe medications, refer patients to secondary care, and order appropriate tests. The studies by Houweling et al (13) and Campbell et al (9;10) included nurses with limited training in chronic disease management. Nurses in the Houweling study were PNs who received minimal training in diabetes protocols and were permitted to prescribe and titrate specific diabetes-related medications. Campbell et al included 1 or 2 health visitors, district nurses, or PNs from the enrolled practices who were trained in CAD clinic protocols.

Outcomes

Table 6 summarizes the primary and secondary outcomes evaluated across studies.

Table 3: Study Characteristics

Author, Year	Country, Setting	Disease	Study Design	Sample Size, # Randomized to Intervention/ Comparator	Loss to Follow-Up, N (%) (Intervention/ Comparator)	Length of Follow-up, Months
Model 1: Nurse Versus Physician (Usual Care)						
Mundinger et al, 2000 (11)	United States, primary care in medical centre	Primary care, chronic[a]	RCT	1,181/800	Not enrolled (health resource use data): 375 (31.7)/290 (36.2) HRQOL/satisfaction: 532 (45.0)/409 (51.1)	6–12[b]
Lenz et al, 2002 (12)	United States, primary care in medical centre	Diabetes[c]	RCT (subgroup)	120/94 (10.8% of those randomized in Mundinger et al)	Health resource use/process measures: 70 (32.7) Clinical outcomes: 96 (44.9) to 138 (64.5)	6
Model 2: Nurse and Physician Versus Physician (Usual Care)						
Houweling et al, 2011 (13)	Netherlands, primary care	Diabetes	RCT	116/114	14 (12)/10(8.8)	14
Khunti et al, 2007 (14)	United Kingdom, primary care	CAD[d] or CHF	Cluster RCT	10 practices (505 cases)/ 10 practices (658 cases)	103 (20.4)/50 (7.6)	12
Laurant et al, 2004 (16)	Netherlands, general practice	Chronic[e]	Cluster RCT	4 local groups (30 GPs)/ 3 local groups (18 GPs)[f]	10–13 (30–43)/3 (16.7)[f]	6 before/18 after
Litaker et al, 2003 (15)	United States, general internal medicine clinic	Diabetes and hypertension	RCT	79/78	NR	12
Campbell et al, 1998 (9;10)	United Kingdom, general practice	CAD[g]	RCT	673/670	Practice data: 38 (5.6)/40 (6%) Questionnaire data: 80 (11.9)/90 (13.4)	12 (visits every 2–6 weeks based on protocol)

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; GP, general practitioner; HRQOL, health-related quality of life; NR, not reported; RCT, randomized controlled trial.

[a]Patients presenting to the emergency department, oversampled those with diabetes, asthma, and/or hypertension.

[b]6 months for health outcomes and quality of life, 12 months for health care utilization data.

[c]Subgroup analysis of Mundinger study; (11) patients with self-reported diabetes at baseline.

[d]Defined as diagnosis of coronary heart disease (angina or past medical history of myocardial infarction).

[e]Targeted patients with COPD, asthma, dementia, or cancer.

[f]Randomization and loss to follow-up at level of physician; range represents responses for objective and subjective workload, respectively.

[g]Working diagnosis of coronary heart disease.

Table 4: Nursing Interventions and Comparators

Author, Year	Type of Nursing Intervention	Type and Training of Specialized Nurse	Collaboration With Primary Care Physician (Usual Care)	Components of Comparator
Model 1: Nurse Versus Physician (Usual Care)				
Mundinger et al, 2000 (11) and Lenz et al, 2002 (12)	Nurse as first contact and ongoing primary care provider + staffed with RNs and medical assistants	NP	Not required; did not need to be on site and quarterly meetings to review select cases	Care from a physician plus RNs and medical assistants
Model 2: Nurse and Physician Versus Physician (Usual Care)				
Houweling et al, 2011 (13)	Nurse as primary care provider for diabetes (transfer of care from GP to practice nurse)	Practice nurse trained in diabetes treatment/management for 2 weeks; enhanced scope of practice for study	Consulted if necessary	Usual care from GP
Khunti et al, 2007 (14)	Nurse-led disease management program for CAD/CHF (weekly clinics)	Peripatetic nurse specialists trained in heart failure management	Unclear; nurse clinics added to the primary care practice	Usual care from GP and practice nurse
Laurant et al, 2004 (16)	Nurse-targeted chronic disease patients	NP with mean 12.1 years postgraduate experience; special study training program 2 weeks before study	GP referred patient to NP (GP decided specific NP tasks and patients to refer); after consultation, nurse cared for patient, GP and nurse shared patient, or patient referred back to GP	Usual care from GP practice team
Litaker et al, 2003 (15)	Nurse as first-line contact for primary diabetes and hypertension care	NP + additional training on study treatment algorithms	Collaborative care; discussed issues to develop treatment plans, physician signed off on prescriptions, physician evaluated patient if necessary	Usual care from physician (Internist)
Campbell et al, 1998 (9;10)	Nurse-led secondary prevention CAD clinic (clinics incorporated into usual practice)	1 or 2 health visitors (specialized nurse), district nurses (specialized nurse), or practice nurses from the primary care team	Patients referred to GP if drug treatment needed	Usual primary care (including same nurses as intervention arm)

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; GP, general practitioner; NP, nurse practitioner; RCT, randomized, controlled trial; RN, registered nurse.

Table 5: Roles of Specialized Nurses in Chronic Disease Management

Author, Year	Type of Nurse (Title)	Clinical Role								Management Role		
		Follow Protocol	Assess or Screen	Prescribe or Titrate	Order Tests	Refer	Admit	Monitor	Educate	Care Coordination/ Action Plans	Telephone Follow-up	Home Follow-up
Model 1: Nurse Versus Physician (Usual Care)												
Mundinger et al, 2000 (11) and Lenz et al, 2002 (12)	NP	X	✓	✓	✓	✓	✓		✓			
Model 2: Nurse and Physician Versus Physician (Usual Care)												
Houweling et al, 2011 (13)	Practice nurse + training	✓	✓	✓[a]	✓							
Khunti et al, 2007 (14)	RN + training		✓	✓	✓[b]	✓[b]						✓
Laurant et al, 2004 (16)	NP	✓	✓	X[cd]	✓[cd]			✓	✓	✓	✓	✓
Litaker et al, 2003 (15)	NP	✓	✓	✓[ce]				✓	✓		✓	✓
Campbell et al, 1998 (9;10)	Health visitor, district nurse or practice nurse	✓	✓	X[f]						✓		

Abbreviations: NP, nurse practitioner; RN, registered nurse.
Note: Blank shaded areas represent tasks that were not reported in the study; shaded areas with Xs represent tasks that were clearly stated as not being part of the nurse's role.
[a]Permitted to prescribe 14 medications and adjust dosages for 30; could adjust insulin dosages but not prescribe insulin.
[b]Nurse could refer patients for echocardiography and assessment in a secondary-care cardiology clinic.
[c]Confirmed by author.
[d]GPs agreed on range of work for NP, but individual GPs had freedom of choice regarding tasks and patients they would delegate to the NP.
[e]NPs did not have autonomous prescribing authority, but followed a titration algorithm under the indirect supervision of the physician. The physician signed prescriptions or the NP called prescriptions into the pharmacy (confirmed by author).
[f] Nurse reviewed medications and promoted Aspirin use, and referred patients to physician if treatment recommended.

Table 6: Outcomes of Interest Reported in Individual Trials

Author, Year	Health Resource Utilization						Disease-Specific Measures	HRQOL	Patient Satisfaction	Process indicators	Efficiency[a]
	Hospital-izations	LOS	ED/ Urgent Care Visits	Mortality	Specialist Visits	Primary Health Care Visits[b]					
Model 1: Nurse Versus Physician (Usual Care)											
Mundinger et al, 2000 (11)	✓[c]		✓[c]		✓[c]	✓[c]	✓[c]	✓[cd]	✓[c]		
Lenz et al, 2002 (12)	✓[c]		✓[c]		✓[c]	✓[c]	✓[c]			✓[c]	
Model 2: Nurse and Physician Versus Physician (Usual Care)											
Houweling et al, 2011 (13)						✓	✓[cd]	✓	✓	✓	✓
Khunti et al, 2007(14)							✓[cd]	✓		✓[cd]	
Laurant et al, 2004 (16)											✓[c]
Litaker et al, 2003[e] (15)						✓	✓	✓	✓	✓	✓
Campbell et al, 1998 (9;10)	✓	✓						✓[cd]		✓[c]	✓

Abbreviations: ED, emergency department; HRQOL, health-related quality of life; LOS, length of stay.
[a]Includes number of nurse-primary care physician consultations, primary care physician time or workload.
[b]Overall number of primary care visits, or number of visits to the randomized group for the condition of interest.
[c]Stated as primary outcome of interest.
[d]Power calculation based on outcome.
[e]Powered for outcome of costs rather than effectiveness.

Findings for Model 1: Nurse Alone Versus Physician Alone

Effectiveness of nurses in Model 1 was based on comparability of results between patients receiving primary health care from specialized nurses and physicians.

Health Resource Utilization

Hospitalizations

Mundinger et al (11) reported data on the proportion of individuals hospitalized within the medical centre under evaluation (Table 7). There was no significant difference in the proportion of patients hospitalized between groups at 6 months' or 12 months' follow-up (GRADE: moderate). Among patients with diabetes in the subgroup analysis by Lenz et al, (12) there was no significant difference in hospitalizations at 6 months after baseline (GRADE: very low).

Table 7: Hospitalizations With Specialized Nursing Care Versus Physicians Alone

Author, Year	Population	Follow-up, Months	N	Proportion Hospitalized (%)		RR (95% CI)[a]	*P* Value[a]
				Nurse	Physician		
Mundinger et al, 2000 (11)	Primary care, chronic	6	1,309	33/800 (4.1)	29/509 (5.7)	0.72 (0.45–1.18)	0.19
	Primary care, chronic	12	1,309	68/800 (8.5)	50/509 (9.8)	0.87 (0.61–1.23)	0.41
Lenz et al, 2002 (12)	Diabetes subgroup	6	145	7/86 (8.1)	6/59 (10.2)	0.80 (0.28–2.26)	0.67

Abbreviations: CI, confidence interval; RR, relative risk.
[a]Values were not reported in the article; they were calculated using Review Manager.

Emergency Department Visits

The study by Mundinger et al evaluated the proportion of combined ED and urgent care visits in the study medical centre (Table 8). Enrolled patients in both the NP and physician groups made significantly fewer ED/urgent care visits during the 12-month follow-up period compared to the 6 months prior to study enrollment. However, there was no significant difference in the number of ED and urgent care visits between groups at 12-month follow-up (GRADE: moderate). Similar results were observed among the subgroup of patients with diabetes (GRADE: very low).

Table 8: Emergency Department and Urgent Care Visits With Specialized Nursing Care Versus Physicians Alone

Author, Year	Population	Follow-up, Months	N	Proportion (%) With 1 or More ED or Urgent Care Visits		RR (95% CI)[a]	*P* Value[a]
				Nurse	Physician		
Mundinger et al, 2000 (11)	Primary care, chronic	6	1,309	182/800 (22.7)	127/509 (24.9)	0.91 (0.75–1.11)	0.36
	Primary care, chronic	12	1,309	274/800 (34.3)	172/509 (33.8)	1.01 (0.87–1.18)	0.86
Lenz et al, 2002 (12)	Diabetes subgroup	6	145	21/86 (24.4)	17/59 (28.8)	0.85 (0.49– 1.46)	0.55

Abbreviations: CI, confidence interval; ED, emergency department; RR, relative risk.
[a]Values were not reported in the article; they were calculated using Review Manager.

Specialist Visits

Specialist visits were evaluated by Mundinger et al (11) and defined as visits to a medical specialty clinic or specialist physician office (Table 9). There were significantly more specialty visits in both groups at 12-month follow-up compared to the 6 months prior to study enrollment. However, there was no significant difference between NPs and physicians at 12-month follow-up (GRADE: moderate). Similar results were observed among the subgroup of patients with diabetes at 6 months (GRADE: very low). (12)

Table 9: Specialist Visits With Specialized Nursing Care Versus Physicians Alone

Author, Year	Population	Follow-up, Months	N	Proportion (%) With 1 or More Speciality Visits		RR (95% CI)[a]	*P* Value[a]
				Nurse	Physician		
Mundinger et al, 2000 (11)	Primary care, chronic	6	1,309	307/800 (38.4)	188/509 (24.7)	1.04 (0.09–1.20)	0.60
	Primary care, chronic	12	1,309	365/800 (45.6)	230/509 (45.2)	1.01 (0.89–1.14)	0.88
Lenz et al, 2002 (12)	Diabetes subgroup	6	145	47/86 (54.6)	28/59 (47.5)	1.15 (0.83–1.60)	0.40

Abbreviations: CI, confidence interval; RR, relative risk.
[a]Values were not reported in the article; they were calculated using Review Manager.

Primary Health Care Visits

The study by Mundinger et al evaluated the number of primary health care visits after the initial visit; only those visits with an NP or physician at the primary health care site were counted as primary care (Table 10). There were significantly more patients with a primary health care visit in the NP group after 6 months, but this difference became nonsignificant at 12 months (GRADE: moderate). Among persons assigned to the NP, 59% saw the same provider for primary health care visits after the initial visit, with 54% of physician patients remaining with their original randomized care provider ($P = 0.11$).

The overall proportion of individuals with a primary health care visit at 6 months was higher among the subgroup of patients with diabetes in both groups. However, there was no significant difference observed between groups. Similarly, patients visited their primary health care provider an average of 3.1 times (standard deviation = 2.38), with no statistical difference between groups (GRADE: very low).

Table 10: Primary Health Care Visits With Specialized Nursing Care Versus Physicians Alone

Author, Year	Population	Follow-up, Months	N	Proportion (%) With Primary Health Care Visits		RR (95% CI)[a]	*P* Value
				Nurse	Physician		
Mundinger et al, 2000 (11)	Primary care, chronic	6	1,309	635/800 (79.4)	349/509 (68.6)	1.16 (1.08–1.24)	< 0.0001
	Primary care, chronic	12	1,309	658/800 (82.2)	412/509 (80.9)	1.02 (0.96–1.07)	0.55
Lenz et al, 2002 (12)	Diabetes subgroup	6	145	73/86 (84.9)	52/59 (88.1)	0.96 (0.84–1.10)	0.57

Abbreviations: CI, confidence interval; RR, relative risk.
[a]Values were not reported in the article; they were calculated using Review Manager.

Disease-Specific Measures

Disease-specific measures were evaluated only among the subgroup of individuals with self-reported chronic disease at baseline (diabetes, hypertension, or asthma) in the Mundinger et al and Lenz et al studies. (11;12) Hemoglobin A1C (HbA1c) data were taken from the diabetes subgroup analysis reported by Lenz et al, (12) and blood pressure and peak flow were taken from the original Mundinger et al study. (11) Measurements were conducted at 6 months only; therefore, a change from baseline could not be calculated.

HbA1c

Final HbA1c was high in both groups at 6-month follow-up (mean 9.72% in the nursing group versus 9.84% in the physician group), but there was no significant difference between patients receiving primary care from nurses and those being treated by physicians ($P = 0.82$) (GRADE: very low).

Blood Pressure

Mean 6-month systolic blood pressure was 139 mm Hg in the nursing group and 137 mm Hg in the physician group ($P = 0.82$). Mean 6-month diastolic blood pressure was significantly lower among patients receiving primary care from nurses compared to physicians (82 mm Hg in the nursing group and 85 mm Hg in the physician group; $P = 0.04$) (GRADE: very low).

Peak Flow

There was no significant difference in peak flow measures among patients with asthma ($P = 0.82$) (GRADE: very low).

Health-Related Quality of Life

SF-36 Scores

The study by Mundinger et al (11) evaluated HRQOL at baseline and 6-month follow-up using the Short Form (36) Health Questionnaire (SF-36). SF-36 scores improved significantly from baseline to follow-up among the entire cohort. However, there were no significant differences between groups in the mean physical component summary score (NP group = 40.53 and physician group = 40.60; $P = 0.92$) or mental component summary score (NP group = 44.55 and physician group = 44.48; $P = 0.92$) when adjusted for age, sex, individual conditions, and baseline subscale scores (GRADE: moderate). Similarly, there was no significant difference between groups for the SF-36 physical component score (NP group = 38.93 and physician group = 36.01; $P > 0.05$) and mental component score (NP group = 45.39 and physician group = 42.15; $P > 0.05$) among the subgroup of diabetes patients (GRADE: very low).

Patient Satisfaction

Patient satisfaction was measured at 6-month follow-up by Mundinger et al (11) using "provider-specific" items from a validated 15-item satisfaction questionnaire. No significant difference in the overall patient satisfaction mean score was found between the NP and physician groups ($P = 0.87$) (GRADE: moderate).

Process Indicators

Documentation of various provider behaviours was assessed via patient chart review in the diabetes subgroup analysis. (12) Nurse practitioners were more likely to document providing education ($P < 0.001$), and monitoring height ($P < 0.01$), urinalysis ($P < 0.01$), and HbA1c levels ($P < 0.05$). There were no significant differences between groups in any assessments of patient history, or in the assessment or monitoring of weight, blood pressure, foot health, blood glucose levels, or creatinine levels. Additionally, there was no significant difference between groups in referrals to an ophthalmologist. The GRADE for this body of evidence was very low.

Results for Model 2: Nurse and Physician versus Physician Alone (or Usual Care)

In Model 2, the effectiveness of specialized nurses plus physicians (or usual care) was assessed by an improvement in patient or health resource use outcomes, or in health care efficiency.

Health Resource Utilization

Hospitalizations

The study by Campbell et al (9) reported on all-cause hospitalizations as a secondary outcome (Table 11). There was a statistically significant decrease in the proportion of patients hospitalized in the first year in the group receiving nurse-led secondary CAD prevention in comparison to usual care alone (GRADE: low). The difference in the hospitalizations was only partly explained by cardiac-related admissions, with 7% in the intervention group and 9% in the control group. Similarly, there was no difference in nonfatal myocardial infarctions (2% in each group).

Table 11: Hospitalizations With Specialized Nursing Care Versus Usual Care

Author, Year	Population	N	Proportion Hospitalized (%)		OR (95% CI)	*P* Value
			Nursing Intervention	Usual Care		
Campbell et al, 1998 (9)	CAD	1,058	Baseline: 132/540 (24) Follow-up: 106/540 (20)[a]	Baseline: 34/518 (26) Follow-up: 145/518 (28)[a]	0.64 (0.48–0.86)[b]	0.003[b]

Abbreviations: CAD, coronary artery disease; CI, confidence interval; OR, odds ratio.
[a]Unadjusted final values.
[b]Adjusted for age, sex, general practice, and baseline performance.

Length of Stay

The study by Campbell further commented on hospital length of stay among individuals with CAD. (9) There was no significant difference in the median length of stay at 1 year (6 days in both groups; $P = 0.49$) (GRADE: low).

Disease-Specific Measures

HbA1c

Two studies reported on HbA1c among patients with diabetes. The average patient in the Litaker et al (15) study had elevated HbA1c at baseline (mean 8.5%), with a significant decrease in the mean change from baseline at 1 year in favour of the specialized nurse-physician team (12) (GRADE: moderate).

Table 12: HbA1C With Specialized Nursing Care Versus Usual Care

Author, Year	Population	N	Mean Change From Baseline (SD)		Mean Difference in Mean Change From Baseline (95% CI)	*P* Value
			Nursing Intervention	Usual Care		
Litaker et al, 2003 (15)	Diabetes and hypertension	157	–0.63 (1.5)	–0.15 (1.0)	–0.48 (–0.88 to –0.08)	0.02

Abbreviations: CI, confidence interval; HbA1c, hemoglobin A1c; SD, standard deviation.

The study by Houweling et al evaluated HbA1c as a primary outcome, observing a nonsignificant decrease in HbA1c among individuals receiving specialized nursing care (MD, –0.12; 95% CI –0.44 to 0.20). This study was not included in the overall body of evidence, as it was underpowered to detect a difference in HbA1c, and 41.7% of patients had controlled HbA1c at baseline (HbA1c < 7%).

Blood Pressure and Lipids

Mean differences from baseline to follow-up in blood pressure and lipids were reported by 4 studies (10;13-15) and are summarized in Table 13. Overall, each study was poorly designed to evaluate these measures, with a large proportion of randomized patients not meeting clinically defined hypertension or high cholesterol levels at baseline. With no subgroup analyses conducted, the clinical relevance of these outcomes could not be assessed.

Table 13: Continuous Blood Pressure and Cholesterol Measures With Specialized Nursing Care Versus Usual Care

Author, Year	Population	N	Mean Change From Baseline (SD)		Mean Difference in Mean Change from Baseline (95% CI)	*P* Value
			Nursing Intervention	Usual Care		
Systolic Blood Pressure (mm Hg)						
Houweling et al, 2011 (13)	Diabetes	206	–7.40 (17.3)	–5.60 (17.30)	–0.72 (NR)	0.122
Khunti et al, 2007 (14)	CAD	1,152	134.72 (SE 0.86)[a]	139.30 (SE 0.80)[a]	–4.58 (–6.68 to –2.28)[a]	0.001
Diastolic Blood Pressure (mm Hg)						
Houweling et al, 2011 (13)	Diabetes	206	–3.2 (10.18)	–1.0 (9.5)	–2.2 (NR)	0.10
Khunti et al, 2007 (14)	CAD	1,152	75.18 (SE 0.46)[a]	78.71 (SE 0.43)[a]	–3.53 (–4.78 to –2.29)[a]	0.0003
Total Cholesterol (mmol/L)						
Houweling et al, 2011 (13)	Diabetes	206	–0.1 (1.02)	–0.05 (0.77)	–0.05 (NR)	0.69
Litaker et al, 2003 (15)	Diabetes	157	–0.28 (0.87)	–0.26 (0.72)	–0.02 (-0.27 to 0.23)	0.85
Khunti et al, 2007 (14)	CAD	1,152	4.53 (SE 0.05)[a]	4.71 (0.43)[a]	–0.18 (–0.30 to –0.05)[a]	0.01

Abbreviations: CAD, coronary artery disease; CI, confidence interval; NR, not reported; SD, standard deviation; SE, standard error.
[a]Final values adjusted for baseline, age, sex, smoking status, and cluster effect.

Control of Disease-Specific Measures

Three studies provided data on the proportion of individuals meeting predefined targets for HbA1c, (13;15) blood pressure, (13-15) or cholesterol control. (13;14) Each study used a different definition of appropriate control. Results and definitions of target values are reported in Table 14.

The study by Houweling et al (13) found no significant differences in the proportion of diabetes patients receiving specialized nursing care who met target values for HbA1c ($P > 0.05$) or lipid control ($P = 0.46$); and neither Houweling et al (13) nor Litaker et al (15) found a significant difference in hypertension control ($P > 0.05$). All patients in the Litaker et al (15) study had hypertension at baseline and a more

stringent threshold was utilized to define hypertension control. Neither study was powered to detect differences in these measures. The GRADE for each of these outcomes was low.

Khunti et al (14) evaluated cholesterol control as a primary outcome measure, observing a significant improvement in the proportion with total cholesterol < 5 mmol/L at 1-year follow-up ($P = 0.03$) among patients in the nurse-led CAD clinic compared to usual care (GRADE: moderate). This study also found a significant increase in the proportion of patients achieving blood pressure control (< 140/85 mm Hg; $P = 0.01$) compared to usual care (GRADE: moderate).

The study by Campbell et al (10) found a significant increase in the proportion of patients achieving appropriate lifestyle control related to moderate physical activity ($P = 0.001$) and a low-fat diet ($P = 0.009$) (GRADE: low). There was no significant difference in the proportion of patients not currently smoking, although this was greater than 80% in each group (GRADE: low). Baseline performance was found to be a strong predictor of each measure.

Table 14: Disease-Specific Measures With Specialized Nursing Care Versus Usual Care

Author, Year	Population	Definition	N	Proportion (%) Meeting Target Values at Follow-Up		OR or RR (95% CI)[a]	*P* Value
				Nursing Intervention	Usual Care		
HbA1c Control							
Houweling et al, 2011 (13)	Diabetes	< 7%	206	38/102 (34.3)	45/104 (43.3)	RR 0.86 (0.62–1.20)	0.38
		< 8.5%	206	88/102 (86.3)	91/104 (87.5)	RR 0.99 (0.89–1.10)	0.79
Blood Pressure Control							
Houweling et al, 2011 (13)	Diabetes	< 140/90 mm Hg	106	26/102 (25.5)	22/104 (21.2)	RR 1.20 (0.73–1.98)	0.46
Litaker et al, 2003 (15)	Diabetes	< 130/85 mm Hg	157	9/79 (11)	8/78 (10)	RR 1.11 (0.45–2.73)	0.82
Khunti et al, 2007 (14)	CAD	< 140/85 mm Hg	961	250/445 (56.1)	223/516 (43.2)	OR 1.61 (1.22–2.13)[b]	0.01
Lipid Control							
Houweling et al, 2011 (13)	Diabetes	Lipid profile[c]	106	81/102 (79.4)	88/104 (84.6)	RR 0.94 (0.83–1.07)	0.33
Khunti et al, 2007 (14)	CAD	Total < 5 mmol/L	735	249/335 (74.3)	254/400 (63.5)	OR 1.58 (1.05–2.37)[b]	0.03
Lifestyle Control							
Campbell et al, 1998 (9)	CAD	Moderate physical activity	1,155	247/587 (42.1)	177/568 (31.2)	OR 1.67 (1.23–2.26)[b]	0.001
		Low-fat diet	945	271/480 (56.5)	226/465 (48.6)	OR 1.47 (1.10–1.96)[b]	0.009
		Not currently smoking	1,152	483/584 (82.7)	481/568 (84.7)	OR 0.78 (0.47–1.28)[b]	0.32

Abbreviations: CAD, coronary artery disease; CI, confidence interval; OR, odds ratio; RR, relative risk.
[a]RRs calculated in Review Manager.
[b]Adjusted for baseline, age, sex, and practice.
[c]Target values based on Dutch guidelines, in which an indication for treatment in men between 50 to 70 years and women 50 to 75 years with a 25% chance of developing cardiovascular disease in the next 10 years. During treatment, the target value for the cholesterol was < 5 mmol/L.

Health-Related Quality of Life

Generic HRQOL Scores

Both the study by Houweling et al (13) and Litaker et al (15) evaluated generic HRQOL among diabetes patients using the SF-36 or the Short Form 12. Houweling et al (13) found no significant difference in the mental component score (MD, –0.3; $P > 0.05$) and a significant deterioration in the physical component score (MD –3.1; $P = 0.04$) in patients receiving specialized nursing care in comparison to physician care alone. Litaker et al (15) found no significant differences in either the physical component score (MD 1.77; $P = 0.19$) or mental component score (MD 2.14; $P = 0.17$) using the Short Form 12. Overall, these findings were inconsistent based on very low quality evidence.

Both studies evaluating patients with CAD found a trend towards an improvement in SF-36 subscales among patients receiving specialized nursing care in comparison to usual care. (14) No summary scores for the physical and mental component scores were provided. Khunti et al (14) found an improvement in the adjusted mean change score for all subscales, of which 5 out of 8 were statistically significant. Similarly, Campbell et al (9) found a significant improvement in the difference in mean change scores for 6 out of 8 individual SF-36 domains when adjusted for age and baseline performance among patients receiving the nursing intervention. The GRADE for this body of evidence was moderate.

Khunti et al (14) found no significant differences in individual SF-36 domains among patients with confirmed left ventricular systolic dysfunction (LVSD); however this study was underpowered to observe a difference among this subgroup of patients and may be a result of a type 2 error (GRADE: low).

Diabetes-Specific HRQOL

Litaker et al (15) found a significant improvement among patients in the NP–MD team in the Diabetes Quality of Life questionnaire subscale of diabetes satisfaction (MD, 5.42; 95% CI, 4.3–10.41). However, no significant difference was found for diabetes impact (MD, 1.07; 95% CI, –1.37 to 3.51), diabetes social worry (MD, 0.57; 95% CI, –2.49 to 3.64), or diabetes worry (MD, 0.71; 95% CI, –4.58 to 6.00), with higher scores representing better quality of life (GRADE: low). Houweling et al (13) identified significant differences for some of the diabetes symptom score dimensions. However, discrete results were not reported and, as a result, were not included in the body of evidence.

CAD- or CHF-Specific HRQOL

Two studies reported data on HRQOL using CAD- or CHF-specific measures, with inconsistent measures and results. Khunti et al (14) evaluated HRQOL among patients with angina by using the Seattle Angina Questionnaire, while Campbell et al (9) used an Angina Type Specification. There was a significant improvement in the Seattle Angina Questionnaire components of exertional capacity (MD, 5.25; $P = 0.001$) and angina frequency (MD, 2.37; $P = 0.04$) among the nurse-led clinic group in comparison to usual care, and no significant differences in angina stability (MD, 2.37; $P = 0.25$), treatment satisfaction (MD, 2.45; $P = 0.37$), or quality of life (MD, 3.95; $P = 0.06$). Campbell et al (9) found a nonsignificant decrease in chest pain between groups (OR, 0.81; 95% CI, 0.61–1.08; $P = 0.14$) and a significant decrease in worsening chest pain (OR, 0.59; 95% CI, 0.37–0.94; $P = 0.02$). The GRADE for this body of evidence was moderate.

Khunti et al (14) also evaluated HRQOL in patients with LVSD using the Left Ventricular Dysfunction Questionnaire. There was no significant difference in the adjusted 12-month score between the nurse-led clinic and the usual care group (MD –2.44; $P = 0.67$). However, this study was not powered to detect these differences, and these findings may reflect a type 2 error.

Patient Satisfaction

Two studies evaluated patient satisfaction with provider care using different measures. However, only the study by Litaker et al (15) evaluated significance and was included in the body of evidence (Table 15). Litaker et al (15) found a significant increase in the mean change from baseline to follow-up in patient satisfaction among patients receiving specialized nursing care with a physician compared to physician alone (GRADE: moderate). Houweling et al (13) also found an increase in patient satisfaction based on a Patients Evaluation and Diabetes Care survey (satisfaction sum score in nursing group 66.4% and physician group 51.7%).

Table 15: Patient Satisfaction With Specialized Nursing Care Versus Usual Care

Author, Year	Population	N	Satisfaction Tool Used	Mean Patient Satisfaction Score		Mean Difference (95% CI)	*P* Value
				Nursing Intervention	Usual Care		
Litaker et al, 2003 (15)	Diabetes and hypertension	157	35-item Patient Satisfaction Questionnaire	6.2[a]	–1.7[a]	7.9	0.01

Abbreviations: CI, confidence interval; NR, not reported.
[a]Mean change from baseline to 12 months in general satisfaction, with higher scores representing greater satisfaction.

Process Indicators and Risk Factor Management

Four studies (2 in diabetes (13;15) and 2 in CAD (10;14) evaluated the role of specialized nurses in improving the management of chronic disease risk factors through appropriate examinations and treatment based on disease-specific guidelines.

Disease Management

Campbell et al (10) evaluated appropriate management of blood pressure and lipids, defined as patients receiving attention for their condition (treated, checked or referred) of patients *or* achieving clinical thresholds of appropriate control (Table 16). Based on these definitions, CAD patients receiving care from specialized nurses were 5 times more likely to achieve appropriate blood pressure ($P < 0.001$) management and 3 times more likely to have appropriate lipid management ($P < 0.001$) compared to treatment from physicians alone (GRADE: moderate).

Table 16: Blood Pressure and Lipid Management With Specialized Nursing Care Versus Usual Care

Author, Year	Population	Definition	N	Proportion Managed (%)		OR (95% CI)[a]
				Nursing Intervention	Usual Care	
Campbell et al, 1998 (10)	CAD	Blood pressure managed[b]	1,173	572/593 (96.5)	510/580 (87.9)	5.32 (3.02–9.41)
		Lipids managed[c]	1,173	244/593 (41.1)	125/580 (21.6)	3.19 (2.39–4.26)

Abbreviations: CAD, coronary artery disease; CI, confidence interval; OR, odds ratio.
[a]Adjusted for baseline, age, sex, and practice.
[b]Last blood pressure < 160/90 mm Hg or receiving attention (treated, checked within 3 months).
[c]Cholesterol < 5.2 mmol/L or receiving attention (treated, checked within 3 months, or referred to a specialist clinic).

Clinical Examinations

Three studies evaluated the proportion of patients receiving appropriate clinical examinations based on guidelines. (13;15) Both diabetes studies (13;15) found patients with diabetes receiving care from specialized nurses to be significantly more likely to receive a foot exam ($P < 0.05$) compared to usual care by a physician (GRADE: moderate). Similarly, patients in the Houweling et al (13) study were significantly more likely to be appropriately referred to an ophthalmologist (if last retina control > 24 months) ($P = 0.01$), with a nonsignificant increase observed in the Litaker et al (15) study ($P = 0.14$) (GRADE: low). This difference may be due to varying definitions of examinations, with Litaker et al (15) evaluating all examinations during the follow-up period rather than appropriate examinations. As well, neither study adjusted for baseline performance.

Khunti et al (14) found a statistically significant increase in the number of referrals for echocardiographs among patients with presumed CHF ($P < 0.01$), as well as the assessment of blood pressure ($P < 0.001$), smoking status ($P < 0.0001$), and body mass index/weight ($P < 0.0001$) among CAD patients receiving secondary prevention from specialized nurses in comparison to usual care. There was no significant difference between groups in the proportion of individuals with cholesterol measured ($P = 0.48$). The GRADE for this body of evidence was moderate.

Table 17: Clinical Examinations Process Measures With Specialized Nursing Care Versus Usual Care

Author, Year	Popu-lation	Measure	N	Proportion (%)		RR or OR (95% CI)[a]	*P* Value
				Nursing Intervention	Usual Care		
Ophthalmologist							
Houweling et al, 2011 (13)	Diabetes	Referred if last exam > 24 months	64	24/34 (70.6)	11/30 (36.7)	RR 1.93 (1.15–3.23)[a]	0.01
Litaker et al, 2003 (15)	Diabetes	Eye exam by ophthalmologist	157	62/79 (78)	53/78 (68)	RR 1.16 (0.95–1.40)[a]	0.14
Foot Exam							
Houweling et al, 2011 (13)	Diabetes	Foot exam, if feet at risk	109	34/60 (56.7)	13/49 (26.5)	RR 2.14 (1.28–3.58)[a]	0.004
Litaker et al, 2003 (15)	Diabetes	Foot exam	157	79/79 (100)	28/78 (36)	RR 2.75 (2.05–3.70)[a]	< 0.0001
Other Measures Taken							
Khunti et al, 2007 (14)	CAD	Blood pressure	1,058	446/450 (99.1)	514/608 (84.5)	OR 22.61 (6.47–70.13)	< 0.001
		Cholesterol	1,059	333/450 (74.0)	403/609 (66.2)	OR 1.21 (0.71–2.08)[b]	0.48
		Body mass index/weight	1,059	396/450 (88.2)	281/609 (46.1)	OR 10.14 (4.99–20.55)[b]	< 0.0001
		Smoking status	1,059	421/450 (93.6)	273/609 (44.8)	OR 33.96 (14.49–79.62)[b]	< 0.0001
	CHF	Echocardiography if CHF presumed but unconfirmed	96	35/96 (36.5)	14/140 (10)	OR 5.64 (2.81–11.31)[b]	< 0.01

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; CI, confidence interval; OR, odds ratio; RR, relative risk.
[a]Relative risks calculated using Review Manager.
[b]Adjusted for baseline, age, sex, and practice.

Medication Prescribing

Four studies evaluated differences in appropriate or overall number of prescriptions received among specialized nurses and physicians. Results are presented in Table 18.

Among patients with diabetes in the Houweling et al (13) study, specialized nurses were significantly more likely to intensify glucose-lowering therapy ($P = 0.0005$) or intensify blood pressure medications ($P = 0.01$) compared to physicians, if patients were not meeting target values for appropriate control. The number of referrals to an internist for starting insulin therapy was also significantly greater among the nursing group ($P < 0.001$). However, it was not stated how many patients were already on insulin or if this increase reflected more appropriate referrals in comparison to physicians ($P = 0.03$). There was no significant difference in the appropriate prescribing of lipid lowering therapy ($P = 0.07$). The GRADE was moderate for all diabetes medication management outcome measures.

Litaker et al (15) found a significant increase in the proportion of individuals appropriately receiving influenza or pneumovax vaccinations ($P < 0.0001$) (GRADE: moderate), as well as receiving patient education related to smoking, the importance of exercise and diet, and medication side effects ($P < 0.001$) in the nursing intervention group in comparison to usual care. There was no significant difference in education related to medication adherence. However, this was greater than 95% in each group ($P = 0.06$).

Khunti et al (14) reported the proportion of CAD or CHF patients receiving appropriate therapy, 2 of which were evaluated as primary outcomes. There was a statistically significant increase in the primary outcome of the appropriate prescribing of beta-blockers among individuals with a prior myocardial infarction ($P = 0.03$) and no significant difference in the prescribing of an angiotensin converting enzyme (ACE) inhibitor among patients with confirmed LVSD ($P = 0.05$). Among secondary outcomes, there was no significant difference in appropriate prescribing of ACE inhibitors for CAD patients with a history of myocardial infarction (MI), or prescribing of an ACE or angiotensin receptor blocker, beta-blocker, or carvedilol/bisoprolol for patients with LVSD. The GRADE was moderate for cardiac medication management measures.

Two studies reported on Aspirin use, with Khunti et al (14) finding no significant difference in the proportion of patients receiving aspirin ($P = 0.55$), and Campbell et al (10) observing a significant increase in use ($P < 0.001$) (GRADE: low). Differences between the 2 studies may reflect variations in the measure of aspirin use. While Khunti et al (14) assessed use across all patients, Campbell et al (10) accounted for patients who were contraindicated for Aspirin use.

Table 18: Number of Appropriate Prescriptions With Specialized Nursing Care Versus Usual Care

Author, Year	Population	Definition	N	Proportion (%) Prescribed Appropriate Therapy at Follow-Up		RR or OR (95% CI)[a]	*P* Value
				Nursing Intervention	Usual Care		
Glucose-Lowering Therapy							
Houweling et al, 2011 (13)	Diabetes	Intensification of glucose lowering therapy if HbA1c ≥ 7	120	53/64 (82.8)	28/56 (50)	RR 1.66 (1.26–2.20)[a]	0.0005[a]
		Referred to internist for insulin	206	10/102 (9.8)	2/104 (1.9)	RR 5.10 (1.15–22.7)[a]	0.03[a]
Blood Pressure Medications							
Houweling et al, 2011 (13)	Diabetes	Intensified blood pressure medication if > 140/90 mm Hg	170	42/85 (49.4)	24/85 (28.2)	RR 1.75 (1.17–2.61)[a]	0.01[a]
Lipid Medications							
Houweling et al, 2011 (13)	Diabetes	Intensified cholesterol therapy if not at target	55	13/29 (44.8)	13/26 (50.0)	RR 0.90 (0.51–1.57)[a]	0.70[a]
Khunti et al, 2007 (14)	CAD	Lipid lowering	1,080	275/461 (59.6)	322/419 (52.0)	OR 1.99 (1.06–3.74)[b]	0.03
Aspirin Therapy							
Khunti et al, 2007 (14)	CAD	Aspirin	1,080	314/461 (68.1)	411/619 (66.4)	OR 1.08 (0.84–1.40)[b]	0.55
Campbell et al, 1998 (10)	CAD	Aspirin taken or contraindicated	1,137	466/575 (81)	373/562 (66.4)	OR 3.22 (2.15–4.80)[b]	< 0.001
Cardiac Medications (Primary Outcomes)							
Khunti et al, 2007 (14)	CAD + prior MI	Beta-blocker	586	125/249 (50.2)	141/337 (41.8)	OR 1.43 (1.19–1.99)[b]	0.03
	LVSD	ACE inhibitor	126	33/51 (64.7)	51/68 (68.0)	OR 0.57 (0.14–2.32)	0.15
Cardiac Medications (Secondary Outcomes)							
Khunti et al, 2007 (14)	CAD + prior MI	ACE inhibitor	489	84 (39.4)	117 (42.4)	OR 0.97 (0.68–1.43)	0.93
	LVSD	ACE or ARB	126	43/51 (84.3)	62/68 (82.7)	OR 0.57 (0.14–2.32)	0.43
		Beta-blocker	126	20/51 (39.2)	28/68 (37.3)	OR 1.72 (0.25–11.82)	0.58
		Carvedilol or bisoprool	126	17/51 (33.3)	18/68 (24.0)	OR 2.75 (0.63–11.86)	0.17
Vaccinations							
Litaker et al, 2003 (15)	Diabetes	Influenza vaccination	157	62/79 (78)	37/78 (47)	RR 1.91 (1.43–2.56)[a]	< 0.0001
		Pneumovax (if unvaccinated)	93	32/44 (72.7)	12/52 (23.1)	RR 3.15 (1.86–5.34)[a]	< 0.0001

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin-receptor blocker; CAD, coronary artery disease; CI, confidence interval; LVSD, left ventricular systolic dysfunction; MI, myocardial infarction; OR, odds ratio; RR, relative risk.

[a]Relative risks and *P* values calculated using Review Manager.

[b]Adjusted for baseline, age, sex, and practice.

Efficiency

Number of Visits

Two studies commented on the number of visits to allocated providers among patients with type 2 diabetes. Houweling et al (13) found a mean increase of 3.3 visits to the practice nurse group (6.1 versus 2.8) in comparison to the physician group ($P < 0.001$) (GRADE: low). Litaker et al (15) stated there was a significant increase in the number of visits related to hypertension or diabetes among patients randomized to the NP–physician team compared to the physician alone ($P < 0.001$). However, no estimates were provided and, as a result, these outcomes were not included in the body of evidence.

Length of Visits

Both the studies (13) provided data on the mean length of visits with each provider or the average contact time (Table 19). Houweling et al (13) found a significant increase of 11 minutes in the average length of visit with the practice nurse in comparison to the general practitioner ($P < 0.001$). The study also found a significant increase of 100 minutes in average contact time. It was not stated if visits with the physician were only those related to diabetes, or all-cause visits. Litaker et al (15) found a significant increase in the average contact time (MD 95 minutes; $P < 0.0001$) related to diabetes or hypertension in patients seeing the nurse–physician team compared to the physician alone.

Table 19: Mean Length of Visits With Specialized Nursing Care Versus Usual Care

Author, Year	Population	Measure	N	Time, Minutes		*P* Value
				Nursing Intervention	Usual Care	
Houweling et al, 2011 (13)	Diabetes	Average length of visit	206	21	10	< 0.001
		Average contact time		128	28	Significant difference
Litaker et al, 2003 (15)	Diabetes	Average contact time	157	180[a]	85[a]	< 0.001

[a]Excluding time spent managing problems by telephone.

Physician Workload

Physician workload or collaboration between nurses and physicians was assessed in 4 studies (2 diabetes, 1 CAD, 1 chronic disease). (10;13;15;16) Two studies provided data on the amount of nurse-physician collaboration in the intervention arm, and 2 studies reported on the change in physician workload before and after the introduction of a nursing intervention.

Diabetes

Table 20 presents the amount of nurse–physician collaboration for diabetes patients receiving specialized nursing care. In the study by Litaker et al, (15) a physician addressed diabetes or hypertension in approximately 40% of patient visits. However, these were stated to be for low-complexity issues generally related to medication addition, deletion, or titration. The total number of visits was not provided. Physicians in the Houweling et al (13) study had a median of 1.4 consultations per patient with the nurse (interquartile range 1–2) in the nursing arm, with a median time of 1 minute. Overall, it remains unclear if the addition of a specialized nurse improved efficiency in these studies.

Table 20: Amount of Collaboration Between Specialized Nurses and Physicians

Author, Year	Population	Measure	N	Estimate (IQR)
Houweling et al, 2011 (13)	Diabetes	Median number of physician consultations with nurse, per patient	206	1.4 (0–2)
		Median time per physician-nurse consultation		1 minute (0–3.3)
Litaker et al, 2003 (15)	Diabetes	Percentage of visits physician addressed diabetes or hypertension	157	40%

Abbreviation: IQR, interquartile range.

CAD

Campbell et al (10) found no significant difference in the change in mean number of physician consultations between groups after the introduction of the nurse-led CAD clinics (mean of 1 consultation/patient in both groups at 1 year; $P = 0.488$). It is uncertain how the estimation of physician consultations was determined (GRADE: low).

Chronic Disease

Laurant et al (16) was the only study to directly evaluate objective and subjective physician workload as a primary outcome before and after the addition of an NP to the general practice team. Results are presented in Table 21.

Objective workload was measured by diary, where over 28 consecutive days general practitioners (GPs) recorded the start and end of their working day, and the number of patient consultations. Overall, there was a nonsignificant increase in the mean difference in number of contacts per week by GPs during surgery hours among practices with the NP intervention. This was reflected by a nonsignificant decrease in mean number of out-of-hours contacts in the intervention group. This pattern was similarly observed when looking at time spent consulting for COPD or asthma patients, where GPs had significantly more surgery hour contacts per week after the addition of the NP (MD 2.82; $P = 0.006$), and a nonsignificant decrease in out-of-hours contacts. The GRADE for the objective workload body of evidence was low.

Table 21: Mean Difference in Change in Objective Workload After Adding a Nurse Practitioner

Author, Year	Population	Measure	N	Change in Mean Number of Contacts/Week (95% CI)		Mean Difference in Change[c]	*P* Value
				Nursing Intervention	Usual Care		
Laurant et al, 2004 (16)	Chronic: COPD, asthma, dementia, or cancer	Surgery hours[a]	30 GPs (4 groups, 20 practices)/ 19 GPs (3 groups, 14 practices)	Total: 4.5 (0.6–8.3)	Total: 0.1 (–1.9 to 2.2)	4.4	0.06
				COPD/asthma: 2.8 (0.3–5.3)	COPD/asthma: –0.2 (–1.4 to 1.1)	2.8	0.01
		Out of hours[b]		Total: –1.5 (–3.9 to 0.9)	Total: 2.1 (–1.3 to 5.5)	–3.6	0.22
				COPD/asthma: –1.5 (–3.0 to –0.03)	COPD/asthma: 0.7 (–0.9 to 2.2)	–2.2	0.09

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; GP, general practitioner.
[a]Standardized by median number of days worked.
[b]Standardized by mean number of shifts.

Subjective physician workload was assessed via validated questionnaire. There was no significant difference in any of the 4 subjective workload components of available time, job satisfaction, inappropriate demands, or cost benefit when a NP was added to the general practitioner practice (GRADE: low).

Summary

An overall summary of outcomes for nursing Models 1 and 2 is presented in Table 22.

Table 22: Summary of Outcomes

Population	Health Resource Utilization	Disease-Specific Measures	HRQOL/Patient Satisfaction	Process Indicators	Efficiency
Model 1: Nurse Versus Physician (Usual Care)					
Primary care population oversampled with chronic disease	No significant difference in hospitalizations, ED visits, specialist visits, or primary care visits	No significant difference in systolic blood pressure or peak flow; significant decrease in diastolic blood pressure	No significant difference in SF-36	NR	Nurses directly substituted care provided by physicians
GRADE	**Moderate**	**Very Low**	**Moderate**	NA	
Diabetes subgroup	No significant difference in hospitalizations, ED visits, specialist visits, or primary care visits	No significant difference in HbA1c	No significant difference in SF-36	Significant increase or no significant difference in education and monitoring of health	
GRADE	**Very low**	**Very low**	**Very low**	**Very low**	
Model 2: Nurse and Physician Versus Physician (Usual Care)					
Diabetes	Significant increase in number of visits	Significant decrease in HbA1c; no significant difference in target HbA1c, blood pressure, or cholesterol	Inconclusive HRQOL; significant increase in patient satisfaction	Trend toward significant improvement	Indeterminate
GRADE	**Low**	**Low–Moderate**	**Low–Moderate**	**Low–Moderate**	—
CAD/coronary heart disease	Significant increase in hospitalizations; no significant difference in length of stay	Significant increase in achievement of target blood pressure, cholesterol, and lifestyle control, and management of blood pressure and cholesterol	Inconclusive HRQOL	Trend toward significant improvement	No difference in change in number of physician consultations
GRADE	**Low**	**Low–Moderate**	**Moderate**	**Low–Moderate**	**Low**
Chronic disease	NR	NR	NR	NR	No significant difference in total surgery hours or out of hours and significant increase in COPD/asthma hours; no difference in subjective physician workload
GRADE	NA	NA	NA	NA	**Low**

Abbreviations: CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; ED, emergency department; HbA1c, hemoglobin A1c; HRQOL, health-related quality of life; LOS, length of stay; SF-36, Short Form (36) Health Questionnaire.

Limitations

There are several limitations that need to be considered when evaluating the strength of this evidence-based analysis. Although all studies included were randomized controlled trials, there was heterogeneity in the roles and training of specialized nurses, and the types of primary health care practices and settings in which the studies were conducted. None of the studies was conducted in Canada, and, as a result, there are limitations to the applicability of the results to the Ontario context, particularly related to the degree of training and scope of practice of nurses. Additionally, most outcomes were evaluated over a 12-month follow-up period, which may not be adequate time to observe an impact.

Only 1 study was identified under Model 1, which was not designed to assess equivalence across all outcomes. This study population was oversampled with chronic disease and, therefore, may not represent a true chronic disease population. A subgroup analysis was undertaken, limited to diabetes patients. However, this analysis was underpowered and may comprise type 2 errors. Additionally, the majority of patients in this study were Hispanic, which limits the generalizability.

Overall, it was unclear in the studies examining Model 2 whether the nurses were substituting or supplementing the role of the physician. The improvement of efficiency in the primary health care setting was only directly evaluated by one study. This study observed an increase in the mean number of physician consultations per week during practice hours, and a trend towards a decrease in out-of-hours time. There remains uncertainty in these estimates as the physicians were responsible for determining which patients were referred to the nurses, and no data was provided on the number of patients referred to the nurse, the characteristics of the patients they dealt with, or the type of collaboration between the nurse and the physicians. Additionally, although nurses in this study were stated as being NPs, they had a limited scope of practice compared to NPs in Ontario.

Conclusions

Model 1

The effectiveness of specialized nurses working under Model 1 was evaluated based on comparable outcomes between nurses and physicians (usual care). This model aims to improve efficiency by directly substituting the role of the physician with a specialized nurse. Results from the evidence-based analysis found specialized nurses providing autonomous patient care to a primary health care population oversampled with chronic disease demonstrated comparable outcomes to physician care alone. Outcomes were similarly comparable among the subgroup of patients with diabetes. Specialized nurses in this model most closely resemble NPs in the Ontario context.

Based on moderate quality of evidence, there was no significant difference among patients receiving primary health care from NPs in comparison to physicians alone for outcomes related to:

- health resource utilization (hospitalizations, ED or urgent care visits, specialist visits, and primary health care visits)
- HRQOL based on the SF-36
- patient satisfaction with care

Diabetes Subgroup

Based on very low quality of evidence, there was no significant difference between patients receiving primary health care from specialized nurses and those being cared for by physicians for:

- health resource utilization (hospitalizations, ED or urgent care visits, specialist visits, and primary health care visits)
- HbA1c

Model 2

When compared to physicians alone or usual care, specialized nurses working with physicians showed a general increase in process measures related to clinical examinations and medication management based on guidelines. This was reflected by a significant reduction in HbA1c among diabetes patients, and a significant increase in the proportion of CAD patients with controlled blood pressure and total cholesterol. Patients receiving secondary prevention for CAD from a nurse-led secondary prevention clinic were significantly less likely to be hospitalized after 1 year. Patients were more satisfied with care provided by the nurse plus physician intervention compared to the physician alone. However, there was inconsistency regarding outcomes related to HRQOL. No outcomes indicated specialized nursing interventions to be more harmful than physicians alone.

The specific role of the specialized nurse in supplementing or substituting physician care was unclear, making it difficult to determine the impact on efficiency. Further research is needed to understand the impact of specialized nurses on primary health care efficiency.

Specialized nurses plus physicians had a positive significant impact when compared to usual care:

- based on moderate quality of evidence for the CAD or CHF population
  - proportion meeting appropriate threshold of blood pressure and cholesterol control
  - proportion with appropriate blood pressure management and cholesterol management
  - number of clinical examinations for blood pressure, BMI and smoking status

  - number of echocardiography assessments for confirmation of CHF, among unconfirmed cases
  - number of prescriptions for a beta-blocker among individuals with a prior MI
- based on moderate quality of evidence for the diabetes population
  - HbA1c
  - patient satisfaction
  - number of foot examinations
  - number with intensification of glucose lowering therapy if uncontrolled HbA1c, intensification of blood pressure lowering therapy if uncontrolled blood pressure, or referral to internist for insulin
- based on low quality of evidence for the CAD population
  - all-cause hospitalizations
  - proportion achieving lifestyle control related to physical activity and low-fat diet
- based on low quality of evidence for the diabetes population
  - number of primary healthcare visits to randomized group

There was no significant difference in patients receiving chronic disease management from specialized nurses compared to usual care for:

- based on moderate quality of evidence for the CAD or CHF population
  - number of clinical examination of cholesterol
  - number of prescriptions for an ACE inhibitor if confirmed LVSD
- based on moderate quality of evidence for the diabetes population
  - number with intensification of cholesterol therapy if not controlled
- based on low quality of evidence for the diabetes population
  - proportion of patients meeting HbA1c, blood pressure, or total cholesterol target values
- based on low quality of evidence for the CAD or CHF population
  - length of hospital stay
  - proportion of non-smokers
  - mean difference in the number of physician consultations before and after the introduction of the nurse-led clinic
- based on low quality of evidence for the chronic disease population
  - objective and subjective physician workload

There was indeterminate or inconsistent evidence, with a trend towards improved outcomes among the nurse-led group, for:

- based on moderate quality of evidence for the CAD or CHF population
  - SF-36 measures of HRQOL
  - angina-specific measures of HRQOL
- based on low quality of evidence for the diabetes population
  - SF-36 and SF-12 measures of HRQOL
  - diabetes-specific measures of HRQOL
  - ophthalmologist exam

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

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Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE
Search date: May 3, 2012
Database: Ovid MEDLINE(R) <1946 to April Week 4 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <May 02, 2012>, Embase <1980 to 2012 Week 17>
Search Strategy:
---
1 exp Coronary Artery Disease/ (223512)
2 exp Myocardial Infarction/ use mesz (135828)
3 exp heart infarction/ use emez (226111)
4 (coronary artery disease or cad or heart attack).ti. (46076)
5 ((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti. (154179)
6 or/1-5 (560881)
7 exp Atrial Fibrillation/ use mesz (29058)
8 exp heart atrium fibrillation/ use emez (58501)
9 ((atrial or atrium or auricular) adj1 fibrillation*).ti,ab. (77417)
10 or/7-9 (104258)
11 exp heart failure/ (312234)
12 ((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab. (244965)
13 11 or 12 (397186)
14 exp Stroke/ (185400)
15 exp Ischemic Attack, Transient/ use mesz (16571)
16 exp transient ischemic attack/ use emez (20600)
17 exp stroke patient/ use emez (5831)
18 exp brain infarction/ or exp cerebrovascular accident/ use emez (105307)
19 (stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab. (295295)
20 or/14-19 (409281)
21 exp Diabetes Mellitus, Type 2/ use mesz (70992)
22 exp non insulin dependent diabetes mellitus/ use emez (108768)
23 exp diabetic patient/ use emez (13793)
24 (diabetes or diabetic* or niddm or t2dm).ti,ab. (801951)
25 or/21-24 (828073)
26 exp Skin Ulcer/ (74585)
27 ((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab. (29869)
28 (decubitus or bedsore*).ti,ab. (8754)
29 or/26-28 (94113)
30 exp Pulmonary Disease, Chronic Obstructive/ use mesz (17962)
31 exp chronic obstructive lung disease/ use emez (57639)
32 (chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab. (57361)
33 (copd or coad).ti,ab. (48369)
34 chronic airflow obstruction.ti,ab. (1087)
35 exp Emphysema/ (38390)
36 exp chronic bronchitis/ use emez (7071)

37 ((chronic adj2 bronchitis) or emphysema).ti,ab. (52147)
38 or/30-37 (165549)
39 exp Chronic Disease/ (353302)
40 ((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab. (231548)
41 39 or 40 (527877)
42 6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 (2716853)
43 exp nursing discipline/ or exp nurse/ or exp Team Nursing/ or exp nurse attitude/ or exp nurse patient relationship/ or exp doctor nurse relation/ or exp nursing staff/ use emez (341407)
44 exp Nursing/ or exp nurse's practice patterns/ or exp nursing, team/ or exp nurses/ or exp nursing staff/ or exp Nurse's Role/ or exp Nurse-Patient Relations/ or exp physician-nurse relations/ or exp Nursing Process/ or exp nursing care/ or exp nursing services/ or exp Nursing Faculty Practice/ use mesz (784042)
45 (nurse or nurses or nursing).ti,ab. (614066)
46 or/43-45 (1006663)
47 42 and 46 (62317)
48 exp Intermediate Care Facilities/ use mesz (601)
49 (intermedia* adj2 care).ti,ab. (2489)
50 exp ambulatory care/ (77241)
51 exp Ambulatory Care Facilities/ use mesz (40298)
52 exp ambulatory care nursing/ use emez (9)
53 exp Outpatients/ use mesz (7332)
54 exp Outpatient Department/ use emez (33551)
55 exp outpatient care/ use emez (18025)
56 exp Community Health Services/ use mesz (450632)
57 exp community care/ use emez (88690)
58 exp Community Medicine/ (3924)
59 exp Subacute Care/ use mesz (711)
60 exp General Practice/ (125169)
61 exp Primary Health Care/ (158229)
62 exp Physicians, Family/ or exp general practitioners/ or exp Physicians, Primary Care/ use mesz (64103)
63 exp general practitioner/ use emez (48542)
64 exp family medicine/ use emez (5963)
65 exp Group Practice/ use mesz (22251)
66 exp Team Nursing/ use emez (23)
67 exp Primary Care Nursing/ use mesz (39)
68 exp Patient Care Team/ use mesz (49665)
69 exp Teamwork/ use emez (9390)
70 *Patient Care Management/ use mesz (1274)
71 ((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)).ti,ab. (343246)
72 ((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*)).ti,ab. (50531)
73 (team* or liaison).ti,ab. (185842)
74 ((general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nurse* or physician*)).ti,ab. (221390)
75 or/48-74 (1391621)
76 47 and 75 (21187)
77 limit 76 to (controlled clinical trial or meta analysis or randomized controlled trial) (1745)
78 exp Technology Assessment, Biomedical/ or exp Evidence-based Medicine/ use mesz (65746)

79 exp Biomedical Technology Assessment/ or exp Evidence Based Medicine/ use emez (561797)
80 (health technology adj2 assess$).ti,ab. (3321)
81 exp Random Allocation/ or exp Double-Blind Method/ or exp Control Groups/ or exp Placebos/ use mesz (393767)
82 Randomized Controlled Trial/ or exp Randomization/ or exp RANDOM SAMPLE/ or Double Blind Procedure/ or exp Triple Blind Procedure/ or exp Control Group/ or exp PLACEBO/ use emez (944772)
83 (random* or RCT).ti,ab. (1316536)
84 (placebo* or sham*).ti,ab. (430858)
85 (control* adj2 clinical trial*).ti,ab. (36726)
86 meta analysis/ use emez (62532)
87 (meta analy* or metaanaly* or pooled analysis or (systematic* adj2 review*) or published studies or published literature or medline or embase or data synthesis or data extraction or cochrane).ti,ab. (270753)
88 or/77-87 (2267776)
89 76 and 88 (3579)
90 limit 89 to english language (3366)
91 remove duplicates from 90 (2472)

CINAHL

#	Query	Results
S54	S50 and S53 Limiters - English Language	589
S53	S51 or S52	157536
S52	random* or sham*or rct* or health technology N2 assess* or meta analy* or metaanaly* or pooled analysis or (systematic* N2 review*) or published studies or medline or embase or data synthesis or data extraction or cochrane or control* N2 clinical trial*	149343
S51	(MH "Random Assignment") or (MH "Random Sample+") or (MH "Meta Analysis") or (MH "Systematic Review") or (MH "Double-Blind Studies") or (MH "Single-Blind Studies") or (MH "Triple-Blind Studies") or (MH "Placebos") or (MH "Control (Research)")	84296
S50	S31 and S49	5113
S49	S32 or S33 or S34 or S35 or S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48	217022
S48	((general or family or primary care or community) N2 (practic* or clinic* or program* or doctor* or nuse* or physician*))	42038
S47	(team* or liaison)	51641
S46	((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) N2 (care or team*)).	30029
S45	((primary or family or community or outpatient* or ambulatory) N2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))	120243
S44	(MH "Team Nursing") OR (MH "Primary Nursing")	1283
S43	(MH "Multidisciplinary Care Team+")	18485
S42	(MH "Group Practice+")	5857
S41	(MH "Physicians, Family")	7173

S40	(MH "Primary Health Care")	24977
S39	(MH "Family Practice")	9153
S38	(MH "Community Medicine")	22
S37	(MH "Community Programs")	3902
S36	(MM "Community Health Services") OR (MH "Community Health Nursing+") OR (MH "Community Networks") OR (MH "Family Services") OR (MH "Occupational Health Services+")	31665
S35	(MH "Outpatients")	27057
S34	(MH "Outpatient Service")	3001
S33	(MH "Ambulatory Care") OR (MH "Ambulatory Care Facilities+") OR (MH "Ambulatory Care Nursing")	13382
S32	(MH "Subacute Care")	975
S31	S27 or S26 or S29 or S33 or S31 or S28 or S27 or S30	30611
S30	S28 or S29	28893
S29	chronic*N2 disease* or chronic* N2 ill*	7650
S28	(MH "Chronic Disease")	24261
S27	(S27 or S26 or S25 or S26)	1861
S26	chronic N2 bronchitis or emphysema	1849
S25	(MH "Emphysema")	908
S24	chronic obstructive N2 disease* or chronic obstructive N2 disorder* or copd or coad	7641
S23	(MH "Pulmonary Disease, Chronic Obstructive+")	5670
S22	S30 or S29	51
S21	pressure N1 ulcer* or bedsore* or bed N1 sore* or skin N1 ulcer* OR pressure N1 wound* OR decubitus	9771
S20	(MH "Skin Ulcer+")	15062
S19	S34 or S33 or S32	45
S18	diabetes or diabetic* or niddm or t2dm	71792
S17	(MH "Diabetic Patients")	3627
S16	(MH "Diabetes Mellitus, Type 2")	18872
S15	S30 or S31 or S32	74
S14	stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA	38660
S13	(MH "Cerebral Ischemia, Transient")	1948
S12	(MH "Stroke") OR (MH "Stroke Patients")	26348
S11	S27 OR S28	25
S10	myocardi*failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation or cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	19281

S9	(MH "Heart Failure+")	14847
S8	S26 OR S25	53
S7	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	8328
S6	(MH "Atrial Fibrillation")	6741
S5	S31 OR S30 OR S29 OR S28	76
S4	TI myocardi* N2 infarct* or TI heart N2 infarct* or TI cardiac N2 infarct* OR TI coronary N2 infarct* or TI arterioscleros* or TI atherosclerosis*	9820
S3	coronary artery disease OR cad OR heart attack*	7863
S2	(MH "Myocardial Infarction+")	19665
S1	(MH "Coronary Arteriosclerosis")	4863

Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	300
2	(coronary artery disease or cad or heart attack*):TI	223
3	((myocardi* or heart or cardiac or coronary) adj2 (atherosclerosis* or arteriosclerosis* or infarct*)):TI	232
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	277
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	181
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	500
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	293
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	668
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	42
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	640
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	631
13	(diabetes or diabetic* or niddm or t2dm):TI	1276
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	280
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	76
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	291
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	228
19	(copd or coad):TI	116
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	11
22	((chronic adj2 bronchitis) or emphysema):TI	48
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	773
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	265
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	170
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	25
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	5011
28	MeSH DESCRIPTOR nursing EXPLODE ALL TREES	311
29	MeSH DESCRIPTOR Nurse-Patient Relations EXPLODE ALL TREES	20

30	MeSH DESCRIPTOR nursing staff EXPLODE ALL TREES	44
31	MeSH DESCRIPTOR nurses EXPLODE ALL TREES	118
32	MeSH DESCRIPTOR nursing, team EXPLODE ALL TREES	3
33	MeSH DESCRIPTOR physician-nurse relations EXPLODE ALL TREES	3
34	MeSH DESCRIPTOR Nursing Process EXPLODE ALL TREES	147
35	MeSH DESCRIPTOR Nursing care EXPLODE ALL TREES	219
36	MeSH DESCRIPTOR nursing services EXPLODE ALL TREES	281
37	MeSH DESCRIPTOR nursing faculty practice EXPLODE ALL TREES	0
38	MeSH DESCRIPTOR Nurse's Role EXPLODE ALL TREES	62
39	(nurse or nurses or nursing)	3334
40	#28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39	3497
41	MeSH DESCRIPTOR Intermediate Care Facilities EXPLODE ALL TREES	4
42	(intermedia* adj2 care)	39
43	MeSH DESCRIPTOR ambulatory care EXPLODE ALL TREES	346
44	MeSH DESCRIPTOR Ambulatory Care Facilities EXPLODE ALL TREES	205
45	MeSH DESCRIPTOR Outpatients EXPLODE ALL TREES	73
46	MeSH DESCRIPTOR Community Health Services EXPLODE ALL TREES	4099
47	MeSH DESCRIPTOR Community Medicine EXPLODE ALL TREES	3
48	MeSH DESCRIPTOR Subacute Care EXPLODE ALL TREES	7
49	MeSH DESCRIPTOR Primary Health Care EXPLODE ALL TREES	673
50	MeSH DESCRIPTOR Physicians, Family EXPLODE ALL TREES	50
51	MeSH DESCRIPTOR Group Practice EXPLODE ALL TREES	65
52	MeSH DESCRIPTOR Patient Care Team EXPLODE ALL TREES	207
53	MeSH DESCRIPTOR Patient Care Management EXPLODE ALL TREES	2512
54	(((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))) OR (((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*))) OR (team* or liaison) OR (general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nuse* or physician*)))	2135
55	#41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54	7583
56	#27 AND #40 AND #55	297

Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2250
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7854
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8562
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2159
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2357
#6	MeSH descriptor **Heart Failure** explode all trees	4818
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or	5347

	decompensation or insufficiency)):ti	
#8	MeSH descriptor **Stroke** explode all trees	4020
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	469
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	10009
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	7179
#12	(diabetes or diabetic* or niddm or t2dm):ti	16895
#13	MeSH descriptor **Skin Ulcer** explode all trees	1599
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	673
#15	(decubitus or bedsore*):ti	100
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1804
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2436
#18	(copd or coad):ti	3352
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	92
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1184
#22	MeSH descriptor **Chronic Disease** explode all trees	10019
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1702
#24	MeSH descriptor **Comorbidity** explode all trees	1987
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	654
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	69160
#27	MeSH descriptor **Intermediate Care Facilities** explode all trees	13
#28	(intermedia* NEAR/2 care):ti or (intermedia* NEAR/2 care):ab	95
#29	MeSH descriptor **Ambulatory Care Facilities** explode all trees	1424
#30	MeSH descriptor **Outpatients** explode all trees	692
#31	MeSH descriptor **Community Health Services** explode all trees	19917
#32	MeSH descriptor **Community Medicine** explode all trees	34
#33	MeSH descriptor **Subacute Care** explode all trees	16
#34	MeSH descriptor **General Practice** explode all trees	2113
#35	MeSH descriptor **Primary Health Care** explode all trees	2928
#36	MeSH descriptor **Physicians, Family** explode all trees	445
#37	MeSH descriptor **General Practitioners** explode all trees	31
#38	MeSH descriptor **Physicians, Primary Care** explode all trees	21
#39	MeSH descriptor **Group Practice** explode all trees	378
#40	MeSH descriptor **Primary Care Nursing** explode all trees	1

#41	MeSH descriptor **Patient Care Team** explode all trees	1177
#42	MeSH descriptor **Patient Care Management** explode all trees	13149
#43	((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ti and ((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ab	2110
#44	(transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ti or (transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ab	1115
#45	((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ti or ((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ab	8087
#46	(team* or liaison):ti or (team* or liaison):ab	3183
#47	(#27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46)	39299
#48	(#26 AND #47)	5315
#49	MeSH descriptor **Nurse's Role** explode all trees	269
#50	MeSH descriptor **Nursing** explode all trees	2702
#51	MeSH descriptor **Nurse's Practice Patterns** explode all trees	17
#52	MeSH descriptor **Nurses** explode all trees	824
#53	MeSH descriptor **Nursing, Team** explode all trees	18
#54	MeSH descriptor **Nursing Staff** explode all trees	447
#55	MeSH descriptor **Nurse-Patient Relations** explode all trees	265
#56	MeSH descriptor **Physician-Nurse Relations** explode all trees	19
#57	MeSH descriptor **Nursing Process** explode all trees	1741
#58	MeSH descriptor **Nursing Care** explode all trees	1437
#59	MeSH descriptor **Nursing Services** explode all trees	1373
#60	MeSH descriptor **Nursing Faculty Practice** explode all trees	4
#61	(nurse or nurses or nursing):ti and (nurse or nurses or nursing):ab	2300
#62	(#49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61)	6577
#63	(#48 AND #62)	871

Appendix 2: Summary of Systematic Reviews

Table A1: Summary of Systematic Reviews

Author, Year	Type of Review	Search Dates	Number of Studies	Type of Intervention and Nurse	Disease	Setting	Outcomes Evaluated	Conclusions	Overall Relevance to Current Review
Nurses in Primary Care (General)									
Browne et al, 2012 (17)	Review of high-quality systematic reviews and studies	2004–2011	27 reviews, 29 studies	Stratified by model of intervention (nurse-involved versus nurse-led and nurse training) All nurses (mainly NPs)	All	All; stratified by acute, community/ primary care or long-term care	Mortality, morbidity, access, waiting time, QOL, hospitalizations, length of stay, ED visits, economics	Effect/cost reviews: 13 more/less; 6 more/same; 4 equal/less; 3 equal/equal; 1 more/more Effect/cost studies: 12 more/less; 2 more/equal; 7 equal/less; 5 equal/equal; 3 equal/more	Mixture of settings, conditions, and type of nurses Very few primary care plus chronic disease studies
Newhouse et al, 2011 (18)	Systematic review of United States studies	1990–2008	69 studies (20 RCTs; 37 NPs, 11 clinical nurse specialists)	APNs (NPs, clinical nurse specialists, nurse midwives, nurse anesthetists)	All	All	Patient satisfaction, perceived health, functional status, disease-specific, ED visits, hospitalizations, length of stay, mortality	APNs provide effective and high-quality patient care in the United States	Mixed populations, setting and interventions Both observational and RCTs included
Laurant et al, 2009 (19)	Systematic review and meta-analysis	Up to 2002	16 studies (13 RCTs)	Substitution of doctors All types of nurses	All (4 in specific chronic conditions)	Primary care	Patient-level, process of care, resource utilization, direct and indirect costs	Nurses can produce as high quality care as primary care doctors and as good health outcomes	Mixed populations, mainly general primary care
Keleher et al, 2009 (20)	Systematic review	1966–2007	Substitution: 2 reviews, 7 RCTs Supplementation: 1 review 19 RCTs	Substitution and supplementation All types of nurses	All	Primary care (included community)	Mortality, QOL, compliance, knowledge, satisfaction, resource use	Nurses can provide effective care and achieve positive health outcomes for patients similar to doctors Nurses are effective in diverse range of roles Insufficient evidence about nurses roles and impact on patient outcomes	Mixed diseases, included community interventions, excluded NPs with autonomous assessment of patients or diabetes/respiratory nurses, included nurses solely providing education/coaching

Dennis et al, 2009 (21)	Systematic review (tally of positive outcome measures)	1999–2007	46 papers (30 RCTs); 21 studies of nurses	Substitution of GPs Nurses (all types) or pharmacists involved in the planning and delivery of continuous care	Adults aged 65 years and over living in the community	Community	Adherence to guidelines, patient service use, disease-specific measures, QOL, health status, patient satisfaction, functional status	Nurses can effectively provide disease management and/or health promotion for older people with chronic disease in primary care While there were improvements in patient outcomes, no reduction in health service use was evident It is important that health professional roles be complementary, otherwise they may duplicate tasks	Not all primary care studies, not all chronic diseases of interest; mixed interventions with specific nursing roles unclear
Horrocks et al, 2002 (22)	Systematic review and meta-analysis	1966–2001	23 observational, 11 RCTs	Substitution of physicians by NPs	All	Primary care	Satisfaction, process measures (length of visit, prescriptions, investigations, return consultations, referrals)	Increasing availability of NPs in primary care is likely to lead to high levels of patient satisfaction and high quality of care	Studies primarily in general primary care without chronic disease
Nurses for Specific Diseases									
Clark et al, 2011 (23)	Systematic review and meta-analysis	2002–2009	11 RCTs	Any intervention conducted by nurses compared to usual doctor-led care (primarily nurse-led clinics)	Hypertension and diabetes	Primary and secondary care	Blood pressure (absolute, changes, proportion reaching target and proportion taking meds)	Some evidence for improved blood pressure outcomes with nurse-led interventions; nurses require an algorithm to structure care; more work is needed	Combination of settings, interventions variable: education multiple providers, home care, lifestyle advice, group self-management
Allen et al, 2010 (24)	Systematic review	2000–2008	55 RCTs	Interventions with a major nursing component	CAD or heart failure	All	Reported all primary clinical outcome measures from each trial (outcomes not prespecified for review)	Most trials demonstrated a beneficial impact of nursing interventions for secondary prevention in CAD or heart failure; optimal combination of intervention components remains unknown	All settings; variable interventions (case management, medication management, education, counselling and support, clinics, home-based, telephone or technology-based)

Loveman et al, 2009 (25)	Systematic review	Up to 2002	6 studies (5 RCTs)	Diabetes specialist nurses (in addition to routine care)	Type 1 and 2 diabetes (3 RCTs in type 2)	Hospital, community, home (mixed)	HbA1c; ED visits, hospitalizations, QOL	Diabetes specialist nurse/nurse case manager may improve diabetes control over short time periods, but effects over longer periods not evident. No significant differences in glycemic episodes, hospitalizations or QOL	Type 1 and 2 diabetes; all settings; among studies of nurses in primary care for type 2 diabetes mainly provided telephone follow-up
McHugh et al, 2009 (26)	Narrative systematic review	1999–2009	6 systematic reviews, 9 empirical studies (5 RCTs)	Specialist community nurses (specialist training within community and primary care)	COPD and musculoskeletal conditions	Community and primary care	Patient outcomes	In patients with COPD, there was evidence of effectiveness of some interventions carried out by nurses, particularly in relation to hospital at home/early discharge roles. Findings were mixed for case management or programs to promote self-care	Not all primary care; COPD studies primarily of nurses providing in-home or phone care, discharge planning, case management or care coordination
Jonsdottir et al, 2007 (27)	Integrated review	1996–2006	16 studies (11 RCTs or reviews of RCTs)	Nursing care in clinics for COPD	COPD	Community, outpatient, and primary care	Not prespecified	Nurse clinics for COPD is in its infancy, more research needed	Primarily home care, telephone calls, education, or self-management
Taylor et al, 2005 (28)	Systematic review	1980–2005	9 RCTs	Interventions for chronic disease management, led, coordinated or delivered by nurses	COPD	Inpatient, outpatient, or community	QOL, exacerbations, pulmonary function, mortality, ED visits, outpatient visits, knowledge, readmission, symptoms	Little evidence to support the implementation of nurse led management interventions for COPD, but data too sparse to exclude benefit or harm	Primarily nurse case managers with discharge planning, home care or self-management/ education programs
Halcomb et al, 2004 (29)	Descriptive systematic review	1980–2004	16 RCTs	Role of practice nurses in HF management	Heart failure	Community	No synthesis of results, general summary of findings	Practice nurses represent a potentially useful adjunct to current models of service provision in heart failure management	Most nurses providing telephone or home care, care coordination or discharge planning

Abbreviations: APN, advance practice nurse; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; ED, emergency department; GP, general practitioner; HbA1c, hemoglobin A1c; NP, nurse practitioner; QOL, quality of life; RCT, randomized controlled trial.

Appendix 3: Summary of Included Studies

Table A2: Summary of Included Studies

Author, Year	Population	Setting	Patient Selection	Inclusion	Exclusion	Randomization	Average Baseline Characteristics	Data Collection/Measurements
Houweling et al, 2011 (13)	Type 2 diabetes	5 GPs from group practice in 1 region of the Netherlands	GPs patient information system and local pharmacy	Diagnosis of diabetes, medication for diabetes, HbA1c measured in last 3 years	No diagnosis of diabetes, type 1 diabetes, not treated in primary care, inability to participate, not willing to return for follow-up	Independent medical investigators Non-transparent, closed envelopes Sequential numbers (even and odd randomized)	Male, 48%; age, 68 years; diabetes duration, 7.5 years; HbA1c, 7.5%; systolic blood pressure/diastolic blood pressure, 159/87 mm Hg; total cholesterol, 5.4 mmol/L; BMI, 30 kg/m^2; feet at risk, 56%	All measures taken prior to randomization and 14 months QOL: SF-36, Patients' Evaluation of the Quality of Diabetes Care Visits: practice nurse kept records for intervention group, patient questioned for GP Process measures: not stated
Khunti et al, 2007 (14)	CAD/CHF	20 volunteer primary care practices (53 GPs) in 1 region of United Kingdom	Practice databases using disease registers and medication searches	Diagnosis of coronary heart disease (angina or past MI) or CHF was recorded or suggested by medications	None	Computer-generated case-control pairs (list size, number GPs, Jarman score, teaching status) randomly allocated nurses to practices Patients enrolled after	Male, 53%; age, 70.5 years; prior MI, 42%; mean years since MI, 8.9; angina, 87.5%; presumed HF, 31%; diabetes, 20%; peripheral vascular disease, 7.5%; hypertension, 53%	Process of care: general practice records QOL: SF-36 and Left Ventricular Dysfunction 36
Laurant et al, 2004 (16)	Chronic disease	Volunteer local groups and GPs in Netherlands	No patient selection (only GPs) 7 of 21 local groups volunteered to participate	None	None	Grouped local groups into matched pairs using deprivation of population and rurality Independent researchers randomly assigned 1 group from each pair with sealed opaque envelopes	No patient-level data; physician characteristics	Objective workload: 28-day diary Subjective workload: questionnaire
Litaker et al, 2003 (15)	Type 2 diabetes and hypertension	Department of general internal medicine in Ohio, United States	Direct physician referral or advertisements within the institution	Type 2 diabetes and mild to moderate hypertension, received primary care at study site, resident of Cleveland	None	Randomly allocated	Female, 58%; age 61 years; African-American, 59% HbA1c, 8.4%; total cholesterol, 5.5 mmol/L; blood pressure < 130/85 mm Hg, 9%; comorbid conditions, 1; Charlson comorbidity, 3.1	Process indicators from patient medical records QOL: SF-12, Diabetes Quality of Life Questionnaire Satisfaction: patient satisfaction questionnaire Clinical outcomes: measured at baseline and 12 months

Mundinger et al, 2000 (11)	General primary care (>50% chronic disease)	4 community-based primary care clinics (17 GPs) and 1 academic centre clinic (7 NPs)	Consecutive recruitment at ED/urgent care; prior diagnosis of asthma/ diabetes/ hypertension oversampled	No current primary care provider at the time of recruitment and planned to be in area for next 6 months	None	Randomly and blindly assigned in 2:1 ratio; later 1:1 ratio	Male, 25.5%; age, 44.5 years; 1 or more chronic disease listed, 51%; ethnicity, 88% Hispanic, 9.3% black, 1.1% white	Recruitment: SF-36 and patient demographics Satisfaction: telephone satisfaction questionnaire 6 month interview: SF-36, satisfaction Physiologic measures: taken by nurse Utilization data: medical system
Lenz et al, 2002 (Mundinger subgroup) (12)	Type 2 diabetes	As above	As above; subgroup self-reported type 2 diabetes	As above	As above	As above	Male 33.8%; age, 54.8 years; hypertension, > 50%; ethnicity, 91.5% Hispanic; Medicaid enrolled, 84.1	As above
Campbell et al, 1998 (9;10)	CAD	Randomly selected practices in Scotland	General practice case notes	Working diagnosis of coronary heart disease	Terminally ill, dementia, house-bound, or excluded at request of GP	Eligible patients stratified by age, sex, general practice, and randomized using tables of random numbers	Male, 58.4%; age, 66.1 years; prior MI, 45%; median years since MI, 5.5; angina, 50%; 1-year hospitalizations, 25%	QOL: SF-36, angina-type specification Hospitalizations: angina-type specification Clinical data: medial records Lifestyle factors: postal questionnaire

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; ED, emergency department; GP, general practitioner; QOL, quality of life; MI, myocardial infarction; SF-36, Short Form (36) Health Survey.

Appendix 4: GRADE Tables

Table A3: GRADE Evidence Profile for Comparison of Specialized Nurses and Physicians (Model 1)

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Quality
Hospitalizations, Chronic Disease						
1 (RCT)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Hospitalizations, Diabetes Subgroup						
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low
ED Visits, Chronic Disease						
1 (RCT)	Serious limitations (–1)	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
ED Visits, Diabetes Subgroup						
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low
Specialist/Outpatient Visits, Chronic Disease						
1 (RCT)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Specialist/Outpatient Visits, Diabetes Subgroup						
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low
Primary Care Visits, Chronic Disease						
1 (RCT)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Primary Care Visits, Diabetes Subgroup						
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low
Health-Related Quality of Life, Chronic						
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
HbA1c, Diabetes Subgroup						
1 (RCT)	Very serious limitations (–2)[bd]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low
Process Measures (Education, History, and Examinations)						
1 (RCT)	Very serious limitations (–2)[bde]	No serious limitations	No serious limitations	Serious limitations (–1)[c]	Undetected	⊕ Very Low

Abbreviations: ED, emergency department; No., number; RCT, randomized controlled trial.
[a]Large and unbalanced loss to follow-up between arms; patients not enrolled in the study differed significantly from enrolled patients.
[b]Results from a single subgroup analysis based on patient self-report of diabetes at baseline; major loss to follow-up with no intention-to-treat or comparison of patients who were enrolled and not enrolled.
[c]Low event rates and study does not meet optimal information size and therefore is likely underpowered.
[d]Only final Hba1c measured; no baseline measurement.
[e]Lack of blinding of nurses and physicians to enrolled patients may bias the recording of process measures.

Table A4: GRADE Evidence Profile for Comparison of Specialized Nurses + Physicians and Physicians (Model 2)—Health Resource Utilization and Disease-Specific Measures

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Quality
Hospitalizations						
1 (RCT), CAD	Very serious limitations (–2)[ab]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Hospital Length of Stay						
1 (RCT), CAD	Very serious limitations (–2)[ab]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Number of Visits						
1 (RCT), diabetes	Very serious limitations (–2)[cd]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Mean Change in HbA1c						
1 (RCT), diabetes	Serious limitations (–1)[e]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
HbA1c Below Threshold						
1 (RCT), diabetes	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (–1)[f]	Undetected	⊕⊕ Low
Blood Pressure Below Threshold						
2 (RCTs), diabetes	Serious limitations (–1)[ec]	No serious limitations	No serious limitations	Serious limitations (–1)[f]	Undetected	⊕⊕ Low
1 (RCT), CAD	Serious limitations (–1) [h]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Lipids Below Threshold						
1 (RCT), diabetes	Serious limitations (–1)[c]	No serious limitations	No serious limitations	Serious limitations (–1)[f]	Undetected	⊕⊕ Low
1 (RCT), CAD	Serious limitations (–1)[e]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Lifestyle Control						
1 (RCT), exercise, CAD	Very serious limitations (–2)[ag]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
1 (RCT), low-fat diet, CAD	Very serious limitations (–2)[ag]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
1 (RCT), not smoking, CAD	Very serious limitations (–2)[ag]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Health-Related Quality of Life						
2 (RCTs), SF-36/SF-12, diabetes	Serious limitations (–1)[ce]	Serious limitations (–1)	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
2 (RCTs), SF-36, CAD	Serious limitations (–1)[ah]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate

1 (RCT), diabetes-specific	Serious limitations (–1)[e]	No serious limitations	No serious limitations	Serious limitations (–1)[f]	Undetected	⊕⊕ Low
2 (RCTs), CAD-specific	Serious limitations (–1)[ah]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Patient Satisfaction						
1 (RCT), diabetes	Serious limitations (–1)[c]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate

Abbreviations: CAD, coronary artery disease; RCT, randomized controlled trial;SF-36, Short Form (36), Health Survey.

[a]No blinding and unknown allocation concealment; potential contamination with same nurses and physicians in both arms.
[b]Hospitalizations assessed based on patient self-report from health-related quality of life instrument.
[c]No blinding and no intention-to-treat analysis conducted.
[d]Number of visits based on patient self-report in physician arm and nurse report in other.
[e]No allocation concealment and blinding not stated; potential contamination as physicians had patients in both arms of the study.
[f]Study was not powered to look at this outcome.
[g]Lifestyle control based on patient questionnaire which is likely biased.
[h]Khunti, general: potential recruitment bias as patients recruited by physician *after* cluster randomization; a large proportion of patients were already meeting appropriate disease-specific control and thresholds at baseline.

Table A5: GRADE Evidence Profile for Comparison of Specialized Nurses + Physicians and Physicians (Model 2)—Process Measures

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Quality
Blood Pressure Management						
1 (RCT), CAD	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Cholesterol Management						
1 (RCT), CAD	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Foot Exams						
2 (RCTs), diabetes	Serious limitations (–1)[bc]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Ophthalmologist Referral						
2 (RCTs), diabetes	Serious limitations (–1)[bc]	Serious limitations (–1)	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Clinical Examinations (Blood Pressure, cholesterol, BMI, smoking, echocardiography)						
1 (RCT), CAD	Serious limitations (–1)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Medication Management (Appropriate glucose lowering therapy, insulin referral, Blood Pressure medication, lipid medication)						
1 (RCT), diabetes	Serious limitations (–1)[bc]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Medication Management (Vaccinations)						
1 (RCT), diabetes	Serious limitations (–1)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Medication Management (Cardiac Medications)						
1 (RCT), CAD	Serious limitations (–1)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕⊕ Moderate
Medication Management (Aspirin)						
2 RCTs - CAD	Serious limitations (–1)[ad]	Serious limitations (–1)	No serious limitations	No serious limitations	Undetected	⊕⊕ Low

Abbreviations: CAD, coronary artery disease; RCT, randomized controlled trial.

[a]No blinding and unknown allocation concealment; potential contamination with same nurses and physicians in both arms.

[b]No allocation concealment and blinding not stated; potential contamination as physicians had patients in both arms of the study.

[c]No intention-to-treat analysis conducted; more patients with feet at risk or foot issues at baseline.

[d] Potential recruitment bias as patients recruited by physician after cluster randomization.

Table A6: GRADE Evidence Profile for Comparison of Specialized Nurses + Physicians and Physicians (Model 2)—Efficiency Measures

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Quality
Objective Workload						
CAD	Serious limitations (–1)[a]	No serious limitations	No serious limitations	Serious limitations (–1)[b]	Undetected	⊕⊕ Low
Chronic disease	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low
Subjective Workload						
Chronic disease	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	No serious limitations	Undetected	⊕⊕ Low

Abbreviation: CAD, coronary artery disease.

[a]Unknown allocation concealment; potential contamination with the same nurses and physicians in both arms.

[b]Very small event rate, study was not powered to look at workload and unclear how this was measured.

[b]Unbalanced response rates between groups; use of an unvalidated diary to assess workload; potential variations between practices in relation to the role of the nurse.

Table A7: Risk of Bias for All Included Studies

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Houweling et al, 2011 (13)	No limitations	Limitations[a]	Limitations[b]	No limitations	Limitations[c]
Khunti et al, 2007 (14)	No limitations	Limitations[a]	No limitations	No limitations	Limitations[d]
Laurant et al, 2004 (16)	No limitations	Limitations[a]	Limitations[e]	No limitations	Limitations[f]
Litaker et al, 2003 (15)	Limitations[g]	Limitations[h]	No limitations	No limitations[i]	Limitations[j]
Mundinger et al, 2000 (11)	No limitations	Limitations[k]	No limitations[l]	No limitations	No Limitations
Lenz et al, 2002 (12) (subgroup of Mundinger)	No limitations	Limitations[k]	Limitations[m]	No limitations	Serious Limitations[n]
Campbell et al, 1998 (9;10)	Limitations[g]	Limitations[h]	No limitations	No limitations	Limitations[o]

[a]Not feasible to blind physicians, nurses or patients, however assessors were not stated as being blinded. Downgraded for subjective outcomes.
[b]10.4% loss to follow-up, with no intention-to-treat analysis conducted.
[c]Unbalanced number of patients with feet at risk at baseline, may effect process measures and health-related quality of life; number and length of visits based on patient self-report for the physician arm and average length of visit was applied whereas nurses reported length of visits in nursing arm.
[d]Potential recruitment bias as patients recruited by physician *after* cluster randomization.
[e]Unbalanced in nonresponse rates of physicians, with no intention-to-treat analysis conducted.
[f] Use of unvalidated diary to assess objective workload; number of patients with chronic disease in practices not reported and number of NP visits with patients not reported; physicians responsible for choosing which patients the nurse practitioner sees and the specific role of the nurse practitioner in the practice.
[g]Allocation concealment not stated.
[h]Not feasible to blind physicians, nurses or patients; however assessors were appropriately blinded to patients. Downgraded for subjective outcomes.
[i]Number of visits to emergency departments and outside providers was stated as being assessed, but results not reported; and selective reporting of estimates, confidence intervals and *P*-values; however, not downgraded as bias could not be confirmed.
[j]Potential contamination as physicians had patients in both arms of the study; powered to look at costs rather than outcomes.
[k]Patients and providers not blinded, but it was stated that no attempt was made to differentiate study patients in practice. Downgraded for subjective outcomes.
[l]Significant loss to follow-up, however subgroup analyses were stated as being conducted among all patients with data and intention-to-treat conduced on all health resource utilization outcomes.
[m]No intention-to-treat analysis stated, unclear if same methods as Mundinger were used.
[n]Chronic disease based on patient self-report of disease at baseline; 6-month follow-up is likely limited to see an improved difference; study not powered to look at subgroup analysis.
[o]Potential contamination by presence of intervention in control group practices; self-reported behavioural practices, hospitalizations based on patient self-report from angina health-related quality of life questionnaire.

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Electronic Tools for Health Information Exchange: An Evidence-Based Analysis

Health Quality Ontario

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Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

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To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

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This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

As patients experience transitions in care, there is a need to share information between care providers in an accurate and timely manner. With the push towards electronic medical records and other electronic tools (eTools) (and away from paper-based health records) for health information exchange, there remains uncertainty around the impact of eTools as a form of communication.

Objective

To examine the impact of eTools for health information exchange in the context of care coordination for individuals with chronic disease in the community.

Data Sources

A literature search was performed on April 26, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published until April 26, 2012 (no start date limit was applied).

Review Methods

A systematic literature search was conducted, and meta-analysis conducted where appropriate. Outcomes of interest fell into 4 categories: health services utilization, disease-specific clinical outcomes, process-of-care indicators, and measures of efficiency. The quality of the evidence was assessed individually for each outcome. Expert panels were assembled for stakeholder engagement and contextualization.

Results

Eleven articles were identified (4 randomized controlled trials and 7 observational studies). There was moderate quality evidence of a reduction in hospitalizations, hospital length of stay, and emergency department visits following the implementation of an electronically generated laboratory report with recommendations based on clinical guidelines. The evidence showed no difference in disease-specific outcomes; there was no evidence of a positive impact on process-of-care indicators or measures of efficiency.

Limitations

A limited body of research specifically examined eTools for health information exchange in the population and setting of interest. This evidence included a combination of study designs and was further limited by heterogeneity in individual technologies and settings in which they were implemented.

Conclusions

There is evidence that the right eTools in the right environment and context can significantly impact health services utilization. However, the findings from this evidence-based analysis raise doubts about the

ability of eTools with care-coordination capabilities to independently improve the quality of outpatient care. While eTools may be able to support and sustain processes, inefficiencies embedded in the health care system may require more than automation alone to resolve.

Plain Language Summary

Patients with chronic diseases often work with many different health care providers. To ensure smooth transitions from one setting to the next, health care providers must share information and coordinate care effectively. Electronic medical records (eTools) are being used more and more to coordinate patient care, but it is not yet known whether they are more effective than paper-based health records. In this analysis, we reviewed the evidence for the use of eTools to exchange information and coordinate care for people with chronic diseases in the community. There was some evidence that eTools reduced the number of hospital and emergency department visits, as well as patients' length of stay in the hospital, but there was no evidence that eTools improved the overall quality of patient care.

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List of Abbreviations

aDiff	Adjusted risk difference
ACE	Angiotensin-converting enzyme
aOR	Adjusted odds ratio
ARB	Angiotensin receptor blocker
aRC	Adjusted regression correlation
BMI	Body mass index
BP	Blood pressure
CAD	Coronary artery disease
CDSS	Clinical decision support system
CI	Confidence interval
CPOE	Computerized physician (or provider) order entry
CRT-D	Cardio-resynchronization therapy with defibrillator
CRT-P	Cardio-resynchronization therapy with pacemaker
CT	Computed tomography
DBP	Diastolic blood pressure
DEMS	Diabetes electronic management system
ED	Emergency department
EDI	Electronic data interchange
EHR	Electronic health record
EMR	Electronic medical record
eTools	Electronic tools
FRACGP	Fellow of the Royal Australian College of General Practitioners
GP	General practitioner
HbA1c	Hemoglobin A1c
ICD	Implantable cardioverter defibrillator
LDL-C	Low-density lipoprotein cholesterol
MRI	Magnetic resonance imaging
NR	Not reported
OR	Odds ratio
PACS	Picture archiving communication system
PCP	Primary care physician
PHR	Personal (or patient) health record
RCT	Randomized controlled trial
SBP	Systolic blood pressure

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this analysis was to examine the impact of electronic tools (eTools) for health information exchange in the context of care coordination for individuals with chronic disease in the community. Of particular interest was the use of eTools by community-based primary care physicians (PCPs) to share information in an accurate and timely manner with laboratories, pharmacies, and other health care providers as patients transition between PCPs and acute care or other specialists. This evidence-based analysis is a part of the mega-analysis Optimizing Chronic Disease Management in the Community.

Clinical Need and Target Population

Continuity of Care

Continuity of care can be categorized into 3 domains: relational, management, and informational. *Informational continuity of care* (the focus of this analysis) is the continuous flow of information between multiple care providers across different parts of the health care system.

Overall sustained continuity of care has been associated with fewer hospitalizations and emergency department (ED) visits, as well as improved patient satisfaction and receipt of preventive services. (1) As patients experience transitions in care (such as between primary care, specialists, and hospitalists) they are at increased risk for adverse events as a result of errors in information transmission. (2) As such, formal efforts towards informational continuity of care have become a key component of care coordination. (3)

Care Coordination

Care coordination involves the exchange of information about a patient's care history, current health status, and/or care plan. (4) It accompanies breaks in continuity of care and is carried out to facilitate the appropriate delivery of health care services by various health care providers. (4) Even the best continuity of care efforts cannot entirely eliminate the need for care coordination during patient transitions; for example, there will always be a need for care coordination between PCPs and specialists.

As a patient navigates the health care system, complex networks of providers require careful care coordination to ensure information continuity (Figure 1). To be well informed, PCPs must coordinate with specialists, EDs, hospital-based physicians, and sources of diagnostic data (e.g., laboratory and imaging results), as well as communicating with nurses and other allied health care professionals. Failures in care coordination can contribute to serious adverse events. (4)

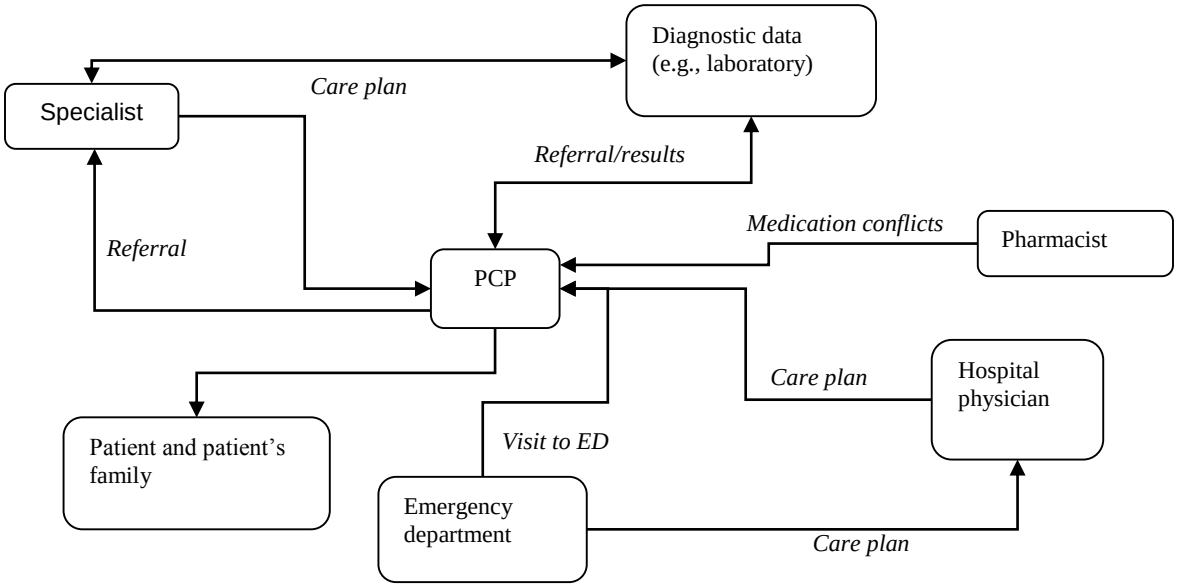

Figure 1: Example of Complex Flow of Information Involved in Care Coordination

Abbreviations: ED, emergency department; PCP, primary care physician.

Tools for Care Coordination

Care coordination may take many different forms. Informal methods include "hallway handoffs" (i.e., person-to-person communication), e-mail, phone calls, and even sticky notes on patient charts. (5) More formal techniques involve standardized levels of information and include structured person-to-person handoffs, discharge summaries with medication history, and organized shared care. (5)

Care coordination is increasingly being conducted using computer-based programs to facilitate information transfer and shared care. (6) There are a number of perceived potential benefits to this approach, including improved provider communication and coordination (as a result of standardized documentation), and speed of availability. (4;5) However, some health care providers are hesitant to adopt computer-assisted management; reasons for concern include security and privacy issues, depersonalization of care, and the up-front costs of incorporating an electronic system. (7)

Care Coordination and Chronic Disease

Individuals with a chronic disease often have multiple concurrent chronic conditions and complications that require regular visits with a number of different specialists in addition to their PCP. As well, these patients may have intermittent interactions with the ED and other acute care settings. (2;3) As such, they may be at increased risk for severe adverse events if information does not flow between health care settings in a timely and accurate manner. (2;3;8) Given the potential patient safety risks associated with poor care coordination, many institutions and health care systems are exploring means of improving care coordination. (6)

Technology

Electronic Tools for Health Information Exchange

Currently, the use of eTools ranges from a single point of information exchange between 2 health care providers to real-time complete sharing of patient electronic medical records (EMRs) between everyone involved in a patient's care. Given the current rate of evolution of computer-assisted communication in health care, the terminology used to describe eTools is almost as varied as the tools themselves. Table 1 describes common terminology and potential applications for a number of eTools used in modern health care systems.

Table 1: Description and Potential Applications for Various eTools

eTool	Description	Application
Alerts and reminders	A system that uses patient-level data and clinical guidelines to prompt physicians with alerts and reminders for patient check-ups and treatments	Usually part of a CPOE or EMR system
CDSS	A system that uses patient-level data and clinical guidelines to prompt physicians with treatment and prevention opportunities for their patients	May be part of a comprehensive EMR system or implemented as a stand-alone system
CPOE	A system to share physician orders with multiple care providers, including nurses, pharmacists, and other allied health care professionals	May be part of a comprehensive EMR system or implemented as a stand-alone system
Disease registry	A system that maintains lists of patients with a particular diagnosis or who require routine health maintenance manoeuvres	Used to track patients who need regular follow-up and to conduct population health status and service utilization monitoring
EHR	Linked health records to identify a patient's interaction with multiple points of contact in the health care system	Used to monitor and manage the population health to identify trends in prevalence rates and risk assessments
EMR	A comprehensive health record at the level of the patient within a single health care system	Typically applied at the level of a single institution or network; may or may not be accessible to health care professionals outside of that institution (e.g., PCPs sharing EMRs with hospital physicians)
e-Prescribing	A system to add, adjust, edit, monitor, and share prescribing orders	May be part of a comprehensive EMR system or implemented as a stand-alone system
Health information system or health information tool	Generic term to describe electronic systems that manage, store, and/or retrieve health data	May be used to describe any combination of eTools used in health information management
PACS	A system to manage, store, and retrieve results of certain health tests, such as an MRI or CT scan	May be part of a comprehensive EMR system or implemented as a stand-alone system
Patient portal	Extensions of existing EMR systems that allow patients to view and interact with at least part of the EMR under the responsibility of physicians and hospitals	Used to facilitate patient interactions with their physicians and other health care professionals; may be used to assist with self-management programs that are guided and monitored by health care providers
PHR	Patient-accessible health record; may or may not include a mechanism to facilitate monitoring by, and communication with, health care providers	May be used to assist with patient self-management, specifically with chronic disease (e.g., monitoring blood glucose levels in patients with diabetes). Usually used to give patients access to their own health records
Risk assessment tool	A system that uses patient-level data and validated risk assessment tools to identify patients at risk (e.g., for diabetes, cardiovascular disease, or rehospitalization)	May be implemented at the level of the individual patient, physician practice, or population level

Abbreviations: CDSS, clinical decision support system; CPOE, computerized physician (or provider) order entry; CT, computed tomography; EHR, electronic health record; EMR, electronic medical record; eTool, electronic tool; MRI, magnetic resonance imaging; PACS, picture archiving communication system; PCP, primary care physician; PHR, personal (or patient) health record.

Dissemination of eTools for Health Information Exchange

The adoption of EMRs has been steadily on the rise. One study commissioned by Canada Health Infoway examined automation in general practice across 10 countries (8 European nations, Australia, and New Zealand). (9) The authors found that nearly all physicians in these countries had computers (90 to 100%) and that in Denmark and Norway, more than 75% of physician offices conducted business in a "paper-light" manner. (9) Overall, the most common application was medication prescribing and monitoring, whether or not it was a mandated component of government regulations. (9)

Denmark is considered a successful example of the adoption of information and communication technology in PCP offices; it had more than 80% dissemination of EMRs among its PCPs by 2009. (10) EMRs were equipped, at a minimum, with the ability to record patient appointments, generate medication prescriptions, send orders and requests to laboratories, include clinical notes, and receive results from other physicians (including discharge summaries). (10) Additionally, as many as 60% of all physicians had EMRs in 2009, facilitating communication with specialists and hospitals for referrals and shared-care functionalities. (10) Where success in EMR uptake has been observed, it has largely been attributed to a central body as the national health system integrator; in the case of Denmark, this is the government agency MedCom. (10) Similar trends have been observed in the United Kingdom, where there has been substantial uptake in computer use in primary care since the late 1980s, specifically to assist with the management of diabetes care. (11) In 1988, 20% of family practices had computers; that number rose to 70% by 1992 and 92% by 1997. (11)

In contrast, North America has been significantly slower to reach the same degree of uptake. The United States Centers for Disease Control and Prevention determined via survey that as of 2010, 48.3% of physicians reported using at least partial EMR/electronic health record (EHR) systems in their practice. (12) This was an increase of 6.3% from 1 year earlier, but part of a growth trend since 2003, when only 17.3% of physicians reported using EMRs/EHRs. (12)

Ontario Context

Ontario's primary health teams are generally supportive of computer-assisted communication. (5) There is consensus that eTools can facilitate the sharing of information, providing greater ease, speed, and accuracy. (5) However, some health care providers maintain a preference for face-to-face communication. (5) This may be attributed to lack of time to sit and read email, lack of familiarity with technology, and/or concerns that it would be time-consuming to learn. (5)

The Ontario government agency e-Health Ontario is mandated to "play a leading role in harnessing [information technology] and innovation to improve patient care, safety and access…" (13) Among its numerous initiatives is the creation of a funding program to encourage community physicians to adopt EMRs and the launch of a comprehensive e-prescribing system at 2 pilot sites. (14)

OntarioMD, an eHealth Ontario partner agency, operates the "new EMR adopter" funding program. This program grants physicians as much as $30,000 (Cdn) in subsidies over the first 3 years of EMR implementation in a previously paper-based practice. (15) The program has a predefined list of standards that must be met for an EMR system to be eligible. As of February 2012, more than 7,000 community-based physicians (including both general practitioners [GPs] and specialists) had been funded via government programs. (16)

Evidence-Based Analysis

Research Questions

- What is the impact of eTools for health information exchange on patient outcomes and health services utilization when used to improve the care coordination of adults with chronic disease?
- What specifications of eTools contribute to their effectiveness?

Research Methods

Literature Search

Search Strategy

A literature search was performed on April 26, 2012, using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published before April 26, 2012 (no start date limit was applied). Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria*

English language, full-reports

- published before April 26, 2012
- tools and systems for electronic health information exchange that facilitate provider-provider communication in the outpatient community setting (including but not limited to referrals, prescribing, computerized physician order entries, and intra-team communication)
- covering 1 or more of the chronic conditions of interest (chronic obstructive pulmonary disease, coronary artery disease, congestive heart failure, atrial fibrillation, diabetes, stroke, chronic wounds) or otherwise identified with general terms for chronic conditions or multiple chronic conditions/multi-morbidity

Exclusion Criteria*

- eTools to facilitate communication between patient and health care provider
- patient health records and patient self-monitoring devices
- database risk-assessment tools
- eTools to facilitate improved management or care of patients within a single physician's practice (e.g., clinical decision-support and patient data management systems)
- studies where no outcomes of interest could be extracted, or where there was substantial confounding in the exposure of interest
- letters, comments, editorials, surveys, and other publications based primarily on expert opinion

*Interventions were evaluated based on the application of the eTool, not on the label applied to it. For example, telemedicine was considered for inclusion if a nurse was involved in the transmission of patient data and the eTool was used as a mechanism for care coordination, but it was excluded if the patient was involved in the transmission of data.

Outcomes of Interest

Primary Outcomes

- health services utilization
  - hospitalizations
  - readmissions
  - length of stay
  - ED use
  - mortality
  - health-related quality of life
  - patient satisfaction
- disease-specific clinical outcomes (e.g., hemoglobin A1c [HbA1c], blood pressure, total cholesterol)

Secondary Outcomes

- process-of-care indicators
  - achievement of a clinical outcome (e.g., HbA1c < 7%)
  - rate of clinical tests/examinations conducted or recorded (e.g., rate of conducting eye examinations among patients with diabetes)
- measures of efficiency
  - record keeping (e.g., accuracy of information)
  - informational continuity (e.g., time to receive discharge summary)
  - time
  - subjective impact on efficiency (e.g., self-identified provider workload)

Statistical Analysis

Where appropriate, a meta-analysis was performed using Review Manager Version 5. (17) A fixed-effect model was used, unless significant heterogeneity was observed ($P \leq 0.10$); then, a random-effects model was used to address significant heterogeneity. A P value of < 0.05 was considered statistically significant.

Where meta-analysis was not appropriate and where sufficient data were provided, effect estimates were calculated and presented descriptively. Some studies presented adjusted effect estimates; these were extracted directly, but they limited the potential for meta-analysis.

Patient-level data were prioritized over population-level data (e.g., number of ED visits per patient versus proportion of the population who had an ED visit), as they were considered to more accurately represent the impact on health services utilization.

Quality of Evidence

The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria. (18) The overall quality was determined to be very low, low, moderate, or high using a step-wise structural methodology.

Study design was the first consideration; the starting assumption was that randomized controlled trials (RCTs) are high quality, whereas, observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (18) For more detailed information, please refer to the latest series of GRADE articles. (18)

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Very confident that the true effect lies close to that of the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate – the true effect is likely to be substantially different from the estimate of effect

Results of Evidence-Based Analysis

The database search yielded 2,723 citations published before April 26, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 2 shows the breakdown of when and for what reason citations were excluded in the analysis.

Seven studies (3 RCTs and 4 observational studies) met the inclusion criteria. The reference lists of the included studies were hand searched to identify any additional potentially relevant studies, and 4 additional citations (1 RCT and 3 observational studies) were included, for a total of 11 citations.

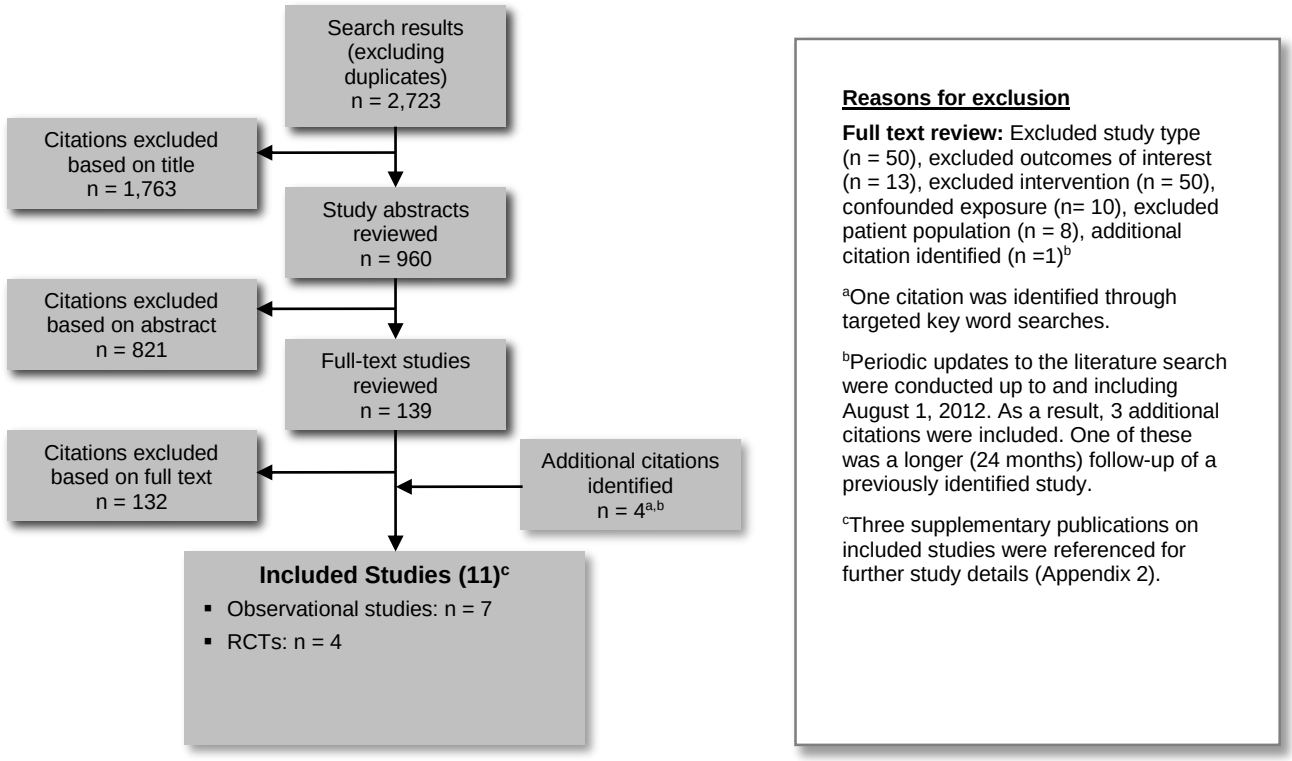

Figure 2: Citation Flow Chart

For each included study, the study design was identified and is summarized in Table 2, which is a modified version of a hierarchy of study design by Goodman. (19)

Table 2: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
RCT Studies[a]	
Systematic review of RCTs	
Large RCT	4
Small RCT	
Observational Studies[b]	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with contemporaneous controls	2
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	1
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	4
Studies presented at an international conference	
Expert opinion	
Total	11

Abbreviation: RCT, randomized controlled trial.
[a]Includes 2 cluster RCTs.
[b]Includes 3 studies that are self-identified as controlled trials, but methodology is that of observational studies.

Summary of Other Evidence

Ten systematic reviews based on original research were identified but not included in the analysis. (20-29) No systematic review was found to be representative of the population, setting, and interventions of interest. Most were narrative reviews that applied no meta-analyses or regression analyses.

The reviews identified components of data management systems that may contribute to the improved care of patients with chronic disease. All acknowledged that there are limitations in the current body of literature, mostly because of significant heterogeneity among interventions and varying degrees of integration of eTools in established organizational structures. None of the reviews identified eTool components that could be clearly attributed to the optimization of chronic disease management in the community, but additional systematic reviews have noted the potential impact of health information exchange in a general primary care population. (30;31)

Characteristics of Included Studies

Eleven studies were included in the evidence-based analysis (Table 3). The studies were from 4 different countries (Australia 1, Netherlands 1, United Kingdom 1, United States 8) and included 4 different populations of interest (coronary artery disease 1, diabetes 7, heart failure 1, multiple chronic conditions 2). Study sample sizes ranged from 235 to 27,207 patients; 1 study reported number of patient encounters (125,700).

The eTools applied in each study were unique, as were the conditions under which they were applied (Table 4). Some were used to coordinate care between hospital-based and outpatient/community-based health care providers; (32-35) some were applied in a community setting to help coordinate care between PCPs and other health care professionals (e.g., nurses and pharmacists); (36;37) the rest were applied in multiple care coordination efforts and/or did not specify their points of care coordination communication. (38-42)

The quality of evidence was evaluated individually for each outcome. When evaluating the quality of evidence, further study details were sought from additional articles published on the same study if possible (Appendix 2). Details of the quality of evidence evaluation are available in Appendix 3.

Table 3: Description of Included Studies

Author, Year	Country, Sites	Study Design	Length of Study	Patient Population	Mean Age, years[a] (Intervention/ Control)	Female, % (Intervention/ Control)	Sample Size, n[b] (Intervention/ Control)	Loss to Follow-up (Intervention/ Control)	List of All Outcomes Reported
Branger et al, 1999 (32)	Netherlands (Apeldoorn region)	Case-control	1 year	Patients with diabetes	58/62	53/53	215/60	None	Number of tests recorded per patient for 11 clinical tests; number of patient contacts with GP and consultant; number of letters between GP and consultants
Cebul et al, 2011 (38)	United States (Ohio)	Case-control	1 year	Adults (18–75 years) with diabetes	58/53	52/57	24,547/2,660	NA	4 measures of care, 5 clinical outcomes, and composite outcomes for each; trends by type of clinical practice and insurance
Crosson et al, 2012 (39)	United States (New Jersey, Pennsylvania)	Case-control	3 years	Patients with diabetes	59/61	53/51	306/492	21 practices withdrew, closed, or otherwise excluded after study recruitment	5 process-of-care measures, 3 treatment measures, 3 outcome measures, and composite outcomes for each
Graumlich et al, 2009 (34)	United States (Illinois)	Cluster RCT	6 months	Patients (18–98 years) with the probability of repeat admission ≥ 0.40[c]	Age presented categorically: 27% were 55–64 years/30% were 18–44 years	57/53	316/315	29 (10 deaths)/ 32 (10 deaths)	Readmissions, ED visits, adverse events, type of adverse event, time to readmission, time to ED visit, time to receive discharge summary
Henderson et al, 2010 (36)	Australia (multiple regions)	Non-RCT	16 months	All patients in GP practice[d]	NR; logistic regression model adjusted for differences in baseline characteristics	NR; logistic regression model adjusted for differences in baseline characteristics	106,900/18,800 patient encounters	NA	Consultation length; multivariate analyses for 33 other quality indicators, most of which are rate of conducting clinical tests
Herrin et al, 2012 (40)	United States (Texas)	Case-control	5 years	Patients with diabetes and ≥ 40 years of age	Age presented categorically: 34% were 51–60 years/38% were 51–60 years	50/50	6,376/7,675 patients 10,171/35,033 patient years	NA; patient years are accounted	11 process-of-care measures, 6 clinical outcome thresholds, and composite of these outcomes

Author, Year	Country, Sites	Study Design	Length of Study	Patient Population	Mean Age, years[a] (Intervention/ Control)	Female, % (Intervention/ Control)	Sample Size, n[b] (Intervention/ Control)	Loss to Follow-up (Intervention/ Control)	List of All Outcomes Reported
Khan et al, 2010 (35)	United States (Vermont, New York)	Cluster RCT	32 months (average)	Adult patients with diabetes	62/63	52/50	3,856/3,512	NR	Hospital admission, readmission, length of stay, ED admission, money in patient charges; stratified by gender and age
Lester et al, 2005 (33)	United States (Massachusetts)	RCT	12 months	Adult patients (>30 years of age) with CAD or CAD risk equivalent	64/62	57/60	118/117	All randomized patients received allocated intervention; only 81 patients in the intervention group and 82 in the control group had LDL-C measures taken	Proportion with change in statin prescription, time to change in prescription, repeat LDL-C, reason for deferred action after referral
Montori et al, 2002 (37)	United States (Minnesota—Mayo clinic)	Cluster RCT	24 months	Adult (≥18 years of age) patients with diabetes (type I or II)	69/72	56/60	399/208	NR	12 performance measures of compliance with clinical tests, 8 metabolic outcomes, 3 health care use outcomes
Walsh et al, 2012 (41)	United States (multiple regions)	Case-control	24 months	Patients with heart failure[e]	70 (median)	28	4,220/2,950	NR	Physician practice characteristics, conformity with 7 quality measures
Wells et al, 1996 (42)	United Kingdom (Bedfordshire)	Case series	23 months	Patients with diabetes	NR	NR	2,049 (after)/ 1,190 (before)	NR	Compliance with 9 performance measures

Abbreviations: CAD, coronary artery disease; ED, emergency department; GP, general practitioner; LDL-C, low-density lipoprotein cholesterol; NA, not applicable; NR, not reported; RCT, randomized controlled trial.

[a]Unless otherwise specified.

[b]Number of patients unless otherwise specified.

[c]Based on age, health status, number of physician visits, CAD, and diabetes, among other factors.

[d]Results stratified and 3 groups of interest were identifiable: 1) diabetes; 2) left ventricular failure, ischemic heart disease, diabetes, or cerebrovascular disease; and 3) atrial fibrillation.

[e]Based on myocardial infarction history and left ventricular systolic dysfunction.

Table 4: Description of Individual Technologies Applied

Author, Year	Care Coordination Communication Sites	Intervention	Control	Description and Context of Intervention Technology
Branger et al, 1999 (32)	PCPs (GPs) ↕ Hospital outpatient clinic diabetes specialists	GPs with the highest number of referred patients through the EDI system to the specialists in the outpatient clinic (20 GPs; 215 patients)	GPs not in the intervention group (12 GPs; 60 patients)	EDI system that fully replaced paper records and has the capability for communication with other electronic information systems; an EDI system has been in place in the study region since 1989, with increasing levels of detail and sophistication since its inception
Cebul et al, 2011 (38)	PCPs ↕ Various sources, including fellow health care team members	Practices using EHRs (3 care organizations; 33 practices; 516 providers; 24,547 patients)	Practices using paper-based records (4 care organizations; 13 practices; 53 providers; 2,660 patients)	Details of individual EHR systems were not specified
Crosson et al, 2012 (39)	PCPs ↕ Various sources, including fellow health care team members	Practices using EHRs for the duration of the study (16 practices; 306 patients at end of study)	Practices not using EHRs (therefore paper records) for the duration of the study (26 practices; 492 patients at end of study)	Details of individual EHR systems were not specified; at the time of this study there were local incentive programs designed to encourage the adoption of EHRs by smaller practices, but it is not clear whether the funders had required components to be eligible for the financial incentive programs
Graumlich et al, 2009 (34)	Hospital internists ↓ Outpatient physicians and dispensing pharmacists in the community	Use of computer software to automatically generate personalized discharge summaries (35 physicians; 316 patients)	Usual care, handwritten discharge summaries (35 physicians; 315 patients)	A CPOE with automatically generated discharge documents, including prescriptions with details for dispensing pharmacist; included decision support software
Henderson et al, 2010 (36)	GPs, PCPs ↕ Various health care providers, including laboratories, pharmacies, and specialists	GPs who were clinical computer users defined as using their computers for prescribing or ordering tests or medical records; this may or may not include the Internet or email (1,069 GPs)	GPs using computers for administrative functions only; this may or may not include the Internet or email capability; this group also included any physicians who did not use a computer at all (188 GPs)	Details of individual computer programs used were not specified; at the time of this study over 97% of Australian GPs had a computer available at their practice
Herrin et al, 2012 (40)	GPs, PCPs ↕ Various sources, including fellow health care team members	Practices using EHRs at some point during the study period (6,376 unique patients throughout study duration of 5 years; 10,017 patient years)	Practices and patients never exposed to EHRs (7,675 unique patients throughout study duration of 5 years; 35,033 patient years)	The local health authority implemented a network of EHRs rolled out to various primary care practices over the study period; these EHRs included CDSSs, order entry, and alerts/reminders, in addition to patient data management and shared care capabilities
Khan et al, 2010 (35)	Laboratories ↓ PCPs	Vermont Diabetes Information System (3,856 patients)	Usual care (3,512 patients)	The Vermont Diabetes Information System compiles lab results, maintains a registry and produces a report for primary care providers and patients; this report includes guideline-based recommendations, and alert letters are issued on an as-needed basis; a regional network of hospital-based laboratories has been in place since 1996, and at the time of the study it included 13 of the 14 regional hospitals

Author, Year	Care Coordination Communication Sites	Intervention	Control	Description and Context of Intervention Technology
Lester et al, 2005 (33)	Hospital specialists ↓ PCPs and patients	Automated identification of patients and emailed outreach to PCPs of patients at high risk; email included best practice decision support, as well as electronic physician order entry and integration into existing EHR (118 patients)	Usual care with EHR system (117 patients)	A total of 14 physicians were invited to participate; each physician had patients in both the intervention and control groups; to be eligible, physicians must have already demonstrated competence with an EHR system
Montori et al, 2002 (37)	Primary care (physicians, nurses, clinical assistants, and diabetes educators) ↕ Various sources, including fellow health care team members	DEMS (16 PCPs; 6,336 patients at end of study)	Before introduction of DEMS (6,646 patients at start of study)	DEMS includes laboratory, medication, examination, and clinical notes in a manner for sharing among different health care providers; it also includes reminders based on clinical guidelines
Walsh et al, 2012 (41)	Not specified	Practices using an EHR alone or in combination with paper records (78 practices; 4,220 patients)	Practices using only paper records (61 practices; 2,950 patients)	Details of individual EHR systems were not specified; EHR use was self-identified in the IMPROVE-HF survey
Wells et al, 1996 (42)	GPs ↕ Various sources, including local hospital, diabetes specialist centre, and fellow health care team members	Shared care as facilitated by the introduction of a computerized system to support diabetes management	Baseline (1,190 patients at start of study)	Information regarding a patient in response to computer-generated prompts or otherwise of clinical importance was transcribed into a central database at the diabetes information centre, which was opened in 1990 to facilitate a shared care structure between the community and hospital physicians

Abbreviations: CDSS, clinical decision support system; CPOE, computerized physician (or provider) order entry; DEMS, diabetes electronic management system; EDI, electronic data interchange; EHR, electronic health record; GP, general practitioner; PCP, primary care physician.

Analysis

The included studies reported on 5 of the 8 primary outcomes of interest (Table 5). No studies reported mortality, health-related quality of life, or patient satisfaction. Studies also reported a number of process-of-care indicators and measures of efficiency.

Table 5: Studies and Outcomes by Chronic Disease Group

Author, Year	Primary Outcomes of Interest										Process of Care Indicators	Measures of Efficiency
	Health Services Utilization				Disease-Specific Clinical Outcomes							
	Hospitaliz-ations	Length of Stay	ED Visits	Readmis-sions	HbA1c	BP	Chol-esterol	Trigly-cerides	Other[a]	Achievement of Clinical Guidelines		
Diabetes												
Branger et al, 1999 (32)					✓						✓	✓
Cebul et al, 2011 (38)										✓	✓	
Crosson et al, 2012 (39)										✓	✓	
Herrin et al, 2012 (40)										✓	✓	
Khan et al, 2010 (35)	✓	✓	✓									
Montori et al, 2002 (37)	✓		✓		✓	✓	✓	✓	✓		✓	✓
Wells et al, 1996 (42)											✓	
CAD												
Lester et al, 2005 (33)							✓			✓		✓
Heart Failure												
Walsh et al, 2012 (41)											✓	
Multiple Chronic Conditions												
Graumlich et al, 2009 (34)			✓	✓					✓	✓		✓
Henderson, et al 2010 (36)											✓	

Abbreviations: BP, blood pressure; CAD, coronary artery disease; ED, emergency department; HbA1c, hemoglobin A1c; PCP, primary care physician.
[a]Includes PCP visits and adverse events.

Health Services Utilization

Five health services utilization outcomes were reported in the included studies: hospitalizations, length of stay, ED visits, readmissions, and primary care visits.

Hospitalizations

One study identified a statistically significant decrease in hospital admissions (relative reduction 15%) in the intervention group (Table 6) (GRADE quality of evidence: moderate).

Table 6: Impact of eTools on Hospitalizations

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Admissions Per Patient, n (Intervention/Control)	Effect Estimate (95% CI)
Khan et al, 2010 (35)	RCT	32 months (average)	3,856/3,512	0.17/0.20	Mean difference –0.03 (–0.05 to –0.01)

Abbreviations: CI, confidence interval; eTool, electronic tool; RCT, randomized controlled trial.

Montori et al also commented that their research did not identify a statistically significant difference between study groups with respect to number of hospitalizations, but they did not provide data to support this statement. (37)

Length of Stay

One study identified a statistically significant decrease in hospital length of stay (relative reduction 10%) in the intervention group (Table 7) (GRADE quality of evidence: moderate).

Table 7: Impact of eTools on Length of Stay

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Days Per Patient, n (Intervention/Control)	Effect Estimate (95% CI)
Khan et al, 2010 (35)	RCT	32 months (average)	3,856/3,512	0.99/1.1	Mean difference –0.11 (–0.19 to –0.03)

Abbreviations: CI, confidence interval; eTool, electronic tool; RCT, randomized controlled trial.

ED Visits

One study identified a statistically significant decrease in number of ED visits (relative reduction 25%) in the intervention group (Table 8) (GRADE quality of evidence: moderate).

Table 8: Impact of eTools on Number of ED Visits

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Visits Per Patient, n (Intervention/Control)	Effect Estimate (95% CI)
Khan et al, 2010 (35)	RCT	32 months (average)	3,856/3,512	0.27/0.36	Mean difference –0.09 (–0.14 to –0.04)

Abbreviations: CI, confidence interval; ED, emergency department; eTool, electronic tool; RCT, randomized controlled trial.
[a]Adjusted with cluster correction.

Patient-level data were prioritized for this review; however, Graumlich et al conducted a smaller RCT that found no statistically significant difference between study groups in proportion of patients with an ED visit (risk difference adjusted for cluster correction –0.052% [95% confidence interval (CI) –0.115 to 0.011]). (34)

Montori et al also commented that their research did not identify a statistically significant difference between study groups with respect to number of ED visits, but they did not provide data to support this statement. (37)

Readmissions
One study identified no statistically significant difference between study groups in patient readmission rates (Table 9) (GRADE quality of evidence: high).

Table 9: Impact of eTools on Readmissions

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Readmissions, n (%) (Intervention/Control)	Effect Estimate (95% CI)
Graumlich et al, 2009 (34)	RCT	6 months	316/315	117 (37.0)/119 (37.8)	aDiff[a] –0.005 (–0.074 to 0.065)

Abbreviations: aDiff, adjusted risk difference; CI, confidence interval; ED, emergency department; eTool, electronic tool; RCT, randomized controlled trial.
[a]Adjusted for previous hospitalizations, ED visits, heart failure, and physician function.

Other Health Services Utilization: Primary Care Visits
Montori et al commented that their research did not identify a statistically significant difference between study groups with respect to number of primary care visits, but they did not provide data to support this statement. (37)

Disease-Specific Clinical Outcomes
Eight disease-specific outcomes were reported in the included studies: HbA1c, systolic blood pressure, diastolic blood pressure, total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, proportion of patients who experienced an adverse event, and achievement of clinical guidelines.

HbA1c
One RCT and 1 observational study reported on HbA1c levels. Neither study identified a statistically significant difference between study groups in HbA1c levels (Table 10) (GRADE quality of evidence: low to very low).

Table 10: Impact of eTools on HbA1c

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	HbA1c, % (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference 0.01 [–0.3 to 0.4)
Branger et al, 1999 (32)	Observational	6 months	215/60	–0.21/–0.12	Mean difference –0.09 [–0.69 to 0.51)

Abbreviations: CI, confidence interval; eTool, electronic tool; HbA1c, hemoglobin A1c; NR, not reported; RCT, randomized controlled trial.

Blood Pressure

One study identified no statistically significant difference between study groups in mean difference in systolic or diastolic blood pressure (Table 11) (GRADE quality of evidence: low).

Table 11: Impact of eTools on Blood Pressure

Author, Year	Study Design	Length of Follow-up	Sample Size, n (intervention/Control)	BP, mm Hg (Intervention/Control)	Effect Estimate (95% CI)
Systolic Blood Pressure					
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference –0.8 (–5.0 to 3.4)
Diastolic Blood Pressure					
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference –0.6 (–2.4 to 1.1)

Abbreviations: BP, blood pressure; CI, confidence interval; eTool, electronic tool; NR, not reported; RCT, randomized controlled trial.

Lipids

One RCT identified no statistically significant difference between study groups with respect to mean difference in total cholesterol (Table 12) (GRADE quality of evidence: low). Two RCTs identified no statistically significant difference between study groups with respect to mean difference in LDL-C (due to different patient populations, estimates could not be pooled) (GRADE quality of evidence: low). One study identified no statistically significant difference between study groups with respect to mean difference in triglycerides (GRADE quality of evidence: low).

Table 12: Impact of eTools on Lipids

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/Control)	Lipids (Intervention/Control)	Effect Estimate (95% CI)
Total Cholesterol, mmol/L					
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference –0.1 (–3.5 to 1.8)
LDL-C, mg/dL					
Lester et al, 2005 (33)	RCT	1 month	81/82	106.8/111.5	Mean difference –4.7 (–13.4 to 4.0)
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference –0.1 (–3.0 to 2.8)
Triglycerides, mg/dL					
Montori et al, 2002 (37)	RCT	24 months	399/208	NR	Mean difference 0.1 (–1.7 to 3.5)

Abbreviations: CI, confidence interval; eTool, electronic tool; NR, not reported; LDL-C, low-density lipoprotein cholesterol; RCT, randomized controlled trial

Lester et al also examined differences in LDL-C levels at the first measures after the introduction of eTools and found no statistically significant difference in LDL-C between patient groups (intervention 111.7 mg/dL, control 118.1mg/dL, $P = 0.2$). (33)

Adverse Events

One study found no statistically significant difference between study groups with respect to the proportion of patients with an adverse event within 1 month after hospital discharge (Table 13) (GRADE quality of evidence: high).

Table 13: Impact of eTools on Adverse Events

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/Control)	Adverse Events, n (%) (Intervention/Control)	Effect Estimate (95% CI)
Graumlich et al, 2009 (34)	RCT	1 month	316/315	117 (37.0)/119 (37.8)	aDiff[a] 0.003 (–0.037 to 0.043)

Abbreviations: aDiff, adjusted risk difference; CI, confidence interval; eTool, electronic tool; RCT, randomized controlled trial.
[a]Adjusted with cluster correction.

Other Disease-Specific Clinical Outcome: Achievement of Clinical Guidelines

The proportion of patients who met a pre-defined threshold of various clinical outcomes was examined in several observational studies (Table 14). An observed increase in the proportion of patients who achieved the clinical threshold was considered an indication of good clinical practice (GRADE quality of evidence: very low).

Table 14: Impact of eTools on Achievement of Clinical Guidelines

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/Control)	Results, % (Intervention/Control)	Effect Estimate (95% CI)
HbA1c Managed and Below Guideline Threshold					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*HbA1c < 8%* 70.5/48.0	aDiff[a] 10.9 (–1.7 to 23.6)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*HbA1c ≤ 8%* 78.9/80.7	aOR[b] 0.9 (0.8–1.0)
BP Managed and Below Guideline Threshold					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*BP < 140/80 mm Hg* 55.8/38.9	aDiff[a] 11.1 (–1.0 to 23.2)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*SBP < 130 mm Hg* 52.2/46.1	aOR[b] 1.2 (1.1–1.3)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*DBP < 80 mm Hg* 63.6/53.0	aOR[b] 1.3 (1.2–1.3)
LDL-C Managed and Below Guideline Threshold[c]					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	87.0/66.1	aDiff[a] 18.1 (11.8–24.4)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	71.3/65.5	aOR[b] 0.7 (0.6–0.8)
Triglycerides < 150 mg/dL					
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	54.8/52.0	aOR[b] 0.9 (0.8–1.0)
BMI < 30 kg/m^2					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	32.8/34.1	aDiff[a] –2.9 (–8.0 to –2.1)
Behavioural Intervention: Nonsmoker					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	82.1/52.3	aDiff[a] 17.0 (5.3–28.6)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	86.9/82.5	aOR[b] 1.1 (1.0–1.2)
Composite					
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*Composite[d]* 43.7/15.7	aDiff[a] 15.2 (4.5–25.9)
Crosson et al, 2012 (39)	Observational	3 years	306/492	*All targets met[e]* NR	aOR[f] 1.42 (1.12–2.51)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Optimal care[g]* 20.2/11.0	aOR[b] 1.5 (1.3–1.6)

Abbreviations: aDiff, adjusted risk difference; aOR, adjusted odds ratio; BP, blood pressure; BMI, body mass index; CI, confidence interval; DBP, diastolic blood pressure; eTool, electronic tool; HbA1c, hemoglobin A1c; LDL-C, low-density lipoprotein cholesterol; NR, not reported; SBP, systolic blood pressure.

[a]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.

[b]Adjusted for age, sex, insulin usage, and year of study.

[c]Cebul et al outcome is LDL-C < 100 mg/dL or use of a statin; Lester et al outcome calculated using reported proportion of patients with LDL-C > 130 mg/dL.

[d]Composite of HbA1c < 8%, blood pressure < 140/80 mm Hg, LDL-C < 100 mg/dL or use of statin, BMI < 30 kg/m^2, or nonsmoker.

[e]Criteria: HbA1c < 7%, LDL-C ≤ 100 mg/dL, or BP ≤ 130/85 mm Hg.

[f]Adjusted for clustering effect.

[g]Achieving HbA1c ≤ 8%, LDL-C <100 mg/dL, blood pressure < 130/80 mm Hg, nonsmoker, and Aspirin use.

Crosson et al also examined a composite outcome of achievement of 2 of 3 targets met and found a statistically significant improvement in the intervention group compared to control group (odds ratio [OR] 1.54, 95% CI 1.06–2.25). (39) They also examined the composite outcome of achievement of all criteria related to appropriate treatment (HbA1c ≤ 8% or > 8% and on an antihyperglycemic agent; LDL-C ≤ 100 mg/dL or > 100 mg/dL and on a lipid-lowering agent; and blood pressure ≤ 130/85 mm Hg or > 130/85 mm Hg and on an antihypertensive agent). They observed no statistically significant difference in the intervention group compared with the control group (OR 1.42, 95% CI 0.81–2.41). (39)

Process-of-Care Indicators

Some studies reported the rate at which clinically important tests or examinations were conducted (or recorded). An observed increase in the rate at which these tests were conducted was considered an indication of good clinical practice.

Blood Pressure Measures Conducted

Three studies examined the number of blood pressure measures conducted upon the implementation of eTools (Table 15) (GRADE quality of evidence: very low).

Table 15: Impact of eTools on Blood Pressure Measures Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Branger et al, 1999 (32)	Observational	1 year	215/60	417 (1.9)/81 (1.4) measures (per patient)	Mean difference 0.50 (0.28–0.72)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	100%/99.9% of patients	aOR[a] 36.5 (6.0–105.9)
Wells et al, 1996 (42)	Observational	23 months	2,049/1,190	92%/74% of patients	OR 4.12 (3.35–5.07)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; OR, odds ratio.
[a]Adjusted for age, sex, insulin usage, and year of study.

Lipid Tests Conducted

Three studies found no difference between study groups with respect to total cholesterol and triglyceride measurements (Table 16) (GRADE quality of evidence: low to very low).

Table 16: Impact of eTools on Lipid Tests Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/ Control)	Effect Estimate (95% CI)
Total Cholesterol					
Montori et al, 2002 (37)	RCT	24 months	399/208	84%/79% of patients	aOR[b] 1.4 (0.8–2.3)
Branger et al, 1999 (32)	Observational	1 year	215/60	149 (0.7)/25 (0.4) measures (per patient)	Mean difference 0.30 (0.03–0.57)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	93.7%/87.4% of patients	aOR[a] 0.9 (0.8–1.0)
Triglycerides					
Montori et al, 2002 (37)	RCT	24 months	399/208	82%/75% of patients	aOR[b] 5.0 (0.9–2.4)
Branger et al, 1999 (32)	Observational	1 year	215/60	52 (0.2)/7 (0.1) measures (per patient)	Mean difference 0.10 (0.02–0.18)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	94.9%/89.7% of patients	aOR[a] 0.8 (0.7–0.9)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; RCT, randomized controlled trial.

[a]Adjusted for age, sex, insulin usage, and year of study.

[b]Adjusted with logistic regression; no further details available.

Montori et al also examined high-density lipoprotein cholesterol and found no statistically significant difference between groups in the proportion of patients receiving the test. (37)

HbA1c Tests Conducted

One RCT found no statistically significant difference between study groups with respect to HbA1c measurements (Table 17) (GRADE quality of evidence: low). Five observational studies found a trend towards increased proportion of patients who received HbA1c tests in the intervention group compared to the control group (GRADE quality of evidence: very low).

Table 17: Impact of eTools on HbA1c Tests Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (37)	RCT	24 months	399/208	99%/94% of patients	aOR[a] 4.5 (1.0–19.5)
Branger et al, 1999 (32)	Observational	1 year	215/60	177 (0.8)/9 (0.2) measures (per patient)	Mean difference[b] 0.60 (0.21–0.99)
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	94.6%/85.6% of patients	aDiff[b] 7.2 (0.4–14.0)
Henderson et al, 2010 (36)	Observational	16 months	3,432/688 encounters	25.1/17.6 per 100 encounters	aRC[c] 3.10 (NR) *P* = 0.24
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	97.6%/92.7% of patients	aOR[d] 0.6 (0.5–0.6)
Wells et al, 1996 (42)	Observational	23 months	2,049/1,190	93%/73% of patients	OR 4.89 (3.95–6.04)

Abbreviations: aDiff, adjusted risk difference; aOR, adjusted odds ratio; aRC, adjusted regression correlation; CI, confidence interval; eTool, electronic tool; FRACGP, Fellowship of the Royal Australian College of General Practitioners; GP, general practitioner; HbA1c, hemoglobin A1c; NR, not reported; OR, odds ratio; RCT, randomized controlled trial.

[a]Adjusted with logistic regression, further details not provided.

[b]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.

[c]Adjusted for GP age, GP sex, FRACGP status, work in deputizing services in preceding month, bulk billing for all patients, practice accreditation status, presence of a practice nurse.

[d]Adjusted for age, sex, insulin usage, and year of study.

Blood Glucose/Fructosamine Tests Conducted

One observational study found no significant difference in the number of blood glucose tests conducted between study groups; it did find an increase in the intervention group in number of fructosamine tests conducted per patient (Table 18) (GRADE quality of evidence: very low).

Table 18: Impact of eTools on Blood Glucose and Fructosamine Tests Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Blood Glucose					
Branger et al, 1999 (32)	Observational	1 year	215/60	400 (1.9)/105 (1.8) measures (per patient)	Mean difference 0.10 (–0.04 to 0.24)
Fructosamine					
Branger et al, 1999 (32)	Observational	1 year	215/60	47 (0.2)/0 (0.0) measures (per patient)	Mean difference 0.20 (0.05–0.35)

Abbreviations: CI, confidence interval; eTools, electronic tools.

Eye Examinations Conducted

One RCT found a statistically significant increase in number of eye examinations conducted in the intervention group (Table 19) (GRADE quality of evidence: low). Five observational studies and found a statistically significant increase in the intervention groups (GRADE quality of evidence: very low).

Table 19: Impact of eTools on Eye Examinations Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (37)	RCT	24 months	399/208	*Retina examination* 69%36% of patients	aOR[a] 2.4 (1.5–3.9)
Branger et al, 1999 (32)	Observational	1 year	215/60	*Ophthalmologist assessment* 64 (0.3)/18 (0.3) assessments (per patient)	Mean difference 0.0 (0.0–0.0)
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*Eye examinations* 62.6%/30.8% of patients	aDiff[b] 25.0 (18.7–31.2)
Henderson et al, 2010 (36)	Observational	16 months	3,432/688 encounters	*Referral to ophthalmologist or allied health professional* 7.1/3.6 per 100 encounters	aRC[c] 2.94 (NR) *P* = 0.002
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Eye examinations* 41.8%/20.0% of patients	aOR[d] 1.5 (1.4–1.7)
Wells et al, 1996 (42)	Observational	23 months	2,049/1,190	*Fundoscopy* 90%/78% of patients	OR 2.54 (2.08–3.10)

Abbreviations: aDiff, adjusted risk difference; aOR, adjusted odds ratio; aRC, adjusted regression correlation; CI, confidence interval; eTool, electronic tool; FRACGP, Fellowship of the Royal Australian College of General Practitioners; GP, general practitioner; NR, not reported; OR, odds ratio; RCT, randomized controlled trial.

[a]Adjusted with logistic regression, further details not provided.

[b]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.

[c]Adjusted for GP age, GP sex, FRACGP status, work in deputizing services in preceding month, bulk billing for all patients, practice accreditation status, presence of a practice nurse.

[d]Adjusted for age, sex, insulin usage, and year of study.

In addition, Wells et al examined visual acuity and found a statistically significant OR of 2.79 (95% CI 2.39 to 3.26) for the number of visual acuity examinations conducted in the intervention groups versus the control groups. (42)

Foot Examinations Conducted

One RCT found a statistically significant increase in number of foot examinations conducted in the intervention group (Table 20) (GRADE quality of evidence: low). Two observational studies found a statistically significant increase in the intervention group (GRADE quality of evidence: very low).

Table 20: Impact of eTools on Foot Examinations Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (37)	RCT	24 months	399/208	88%/66% of patients	aOR[a] 2.3 (1.2–4.4)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	56.6%/10.8% of patients	aOR[b] 2.8 (2.6–3.0)
Wells et al, 1996 (42)	Observational	23 months	2,049/1,190	96%/89% of patients	OR 2.97 (2.23–3.95) $P \leq 0.01$

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; OR, odds ratio; RCT, randomized controlled trial.
[a]Adjusted with logistic regression, further details not provided.
[b]Adjusted for baseline performance and cohort.

A pooled estimate also demonstrated a significant increase in number of foot examinations in the intervention group (Figure 3).

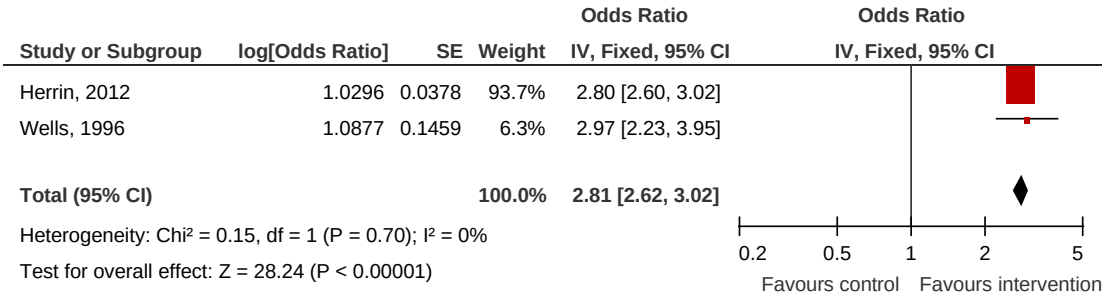

Figure 3: Pooled Effect Estimate of Foot Examinations Conducted in Observational Studies

Abbreviations: CI, confidence interval; IV, instrumental variable; RCT, randomized controlled trial; SE, standard error.

Urine Protein Tests Conducted for Kidney Management

One RCT found a statistically significant increase in number of urine protein tests conducted in the intervention group (Table 21) (GRADE quality of evidence: low). Three observational studies found no statistically significant increase in the intervention group (GRADE quality of evidence: very low).

Table 21: Impact of eTools on Urine Protein Tests Conducted for Kidney Management

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (37)	RCT	24 months	399/208	*Microalbuminuria* 55%/27% of patients	aOR[a] 3.2 (1.9–5.2)
Branger et al, 1999 (32)	Observational	1 year	215/60	*Proteinuria level* 20 (0.1)/29 (0.5) measures (per patient)	Mean difference –0.40 (–0.95 to 0.15)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Microalbumin* 71.5%/54.8% of patients	aOR[b] 1.2 (1.1–1.3)
Wells, et al, 1996 (42)	Observational	23 months	2,049/1,190	*Urine protein* 84%/57% of patients	OR 3.96 (3.4–4.7)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; OR, odds ratio; RCT, randomized controlled trial.
[a]Adjusted with logistic regression; further details not provided.
[b]Adjusted for age, sex, insulin usage, and year of study.

Other Tests for Kidney Management Conducted

One observational study found no statistically significant difference between study groups in number of creatinine tests conducted (Table 22) (GRADE quality of evidence: very low). One observational study examined a composite kidney management outcome and demonstrated a statistically significant increase in appropriate kidney management in the intervention group (GRADE quality of evidence: very low). One observational study found that the number of patients who received urinalysis testing was significantly lower in the intervention group (GRADE quality of evidence: very low).

Table 22: Impact of eTools on Other Tests Conducted for Kidney Management

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Branger et al, 1999 (32)	Observational	1 year	215/60	*Creatinine levels* 106 (0.5)/21 (0.4) measures (per patient)	Mean difference 0.10 (–0.04 to 0.24)
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*Kidney management (microalbumin or ACE inhibitor or ARB)* 93.4%/78.2% of patients	aDiff[a] 13.3 (8.4–18.3)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Urinalysis* 47.6%/50.6% of patients	aOR[b] 0.8 (0.7–0.8)

Abbreviations: ACE, angiotensin-converting enzyme; aDiff, adjusted risk difference; aOR, adjusted odds ratio; ARB, angiotensin receptor blocker; CI, confidence interval; eTool, electronic tool.
[a]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.
[b]Adjusted for age, sex, insulin usage, and year of study.

Weight Measures Conducted

One study found a statistically significant increase in the number of weight measures in the intervention group (Table 23) (GRADE quality of evidence: very low).

Table 23: Impact of eTools on Weight Measures Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Branger et al, 1999 (32)	Observational	1 year	215/60	448 (2.1)/27 (0.5) measures (per patient)	Mean difference 1.6 (0.62–2.58)

Abbreviations: CI, confidence interval; eTools, electronic tools.

Height Measures Conducted

One study found a statistically significant increase in the proportion of patients with a height measure recorded in the intervention group (Table 24) (GRADE quality of evidence: very low).

Table 24: Impact of eTools on Height Measures Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Wells et al, 1996 (42)	Observational	23 months (41)	2,049/1,190	90%/80% of patients	OR 2.25 (1.84–2.75)

Abbreviations: CI, confidence interval; eTool, electronic tool; OR, odds ratio.

Vaccinations and Immunizations Administered

One RCT found a statistically significant increase in immunizations in the intervention group (Table 25) (GRADE quality of evidence: low). Two observational studies found an increase in vaccinations in the intervention groups (Table 25) (GRADE quality of evidence: very low).

Table 25: Impact of eTools on Immunizations Administered

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results, % of patients (Intervention/Control)	Effect Estimate (95% CI)
Montori et al, 2002 (36;37)	RCT	24 months	399/208	*Immunization* 80/64	aOR[a] 1.7 (1.1–2.7)
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*Pneumococcal vaccination* 83.0/15.0	aDiff[b] 57.1 (43.6–70.5)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Influenza vaccination* 61.6/50.5	aOR[c] 1.1 (1.0–1.1)

Abbreviations: aDiff, adjusted risk difference; aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; RCT, randomized controlled trial.
[a]Adjusted with logistic regression; further details not provided.
[b]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.
[c]Adjusted for age, sex, insulin usage, and year of study.

Appropriately Managed Medications

Two observational studies found no difference between study groups with respect to number of angiotensin-converting enzyme (ACE) inhibitors prescriptions per patient encounter or in proportion of patients with prescriptions (Table 26) (GRADE quality of evidence: very low).

Table 26: Impact of eTools on Appropriately Prescribed ACE Inhibitors

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Henderson et al, 2010 (36)	Observational	16 months	5,838/1,075 encounters	5.9/4.5 per 100 encounters	aRC[a] 0.16 (NR) *P* = 0.86
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*ACE inhibitor/ARB improvement in use of therapy from baseline* 7.3%/8.6%	aOR[b] 0.83 (0.63–1.09)

Abbreviations: ACE inhibitor, angiotensin-converting enzyme inhibitor; aOR, adjusted odds ratio; ARB, angiotensin receptor blocker; aRC, adjusted regression correlation; CI, confidence interval; eTool, electronic tool; FRACGP, Fellowship of the Royal Australian College of General Practitioners; GP, general practitioner; NR, not reported.

[a]Adjusted for GP age, GP sex, FRACGP status, work in deputizing services in preceding month, bulk billing for all patients, practice accreditation status, presence of a practice nurse.

[b]Adjusted for patient and practice characteristics.

Two observational studies found no difference between study groups in anticoagulation prescriptions for atrial fibrillation (Table 27) (GRADE quality of evidence: very low).

Table 27: Impact of eTools on Appropriately Prescribed Anticoagulation for Atrial Fibrillation

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Henderson et al, 2010 (36)	Observational	16 months	906/145 encounters	*Warfarin* 35.4/40.0 per 100 encounters	aRC[a] –5.23 (NR) *P* = 0.14
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*Anticoagulation for atrial fibrillation improvement in use of therapy from baseline* 6.4%/8.6%	aOR[b] 0.65 (0.40–1.05)

Abbreviations: aOR, adjusted odds ratio; aRC, adjusted regression correlation; CI, confidence interval; eTool, electronic tool; FRACGP, Fellowship of the Royal Australian College of General Practitioners; GP, general practitioner.

[a]Adjusted for GP age, GP sex, FRACGP status, work in deputizing services in preceding month, bulk billing for all patients, practice accreditation status, presence of a practice nurse.

[b]Adjusted for patient and practice characteristics.

Two observational studies examined appropriately prescribed Aspirin. One study found no significant difference between study groups in the prescribing of Aspirin or clopidogrel, while the other found a statistically significant increase in the proportion of patients who received Aspirin in the intervention group (Table 28) (GRADE quality of evidence: very low).

Table 28: Impact of eTools on Appropriately Prescribed Aspirin

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Henderson et al, 2010 (36)	Observational	16 months	5,838/1,075 encounters	*Aspirin or clopidogrel* 8.7/9.6 per 100 encounters	aRC[a] –1.93 (NR) *P* = 0.14
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Aspirin* 82.2%51.4% of patients	aOR[b] 4.8 (4.4–5.3)

Abbreviations: aOR, adjusted odds ratio; aRC, adjusted regression correlation; CI, confidence interval; eTool, electronic tool; FRACGP, Fellowship of the Royal Australian College of General Practitioners; GP, general practitioner; NR, not reported.
[a]Adjusted for GP age, GP sex, FRACGP status, work in deputizing services in preceding month, bulk billing for all patients, practice accreditation status, presence of a practice nurse.
[b]Adjusted for age, sex, insulin usage and year of study.

A number of other outcomes related to appropriately prescribed medications were examined; no statistically significant results were observed, with the exception of the proportion of patients prescribed beta-blockers (Table 29) (GRADE quality of evidence: very low).

Table 29: Impact of eTools on Other Outcomes of Appropriately Managed Medications

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results, % (Intervention/Control)	Effect Estimate (95% CI)
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*Aldosterone antagonist* 17.4/20.7	aOR[a] 0.86 (0.49–1.50)
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*ICD/CRT-D* 19.1/18.0	aOR[a] 1.06 (0.78–1.44)
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*Beta-blocker* 6.9/5.3	aOR[a] 1.43 (1.05–1.93)
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*CRT-P/CRT-D* 33.6/31.1	aOR[a] 1.33 (0.73–2.43)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; CRT-D, cardio-resynchronization therapy with defibrillator; CRT-P, cardio-resynchronization therapy with pacemaker; eTool, electronic tool; ICD, implantable cardioverter defibrillator.
[a]Adjusted for patient and practice characteristics.

Finally, 1 RCT found a statistically significant increase in the number of changes in statin prescriptions in the intervention group at 1 month, but not at 1 year (Table 30) (GRADE quality of evidence: low at 1 month and moderate at 1 year; difference is due to wide confidence intervals at 1 month).

Table 30: Impact of eTools on Appropriate Changes Made to Statin Prescriptions

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results, % (Intervention/Control)	Effect Estimate (95% CI)
Lester et al, 2005 (33)	RCT	1 month	118/117	*At 1 month* 15.3/2.0	OR 10.35 (2.34–45.71)
Lester et al, 2005 (33)	RCT	1 year	118/117	*At 1 year* 24.6/17.1	OR 1.58 (0.83–2.99)

Abbreviations: CI, confidence interval; eTool, electronic tool; OR, odds ratio; RCT, randomized controlled trial.

Behavioural Management Interventions

Two studies found a statistically significant increase in the proportion of patients receiving diet advice in the intervention groups (Table 31) (GRADE quality of evidence: low to very low).

One RCT found no significant change in the proportion of patients receiving tobacco advice, but 1 observational study found a statistically significant increase in the proportion of patients receiving a smoking assessment in the intervention group (GRADE quality of evidence: low to very low).

One RCT found a statistically significant increase in the proportion of patients receiving exercise and self-management advice in the intervention group (GRADE quality of evidence: low). One observational study found a statistically significant improvement in heart failure education in the intervention group (GRADE quality of evidence: very low).

Table 31: Impact of eTools on Behavioural Management Interventions

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results, % of patients (Intervention/Control)	Effect Estimate (95% CI)
Diet Advice					
Montori et al, 2002 (37)	RCT	24 months	399/208	70/60	aOR[a] 1.9 (1.2–3.0)
Wells et al, 1996 (42)	Observational	23 months	2,049/1,190	*Saw dietitian* 91/81	OR 2.36 (1.92–2.91)
Smoking					
Montori et al, 2002 (37)	RCT	24 months	399/208	*Tobacco advice* 94/87	aOR[a] 2.0 (0.9–4.3)
Herrin et al, 2012 (40)	Observational	5 years	10,017/35,033 patient years	*Smoking assessment* 98.6/94.3	aOR[b] 2.6 (2.2–3.1)
Other					
Montori et al, 2002 (37)	RCT	24 months	399/208	*Exercise advice* 80/52	aOR[a] 2.7 (1.6–4.5)
Montori et al, 2002 (37)	RCT	24 months	399/208	*Self-management support* 61/38	aOR[a] 2.6 (1.7–3.8)
Walsh et al, 2012 (41)	Observational	24 months	4,220/2,950	*Heart failure education improvement in use of therapy from baseline* 24.7/26.6	aOR[c] 0.95 (0.67–1.35)

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; NR, not reported; OR, odds ratio; RCT, randomized controlled trial.

[a]Adjusted with logistic regression; further details not provided.

[b]Adjusted for age, sex, insulin usage, and year of study.

[c]Adjusted for patient and practice characteristics.

Composite Outcomes

Two observational studies examined a composite outcome of conducting or recording certain examinations and tests as good clinical practice measures. One study found a statistically significant increase in the proportion of patients who had an HbA1c measurement, kidney management, eye examination, or pneumococcal vaccination in the intervention group (Table 32). The other study did not find a statistically significant difference between study groups for meeting 3 of the following criteria: HbA1c assessed within previous 6 months, urine microalbumin assessed within the previous 12 months, smoking status assessed within the previous 6 months, LDL-C assessed within the previous 12 months, or blood pressure recorded at the previous 3 visits (GRADE quality of evidence: very low).

Table 32: Impact of eTools on Composite Outcomes of Tests Conducted

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Cebul et al, 2011 (38)	Observational	1 year	24,547/2,660	*Composite*[a] 50.9/6.6% of patients	aDiff[b] 35.1 (28.3–41.9) *P* < 0.001
Crosson et al, 2012 (39)	Observational	3 years	306/492	*3 of 5 criteria*[c] *met* NR	aOR[d] 1.60 (0.93–2.74) *P* = 0.09

Abbreviations: aDiff, adjusted risk difference; aOR, adjusted odds ratio; CI, confidence interval; eTool, electronic tool; HbA1c, hemoglobin A1c; LDL-C, low density lipoprotein cholesterol; NR, not reported.

[a]Composite of measurement of HbA1c, kidney management, eye examination, and pneumococcal vaccination.

[b]Adjusted for insurance type, age, sex, race/ethnic group, language preference, estimated household income, and education level.

[c]Criteria: HbA1c assessed within last 6 months, urine microalbumin assessed within last 12 months, smoking status assessed within last 6 months, LDL-C assessed within last 12 months, blood pressure recorded at each of 3 previous visits.

[d]Adjusted for clustering effect.

Measures of Efficiency

Various measures of efficiency in the context of the utilization of electronic tools for health information exchange as a means of chronic disease management in the community were identified in the included studies. Specifically, 2 categories of efficiency examined: time and communication.

Time

One RCT found no statistically significant difference between study groups in time to receipt of discharge summary when comparing electronic discharge summaries and handwritten structure summaries (Table 33) (GRADE quality of evidence: high).

One RCT found a statistically significant shorter time to change in a statin medication among patients whose care providers received an electronic outreach summary report, but found no difference between study groups in time to first measurement of LDL-C (Table 33) (GRADE quality of evidence: moderate).

One observational evaluation found a statistically significant increase in the length of time PCPs and nurses spent with their patients 2 years after implementation of the electronic diabetes management system (Table 33) (GRADE quality of evidence: very low).

Table 33: Impact of eTools on Time

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Time to Receive Discharge Summary					
Graumlich et al, 2009 (34)	RCT	6 months	316/315	*Proportion of physicians to receive discharge summaries within 1–7 days* 56.0%/57.1%	aDiff[a] –1.1% (–9.2%–6.9%)
Time to Receive Clinical Intervention					
Lester et al, 2005 (33)	RCT	1 year	118/117	*Time to first measure of LDL-C* 99 days/121 days	Mean difference –22.0 (–82.9 to 38.9)
Lester et al, 2005 (33)	RCT	1 year	118/117	*Time to change in statin prescription (median)* 0 months/7.1 months	Mean difference –7.1 (–12.0 to –2.2)
Time Spent With Patients					
Montori et al, 2002 (37)	Before/after evaluation for this outcome; RCT	2 years	399/208	*Time spent with patients (provider)* Start of implementation: median 5 min (range 0–30 min) 2 years after implementation: median 9.5 min (range 0–34)	Mean difference 4.5 (1.83–7.17)
				Time spent with patients (nurse) Start of implementation: median 15 min (range 4–45 min) 2 years after implementation: median 18 min (range 10–55)	Mean difference 3.00 (0.67–5.33)

Abbreviations: aDiff, adjusted risk difference; CI, confidence interval; eTool, electronic tool; LDL-C, low-density lipoprotein cholesterol; RCT, randomized controlled trial.
[a]Adjusted with cluster correction.

Additionally, the RCT by Lester et al found that it took physicians less than 60 seconds to complete the emailed report. (33)

Communication
One observational study identified a statistically significant increase in the number of letters sent from consultants to GPs in the intervention group, but not from GPs to consultants or in the number of patient contacts with either GP or consultant (Table 34) (GRADE quality of evidence: very low).

Table 34: Impact of eTools on Frequency of Communication

Author, Year	Study Design	Length of Follow-up	Sample Size, n (Intervention/ Control)	Results (Intervention/Control)	Effect Estimate (95% CI)
Branger et al, 1999 (32)	Observational	1 year	215/60	*Number of letters sent from GPs to consultants* 151 (0.7)/14 (0.2) total (per patient) *P* ≥ 0.05 *Number of letters sent from consultants to GPs* 339 (1.6)/24 (0.4) total (per patient) *P* = 0.00 *Number of patient contacts with GPs and consultants* 14 with GP, 4 with consultant/ 14 with GP, 4 with consultant *P* ≥ 0.05	Not estimable

Abbreviations: CI, confidence interval; eTool, electronic tool; GP, general practitioner.

Potential Trends in Analysis Results

The second research question was aimed at identifying any potential factors that contribute to the observed outcomes of interest, and 96 different outcomes were extracted. Given that most of the included studies did not report outcomes in a consistent manner, a simple accounting summary was constructed to explore any potential trends. If a trend existed, we would expect to see mostly positive outcomes in 1 component while mostly nonsignificant outcomes in another with the same categorical exploration.

Three different potential trends were examined: 1) impact of eTools by specific disease population; 2) impact of eTools by targeted care coordination aspect; and 3) impact of eTools by technology.

Overall, no outstanding trends were identified, indicating that there was no single disease group, care coordination aspect, or technology that contributed more significantly to the observed impacts of eTools. This observed trend of no difference held when a subgroup analysis was conducted, limiting the analysis to an examination of only process-of-care outcomes (Figure 4).

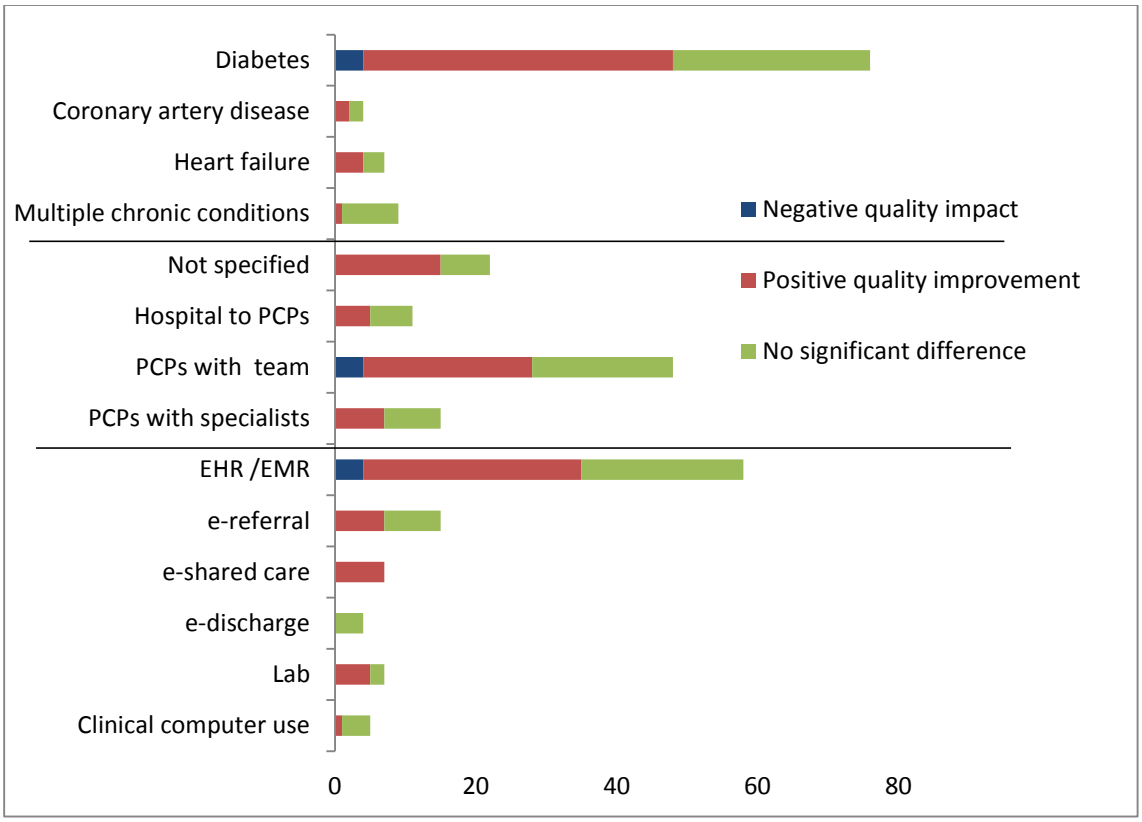

Figure 4: Subgroup Analysis: Process-of-Care Outcomes By Disease, Care Coordination Aspect, and Technology

Abbreviations: EHR, electronic health record; EMR, electronic medical record; PCP, primary care physician.

Summary of Results

Eleven articles were identified from a systematic literature search that examined the application of eTools for health information exchange to assist with the management of patients with chronic disease in the community setting. There was a substantial amount of technological, clinical, and methodological diversity among the included studies.

Three categories of outcomes of interest were examined: 1) the primary outcomes of interest, which included both health services utilization and disease-specific clinical outcomes; 2) process-of-care indicators; and 3) measures of efficiency.

Primary Outcomes (Health Services Utilization and Disease-Specific Clinical Outcomes)

In summary, 1 RCT demonstrated a reduction in hospitalizations, length of stay, and ED visits (Table 35). In this study, the intervention was an electronic laboratory report generated and forwarded to PCPs with recommendations linked to guidelines. (35) Among the other studies examining various eTools, there was evidence of no difference in readmissions and various disease-specific outcomes between study groups.

Table 35: Summary of Health Services Utilization and Disease-Specific Clinical Outcomes

Outcome	Number of Studies	Statistical Method	Effect Estimate (95% CI)	GRADE[a]
Hospitalizations	1 (RCT)	Mean difference	–0.03 (–0.05 to –0.01)	Moderate
Length of stay, days	1 (RCT)	Mean difference	–0.11 (–0.19 to –0.03)	Moderate
ED visits	1 (RCT)	Mean difference	–0.09 (–0.14 to –0.04)	Moderate
Readmissions	1 (RCT)	Risk difference	–0.005 (–0.074 to 0.065)	High
Disease-Specific Outcomes				
HbA1c, %	1 (RCT)	Mean difference	0.01 (–0.3 to 0.4)	Low
	1 (Observational)	Mean difference	–0.09 (–0.69 to 0.51)	Very low
SBP, mm Hg	1 (RCT)	Mean difference	–0.8 (–5.0 to 3.4)	Low
DBP, mm Hg	1 (RCT)	Mean difference	–0.6 (–2.4 to 1.1)	Low
Total cholesterol, mmol/L	1 (RCT)	Mean difference	–0.1 (–3.5 to 1.8)	Low
LDL–C, mg/dL	2 (RCT)	Mean difference	–4.7 (–13.4 to 4.0)	Low
		Mean difference	–0.1 (–3.0 to 2.8)	Low
Triglycerides, mg/dL	1 (RCT)	Mean difference	0.1 (–1.7 to 3.5)	Low
Adverse events	1 (RCT)	Risk difference	0.003 (–0.037 to 0.043)	High
Achievement of Clinical Outcomes				
HbA1c < 8%	2 (Observational)	Risk difference	10.9 (–1.7 to 23.6)	Very low
HbA1c ≤ 8%		Odds ratio	0.9 (0.8–1.0)	
BP < 140/80 mm Hg	1 (Observational)	Risk difference	11.1 (–1.0 to 23.2)	Very low
SBP < 130 mm Hg	1 (Observational)	Odds ratio	1.2 (1.1–1.3)	
DBP < 80 mm Hg	1 (Observational)	Odds ratio	1.3 (1.2–1.3)	
LDL-C < 100 mg/dL or statin	2 (Observational)	Risk difference	18.1 (11.8–24.4)	Very low
LDL-C < 100 mg/dL		Odds ratio	0.7 (0.6–0.8)	
Triglycerides < 150 mg/dL	1 (Observational)	Odds ratio	0.9 (0.8–1.0)	Very low
BMI < 30 kg/m^2	1 (Observational)	Risk difference	–2.9 (–8.0 to –2.1)	Very low
Nonsmoker	2 (Observational)	Risk difference	17.0 (5.3–28.6)	Very low
		Odds ratio	1.1 (1.0–1.2)	
Composite of targets met[b]	1 (Observational)	Risk difference	15.2 (4.5–25.9)	Very low
Composite—3 of 3 targets met[c]	1 (Observational)	Odds ratio	1.42 (1.12–2.51)	
Composite—optimal care[d]	1 (Observational)	Odds ratio	1.5 (1.3–1.6)	

Abbreviations: BMI, body mass index; BP, blood pressure; CI, confidence interval; DBP, diastolic blood pressure; ED, emergency department; HbA1c, hemoglobin A1c; LDL-C, low density lipoprotein cholesterol; RCT, randomized controlled trial; SBP, systolic blood pressure.

[a]Details of individual GRADE assessments are available in Appendix 3.

[b]Composite of HbA1c < 8%, blood pressure <140/80 mm Hg, LDL-C <100 mg/dL or use of statin, BMI < 30 kg/m^2, or nonsmoker.

[c]Criteria: HbA1c < 7%, LDL-C ≤ 100 mg/dl, or blood pressure ≤ 130/85 mm Hg.

[d]Achieving HbA1c ≤ 8%, LDL-C <100 mg/dL, blood pressure < 130/80 mm Hg, nonsmoker, and Aspirin use.

Process-of-Care Indicators

All process of care measures reported were related to the frequency of which certain tests or examinations were conducted (or recorded). Results for this grouping of outcomes were inconclusive. Additionally, there was no observed trend of an impact based on the disease-specific grouping of patients, the care coordination aspect targeted, or the technology applied (Table 36).

Table 36: Summary of Process-of-Care Indicators

Outcome	Number of Studies (Study Design)	Statistical Method	Effect Estimate (95% CI)	GRADE[a]
Rate of Conducting (or Recording) Clinical Tests				
BP measures	3 (Observational)	Mean difference	0.50 (0.28–0.72)	Very low
		Odds ratio	36.5 (6.0–105.9)	
		Odds ratio	4.12 (3.35–5.07)	
Total cholesterol	1 (RCT)	Odds ratio	1.4 (0.8–2.3)	Low
	2 (Observational)	Mean difference	0.30 (0.03–0.57)	Very low
		Odds ratio	0.9 (0.8–1.0)	
Triglycerides	1 (RCT)	Odds ratio	5.0 (0.9–2.4)	Low
	2 (Observational)	Mean difference	0.10 (0.02–0.18)	Very low
		Odds ratio	0.8 (0.7–0.9)	
HbA1c	1 (RCT)	Odds ratio	4.5 (1.0–19.5)	Low
	5 (Observational)	Mean difference	0.6 (0.21–0.99)	Very low
		Risk difference	7.2 (0.4–14.0)	
		Regression correlation	3.10 (NR), *P* = 0.24	
		Odds ratio	0.6 (0.5–0.6)	
		Odds ratio	4.89 (3.95–6.04)	
Blood glucose	1 (Observational)	Mean difference	0.10 (–0.04 to 0.24)	Very low
Fructosamine	1 (Observational)	Mean difference	0.20 (0.05–0.35)	Very low
Eye examinations	1 (RCT)	Odds ratio	2.4 (1.5–3.9)	Low
	5 (Observational)	Mean difference	0.0 (0.0–0.0)	Very low
		Risk difference	25.0 (18.7–31.2)	
		Regression correlation	2.94 (NR), *P* = 0.002	
		Odds ratio	1.5 (1.4–1.7)	
		Odds ratio	2.54 (2.08–3.10)	
Foot examinations	1 (RCT)	Odds ratio	2.3 (1.2–4.4)	Low
	2 (Observational)	Odds ratio	2.81 (2.62–3.02)[b]	Very low
Kidney management: urine protein	1 (RCT)	Odds ratio	3.2 (1.9–5.2)	Low
	3 (Observational)	Mean difference	–0.40 (–0.95 to 0.15)	Very low
		Odds ratio	1.2 (1.1–1.3)	
		Odds ratio	3.96 (3.4–4.7)	
Kidney management: creatinine	1 (Observational)	Mean difference	0.10 (–0.04 to 0.24)	Very low

Outcome	Number of Studies (Study Design)	Statistical Method	Effect Estimate (95% CI)	GRADE[a]
Kidney management: composite outcome	1 (Observational)	Risk difference	13.3 (8.4–18.3)	Very low
Kidney management: urinalysis	1 (Observational)	Odds ratio	0.8 (0.7–0.8)	Very low
Weight	1 (Observational)	Mean difference	1.6 (0.62–2.58)	Very low
Height	1 (Observational)	Odds ratio	2.25 (1.84–2.75)	Very low
Vaccinations and immunizations	1 (RCT)	Odds ratio	1.7 (1.1–2.7)	Low
	2 (Observational)	Risk difference	57.1 (43.6–70.5)	Very low
		Odds ratio	1.1 (1.0–1.1)	
Medications: ACE inhibitors	2 (Observational)	Regression correlation	0.16 (NR), *P* = 0.86	Very low
		Odds ratio	0.83 (0.63–1.09)	
Medications: anticoagulation	2 (Observational)	Regression correlation	–5.23 (NR), *P* = 0.14	Very low
		Odds ratio	0.65 (0.40–1.05)	
Medications: Aspirin (or clopidogrel)	2 (Observational)	Regression correlation	–1.93 (NR), *P* = 0.14	Very low
		Odds ratio	4.8 (4.4–5.3)	
Medications: aldosterone antagonist	1 (Observational)	Odds ratio	0.86 (0.49–1.50)	Very low
Medications: ICD/CRT-D	1 (Observational)	Odds ratio	1.06 (0.78–1.44)	Very low
Medications: beta-blocker	1 (Observational)	Odds ratio	1.43 (1.05–1.93)	Very low
Medications: CRT-P/CRT-D	1 (Observational)	Odds ratio	1.33 (0.73–2.43)	Very low
Medications: changes in statins (1 month)	1 (RCT)	Odds ratio	10.35 (2.34–45.71)	Low
Medications: changes in statins (1 year)	1 (RCT)	Odds ratio	1.58 (0.83–2.99)	Moderate
Behavioural interventions: diet advice	1 (RCT)	Odds ratio	1.9 (1.2–3.0)	Low
	1 (Observational)	Odds ratio	2.36 (1.92–2.91)	Very low
Behavioural interventions: smoking assessment	1 (RCT)	Odds ratio	2.0 (0.9–4.3)	Low
	1 (Observational)	Odds ratio	2.6 (2.2–3.1)	Very low
Behavioural interventions: exercise advice	1 (RCT)	Odds ratio	2.7 (1.6–4.5)	Low
Behavioural interventions: self-management support	1 (RCT)	Odds ratio	2.6 (1.7–3.8)	Low
Behavioural interventions: HF education	1 (Observational)	Odds ratio	0.95 (0.67–1.35)	Very low
Composite outcomes	1 (Observational)	Risk difference	35.1 (28.3–41.9)	Very low
	1 (Observational)	Odds ratio	1.60 (0.93–2.74)	

Abbreviations: ACE inhibitor, angiotensin-converting enzyme inhibitor; BP, blood pressure; CI, confidence interval; CRT-D, cardio-resynchronization therapy with defibrillator; CRT-P, cardio-resynchronization therapy with pacemaker; HbA1c, hemoglobin A1C; ICD, implantable cardioverter defibrillator; NR, not reported; RCT, randomized clinical trial.

[a]Details of individual GRADE assessments are available in Appendix 3.

[b]Pool effect estimate.

Measures of Efficiency

There was evidence that an electronic discharge summary was received in as timely a manner as paper-based discharge summaries; overall, the evidence did not demonstrate improved efficiency (Table 37).

Table 37: Summary of Measures of Efficiency

Outcome	Number of Studies	Statistical Method	Effect Estimate (95% CI)	GRADE[a]
Impact on Time				
Proportion of PCPs receiving discharge summary within 1–7 days	1 (RCT)	Risk difference	1.1 (–9.2 to 6.9)	High
Time to first measure of LDL-C, days	1 (RCT)	Mean difference	–22.0 (–82.9 to 38.9)	Moderate
Time to change in statin prescription	1 (RCT)	Mean difference	–7.1 (–12.0 to –2.2)	Moderate
Time spent by providers with patients	1 (Observational)	Mean difference	4.5 (1.83–7.17)	Very low
Time spent by nurses with patients	1 (Observational)	Mean difference	3.00 (0.67–5.33)	Very low
Impact on Communication				
Number of letters from GP to consultant	1 (RCT)	NR	Not significant	Very low
Number of letters from consultant to GP	1 (RCT)	NR	Significant increase	Very low
Number of patient contacts with GP	1 (RCT)	NR	Not significant	Very low
Number of patient contacts with consultant	1 (RCT)	NR	Not significant	Very low

Abbreviations: CI, confidence interval; GP, general practitioner; LDL-C, low-density lipoprotein cholesterol; NR, not reported; PCP, primary care physician; RCT, randomized clinical trial.

[a]Details of individual GRADE assessments are available in Appendix 3.

Conclusions

The findings from this evidence-based analysis call into question the ability of eTools to independently improve the quality of outpatient care coordination. Although automation is intended to facilitate consistency in application and measurement, eTools may not be able to overcome underlying process inefficiencies. That said, based on the findings from this report, there does not appear to be evidence of patient harm with the implementation of eTools in various contexts and settings. (Note: All conclusions are from the perspective of implementation of eTools versus comparator groups.)

Health Services Utilization

When an automated laboratory results report with clinical alerts mapped to guidelines was shared with primary care, there was evidence of a reduction in the following:

- hospitalizations (relative reduction 15%), based on moderate quality evidence
- hospital length of stay (relative reduction 10%), based on moderate quality evidence
- ED visits (relative reduction 25%), based on moderate quality evidence

There was evidence of no difference in the proportion of patients who experienced a readmission, based on high quality evidence.

Disease-Specific Clinical Outcomes

Following implementation of a variety of eTools with health information exchange capabilities, there was evidence of no difference in the following:

- proportion of patients experiencing adverse events, based on high quality evidence
- blood pressure, based on low quality evidence
- lipid levels, based on low quality evidence
- HbA1c, based on very low quality evidence

There was inconclusive evidence of impact on the proportion of patients achieving a previously defined guideline threshold (HbA1c, blood pressure control, lipid levels, smoking status, body mass index, or composite outcomes), based on very low quality evidence.

Process-of-Care Indicators

The evidence did not demonstrate that eTools for health information exchange had an overall positive impact on process-of-care measures, and there was no trend for specific diseases, care coordination aspects, or technologies.

There was evidence of an increase in the number of the following:

- foot examinations, based on low quality evidence
- fructosamine tests, based on low quality evidence
- weight measures, based on low quality evidence
- height measures, based on low quality evidence
- blood pressure examinations, based on low to very low quality evidence

- vaccinations and immunizations, based on low to very low quality evidence
- eye examinations, based on very low quality evidence
- medication management of beta-blockers, based on very low quality evidence

There was evidence of no difference in the following:

- changes in prescribed statins at 1 year, based on moderate quality evidence
- blood glucose tests, based on low quality evidence
- lipid tests conducted, based on very low quality evidence
- medication management, based on very low quality of evidence, of ACE inhibitors, Aspirin, aldosterone antagonists, anticoagulants, or implantable cardioverter and resynchronization devices

There was inconclusive evidence of an impact on the following:

- kidney management, based on low to very low quality evidence
- behavioural interventions, based on low to very low quality evidence
- HbA1c tests, based on very low quality evidence
- composite outcomes of process of care indicators, based on very low quality evidence

Measures of Efficiency

The evidence did not demonstrate improved efficiency for care providers upon implementation of eTools for health information exchange.

There was evidence of no difference in the proportion of PCPs receiving discharge summaries within the first week post-discharge, based on high quality evidence.

There was no demonstrated improved impact on the following:

- efficiencies related to time, based on very low quality evidence
- efficiencies related to communication, based on moderate to very low quality evidence

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

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Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
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Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Search date: April 26, 2012
Databases searched: Databases searched: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, EBSCO CINAHL, Centre for Reviews and Dissemination.
Ovid MEDLINE(R) <1946 to April Week 3 2012>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <April 25, 2012>, Embase <1980 to 2012 Week 16>
Search Strategy:
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1 exp Coronary Artery Disease/ (223075)
2 exp Myocardial Infarction/ use mesz (135539)
3 exp heart infarction/ use emez (225793)
4 (coronary artery disease or cad or heart attack).ti. (45983)
5 ((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti. (153984)
6 or/1-5 (559947)
7 exp Atrial Fibrillation/ use mesz (28957)
8 exp heart atrium fibrillation/ use emez (58378)
9 ((atrial or atrium or auricular) adj1 fibrillation*).ti,ab. (77199)
10 or/7-9 (103984)
11 exp heart failure/ (311514)
12 ((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab. (244313)
13 11 or 12 (396209)
14 exp Stroke/ (184883)
15 exp Ischemic Attack, Transient/ use mesz (16552)
16 exp transient ischemic attack/ use emez (20571)
17 exp stroke patient/ use emez (5818)
18 exp brain infarction/ or exp cerebrovascular accident/ use emez (105144)
19 (stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab. (294576)
20 or/14-19 (408356)
21 exp Diabetes Mellitus, Type 2/ use mesz (70547)
22 exp non insulin dependent diabetes mellitus/ use emez (108517)
23 exp diabetic patient/ use emez (13718)
24 (diabetes or diabetic* or niddm or t2dm).ti,ab. (799410)
25 or/21-24 (825461)
26 exp Skin Ulcer/ (74421)
27 ((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab. (29783)
28 (decubitus or bedsore*).ti,ab. (8729)
29 or/26-28 (93902)
30 exp Pulmonary Disease, Chronic Obstructive/ use mesz (17882)
31 exp chronic obstructive lung disease/ use emez (57527)
32 (chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab. (57215)
33 (copd or coad).ti,ab. (48215)
34 chronic airflow obstruction.ti,ab. (1086)
35 exp Emphysema/ (38314)
36 exp chronic bronchitis/ use emez (7067)
37 ((chronic adj2 bronchitis) or emphysema).ti,ab. (52038)
38 or/30-37 (165176)
39 exp Chronic Disease/ (352795)
40 ((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab. (230609)
41 39 or 40 (526597)
42 6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 (2710352)
43 exp Medical Informatics/ use mesz (270756)
44 exp Medical Records Systems, Computerized/ use mesz (20862)
45 exp *Data Processing/ use emez (451316)
46 (ehr or ehealth or etool* or eprescri* or (computer* adj2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS).ti,ab. (13421)

47 ((electronic or e or computer*) adj2 (health or patient or medical) adj record*).ti,ab. (20226)
48 ((electronic or e or computer*) adj2 (management or tool* or system* or prescrib* or decision support or discharge or (medication adj2 reconciliation))).ti,ab. (40980)
49 or/44-48 (515984)
50 exp Intermediate Care Facilities/ use mesz (601)
51 (intermedia* adj2 care).ti,ab. (2483)
52 exp ambulatory care/ (77162)
53 exp Ambulatory Care Facilities/ use mesz (40218)
54 exp ambulatory care nursing/ use emez (9)
55 exp Outpatients/ use mesz (7295)
56 exp Outpatient Department/ use emez (33491)
57 exp outpatient care/ use emez (17984)
58 exp Community Health Services/ use mesz (449731)
59 exp community care/ use emez (88605)
60 exp Community Medicine/ (3920)
61 exp Subacute Care/ use mesz (707)
62 exp General Practice/ (125046)
63 exp Primary Health Care/ (157916)
64 exp Physicians, Family/ or exp general practitioners/ or exp Physicians, Primary Care/ use mesz (63980)
65 exp general practitioner/ use emez (48469)
66 exp family medicine/ use emez (5959)
67 exp Group Practice/ use mesz (22240)
68 exp Team Nursing/ use emez (23)
69 exp Primary Care Nursing/ use mesz (38)
70 exp Patient Care Team/ use mesz (49591)
71 exp Teamwork/ use emez (9370)
72 *Patient Care Management/ use mesz (1271)
73 ((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)).ti,ab. (342433)
74 ((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*)).ti,ab. (43679)
75 (team* or liaison).ti,ab. (185342)
76 ((general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nuse* or physician*)).ti,ab. (212184)
77 or/50-76 (1387096)
78 42 and 49 and 77 (3445)
79 limit 78 to english language (3248)
80 limit 79 to (case reports or comment or editorial or letter) [Limit not valid in Embase; records were retained] (56)
81 Case Report/ use emez (1818833)
82 79 not (80 or 81) (3157)
83 remove duplicates from 82 (2435)

CINAHL

#	Query	Results
S56	S35 and S53 and S54 Limiters - English Language	478
S55	S35 and S53 and S54	484
S54	S4 OR S7 OR S10 OR S14 OR S18 OR S21 OR S28	110786
S53	S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49 or S50 or S51 or S52	218102
S52	((general or family or primary care or community) N2 (practic* or clinic* or program* or doctor* or nuse* or physician*))	42239
S51	(team* or liaison)	51916
S50	((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or	30234

	integrat* or joint or multi-modal or multimodal) N2 (care or team*)).	
S49	((primary or family or community or outpatient* or ambulatory) N2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))	120869
S48	(MH "Team Nursing") OR (MH "Primary Nursing")	1298
S47	(MH "Multidisciplinary Care Team+")	18615
S46	(MH "Group Practice+")	5868
S45	(MH "Physicians, Family")	7237
S44	(MH "Primary Health Care")	25141
S43	(MH "Family Practice")	9219
S42	(MH "Community Medicine")	23
S41	(MH "Community Programs")	3920
S40	(MM "Community Health Services") OR (MH "Community Health Nursing+") OR (MH "Community Networks") OR (MH "Family Services") OR (MH "Occupational Health Services+")	31826
S39	(MH "Outpatients")	27169
S38	(MH "Outpatient Service")	3017
S37	(MH "Ambulatory Care") OR (MH "Ambulatory Care Facilities+") OR (MH "Ambulatory Care Nursing")	13447
S36	(MH "Subacute Care")	976
S35	S29 or S30 or S31 or S32 or S33 or S34	39837
S34	(electronic or e or computer*) N2 (management or tool* or system* or prescrib* or decision support or discharge or (medication N2 reconciliation))	6013
S33	((electronic or e or computer*) N2 (health or patient or medical) N1 record*)	8817
S32	(ehr or ehealth or etool* or eprescri* or (computer* N2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS)	2165
S31	(MH "Information Technology+") OR (MH "Systems Development+")	13019
S30	(MH "Computerized Patient Record")	7254
S29	(MH "Health Information Systems+") OR (MH "Management Information Systems+") OR (MH "Health Informatics+") OR (MH "Image Retrieval Systems") OR (MH "Integrated Advanced Information Management Systems") OR (MH "Laboratory Automation Systems")	25352
S28	S26 or S27	29029
S27	chronic*N2 disease* or chronic* N2 ill*	7671
S26	(MH "Chronic Disease")	24387
S25	chronic N2 bronchitis or emphysema	1854
S24	(MH "Emphysema")	911
S23	chronic obstructive N2 disease* or chronic obstructive N2 disorder* or copd or coad	7697
S22	(MH "Pulmonary Disease, Chronic Obstructive+")	5746
S21	S19 or S20	16558
S20	pressure N1 ulcer* or bedsore* or bed N1 sore* or skin N1 ulcer* OR pressure N1 wound* OR decubitus	9821
S19	(MH "Skin Ulcer+")	15161
S18	S15 or S16 or S17	72199
S17	diabetes or diabetic* or niddm or t2dm	72199
S16	(MH "Diabetic Patients")	3650
S15	(MH "Diabetes Mellitus, Type 2")	18985
S14	S19 or S18 or S17	71
S13	stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or	38866

	cerebrovascular infarct* or brain infarct* or CVA	
S12	(MH "Cerebral Ischemia, Transient")	1954
S11	(MH "Stroke") OR (MH "Stroke Patients")	26468
S10	S22 OR S21	50
S9	myocardi*failure OR myocardial decompensation OR myocardial insufficiency OR cardiac failure OR cardiac decompensation or cardiac insufficiency OR heart failure OR heart decompensation OR heart insufficiency	19373
S8	(MH "Heart Failure+")	14932
S7	S25 OR S24	53
S6	atrial N1 fibrillation* OR atrium N1 fibrillation* OR auricular N1 fibrillation*	8361
S5	(MH "Atrial Fibrillation")	6776
S4	S31 OR S28 OR S27 OR S26	76
S3	TI myocardi* N2 infarct* or TI heart N2 infarct* or TI cardiac N2 infarct* OR TI coronary N2 infarct* or TI arterioscleros* or TI atherosclerosis*	9857
S2	coronary artery disease OR cad OR heart attack*	7893
S1	(MH "Myocardial Infarction+") or (MH "Coronary Arteriosclerosis")	24056

CRD

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	300
2	(coronary artery disease or cad or heart attack*):TI	223
3	((myocardi* or heart or cardiac or coronary) adj2 (atherosclerosis* or arteriosclerosis* or infarct*)):TI	232
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	277
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	181
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	500
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	293
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	668
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	42
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	640
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	631
13	(diabetes or diabetic* or niddm or t2dm):TI	1276
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	280
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	76
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	291
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	228
19	(copd or coad):TI	116
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	11
22	((chronic adj2 bronchitis) or emphysema):TI	48
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	772
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	265
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	170
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	25
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	5010
28	MeSH DESCRIPTOR medical informatics EXPLODE ALL TREES	2338
29	MeSH DESCRIPTOR Medical Records Systems, Computerized EXPLODE ALL TREES	49
30	((ehr or ehealth or etool* or eprescri* or (computer* adj2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS))	64
31	(((electronic or e or computer*) adj2 (health or patient or medical) adj record*))	86
32	((electronic or e or computer*) adj2 (management or tool* or system* or prescrib* or decision support or discharge or (medication adj2 reconciliation)))	340

33	#28 OR #29 OR #30 OR #31 OR #32	2608
34	MeSH DESCRIPTOR Intermediate Care Facilities EXPLODE ALL TREES	4
35	(intermedia* adj2 care)	39
36	MeSH DESCRIPTOR ambulatory care EXPLODE ALL TREES	346
37	MeSH DESCRIPTOR Ambulatory Care Facilities EXPLODE ALL TREES	205
38	MeSH DESCRIPTOR Outpatients EXPLODE ALL TREES	73
39	MeSH DESCRIPTOR Community Health Services EXPLODE ALL TREES	4097
40	MeSH DESCRIPTOR Community Medicine EXPLODE ALL TREES	3
41	MeSH DESCRIPTOR Subacute Care EXPLODE ALL TREES	7
42	MeSH DESCRIPTOR Primary Health Care EXPLODE ALL TREES	673
43	MeSH DESCRIPTOR Physicians, Family EXPLODE ALL TREES	50
44	MeSH DESCRIPTOR Group Practice EXPLODE ALL TREES	65
45	MeSH DESCRIPTOR Patient Care Team EXPLODE ALL TREES	207
46	MeSH DESCRIPTOR Patient Care Management EXPLODE ALL TREES	2512
47	(((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))) OR (((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*))) OR (team* or liaison) OR (general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nuse* or physician*)))	2134
48	#34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47	7581
49	#27 AND #33 AND #48	65

Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2250
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7854
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8562
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2159
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2357
#6	MeSH descriptor **Heart Failure** explode all trees	4818
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5347
#8	MeSH descriptor **Stroke** explode all trees	4020
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	469
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	10009
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	7179
#12	(diabetes or diabetic* or niddm or t2dm):ti	16895
#13	MeSH descriptor **Skin Ulcer** explode all trees	1599
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	673
#15	(decubitus or bedsore*):ti	100
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1804
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2436
#18	(copd or coad):ti	3352
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	92
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1184

#22	MeSH descriptor **Chronic Disease** explode all trees	10019
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1702
#24	MeSH descriptor **Comorbidity** explode all trees	1987
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	654
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	69160
#27	MeSH descriptor **Medical Informatics** explode all trees	7364
#28	MeSH descriptor **Medical Records Systems, Computerized** explode all trees	287
#29	((electronic or e or computer*) NEAR/2 (health or patient or medical) NEAR record*):ti or ((electronic or e or computer*) NEAR/2 (health or patient or medical) NEAR record*):ab	276
#30	(ehr or ehealth or etool* or eprescri* or (computer* NEAR/2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS):ti or (ehr or ehealth or etool* or eprescri* or (computer* NEAR/2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS):ab	353
#31	((electronic or e or computer*) NEAR/2 (management or tool* or system* or prescrib* or decision support or discharge or (medication NEAR/2 reconciliation))):ti or ((electronic or e or computer*) NEAR/2 (management or tool* or system* or prescrib* or decision support or discharge or (medication NEAR/2 reconciliation))):ab	889
#32	(#27 OR #28 OR #29 OR #30 OR #31)	8363
#33	MeSH descriptor **Intermediate Care Facilities** explode all trees	13
#34	(intermedia* NEAR/2 care):ti or (intermedia* NEAR/2 care):ab	95
#35	MeSH descriptor **Ambulatory Care** explode all trees	3189
#36	MeSH descriptor **Ambulatory Care Facilities** explode all trees	1424
#37	MeSH descriptor **Outpatients** explode all trees	692
#38	MeSH descriptor **Community Health Services** explode all trees	19917
#39	MeSH descriptor **Community Medicine** explode all trees	34
#40	MeSH descriptor **Subacute Care** explode all trees	16
#41	MeSH descriptor **General Practice** explode all trees	2113
#42	MeSH descriptor **Primary Health Care** explode all trees	2928
#43	MeSH descriptor **Physicians, Family** explode all trees	445
#44	MeSH descriptor **General Practitioners** explode all trees	31
#45	MeSH descriptor **Physicians, Primary Care** explode all trees	21
#46	MeSH descriptor **Group Practice** explode all trees	378
#47	MeSH descriptor **Primary Care Nursing** explode all trees	1
#48	MeSH descriptor **Patient Care Team** explode all trees	1177
#49	MeSH descriptor **Patient Care Management** explode all trees	13149
#50	((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ti and ((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ab	2110
#51	(transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ti or (transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ab	1115
#52	((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ti or ((general or family or primary care or community) NEAR/2 (practic* or clinic* or	8087

	program* or doctor* or nuse* or physician*)):ab	
#53	(team* or liaison):ti or (team* or liaison):ab	3183
#54	(#50 OR #51 OR #52 OR #53)	12346
#55	(#54 AND #32 AND #26)	

Appendix 2: Additional Publications

Table A1: Additional Publications Referenced for Supplementary Details on Included Studies

Included Studies			Additional Publications	
Author, Year	**Study Design**	**Description of Intervention**	**Author, Year**	**Description of Research Article**
Khan et al, 2010 (35)	Cluster RCT	Randomized hospital laboratories to use electronic laboratory results management system, which can automatically generate a report for PCPs	MacLean et al, 2004 (43)	Detailed description of planned study protocol
Montori et al, 2002 (37)	Cluster controlled trial	Physicians assigned to the intervention group used a diabetes electronic management system compared to control physicians, who maintained usual care with a paper-based patient chart system	Gorman et al, 2000 (44)	Detailed description of intervention technology
Walsh et al, 2012 (41)	Prospective case series	EHR use was self-identified through physician surveys; physicians who used EHRs were compared to physicians using paper-based practices—details of individual EHR systems are unknown	Walsh et al, 2010 (45)	Detailed study description and baseline data

Abbreviations: EHR, electronic health record; PCP, primary care physician; RCT, randomized controlled trial.

Appendix 3: GRADE Tables

Table A2: GRADE Evidence Profile for Health Services Utilization and Disease-Specific Clinical Outcomes

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Hospitalizations							
1 (RCT)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
Length of Stay							
1 (RCT)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
ED Visits							
1 (RCT)	Serious limitations (–1)[a]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
Readmissions							
1 (RCT)	No serious limitations	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕⊕ High
HbA1c							
1 (RCT)	Very serious limitations (–2)[b]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
1 (observational)	Serious limitations (–1)[c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
SBP							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
DBP							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
Total Cholesterol							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
LDL-C							
2 (RCTs)	Very serious limitations (–2)[b,d]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low

Triglycerides							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
Adverse Events							
1 (RCT)	No serious limitations	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕⊕ HIgh
HbA1c Managed and Below Clinical Guidelines							
2 (observational)	Serious limitations (–1)[e,f]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
BP Managed and Below Clinical Guidelines							
2 (observational)	Serious limitations (–1)[e,f]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
LDL-C Managed and Below Clinical Guidelines							
2 (observational)	Serious limitations (–1)[e,f]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Triglycerides Managed and Below Clinical Guidelines							
1 (observational)	Serious limitations (–1)[e]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
BMI < 30 kg/m^2							
1 (observational)	Serious limitations (–1)[f]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Nonsmoker							
2 (observational)	Serious limitations (–1)[e,f]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Composite Outcomes of Various Targets Met							
3 (observational)	Very serious limitations (–2)[e,f,g]	No serious limitations	Serious limitations (–1)[h]	No serious limitations	Undetected	None identified	⊕ Very low

Abbreviations: BMI, body mass index; BP, blood pressure; DBP, diastolic blood pressure; ED, emergency department; EHR, electronic health record; EMR, electronic medical record; HbA1c, hemoglobin A1c; LDL-C, low density lipoprotein cholesterol; No., number; RCT, randomized controlled trial; SBP, systolic blood pressure.

[a]Potential bias as a result of clustering effect.

[b]Physicians to receive intervention were nominated by the study sites through unknown selection methodology. Additional selective reporting bias as authors did not report data for 3 outcomes (hospitalizations, ED visits, and primary care visits).

[c]Physicians with greatest number of referrals were provided with electronic intervention, while the others were considered the control group.

[d]Physicians had patients in both study groups, contaminating blinding.

[e]Unknown methodology for selecting practices involved early versus later in the process of rolling out EHR systems.

[f]Self-selected to use EMRs (or other eTools), and therefore may inherently be different from those who did not.

[g]Intervention was implemented at the level of physician practice, and this resulted in some flux of individual patients within both study groups.

[h]The composite outcomes included different components in the various studies.

Table A3: GRADE Evidence Profile for Process-of-Care Indicators

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
BP Measures							
3 (observational)	Very serious limitations (–2)[a,b,c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Total Cholesterol							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
2 (observational)	Serious limitations (–1)[a,b]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Triglycerides							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
2 (observational)	Serious limitations (–1)[a,b]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
HbA1c							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
5 (observational)	Serious limitations (–1)[a,b,c]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None identified	⊕ Very low
Blood Glucose							
1 (observational)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Fructosamine							
1 (observational)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Eye Examinations							
1 (RCT)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
5 (observational)	Serious limitations (–1)[a,b,c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Foot Examinations							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
2 (observational)	Serious limitations (–1)[b,c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Kidney Management: Urine Protein							
1 (RCT)	Very serious limitations (–2)[d]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
3 (observational)	Serious limitations (–1)[a,b,c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Kidney Management: Creatinine							
1 (observational)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Kidney Management: Composite Outcome							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Kidney Management: Urinalysis							
1 (observational)	Serious limitations (–1)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Weight							
1 (observational)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Height							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Vaccinations and immunizations							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
2 (observational)	Serious limitations (–1)[b,c]	No serious limitations	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Medications: ACE Inhibitors							
2 (observational)	Serious limitations (–1)[c]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None identified	⊕ Very low
Medications: Anticoagulation							
2 (observational)	Serious limitations (–1)[c]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None identified	⊕ Very low
Medications: Aspirin							

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
2 (observational)	Serious limitations (–1)[b,c]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None identified	⊕ Very low
Medications: Aldosterone Antagonists							
1 (observational)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Medications: ICD/CRT-D							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Medications: Beta-blocker							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Medications: CRT-P/CRT-D							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Medications: Changes in Statins (1 month)							
1 (RCT)	Serious limitations (–1)[f]	Not relevant	No serious limitations	Serious limitations (–1)[g]	Undetected	None identified	⊕⊕ Low
Medications: Changes in Statins (1 year)							
1 (RCT)	Serious limitations (–1)[f]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
Behavioural Interventions: Diet Advice							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Behavioural Interventions: Smoking Assessment							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
1 (observational)	Serious limitations (–1)[b]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Behavioural interventions: Exercise Advice							
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
Behavioural interventions: Self-Management Support							

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
1 (RCT)	Very serious limitations (–2)[d]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕ Low
Behavioural Interventions: Heart Failure Education							
1 (observational)	Serious limitations (–1)[c]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕ Very low
Composite Outcomes of Tests Conducted or Recorded							
2 (observational)	Serious limitations (–1)[a]	No serious limitations	Serious limitations (–1)[e]	No serious limitations	Undetected	None identified	⊕ Very low

Abbreviations: ACE inhibitor, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CRT-D, cardio-resynchronization therapy with defibrillator; CRT-P, cardio-resynchronization therapy with pacemaker; ED, emergency department EHR, electronic health record; EMR, electronic medical record; eTool, electronic tool; HbA1c, hemoglobin A1c; ICD, implantable cardioverter defibrillator; No., number; RCT, randomized controlled trial.

[a]Physicians with the greatest number of referrals were provided with electronic intervention, while the others were considered the control group.

[b]Unknown methodology for selecting practices involved early versus later in the process of rolling out EHR systems.

[c]Physicians self-selected to use EMRs (or other eTools), and therefore may inherently be different from those who did not.

[d]Physicians to receive intervention were nominated by the study sites through unknown selection methodology. Additional selective reporting bias as authors did not report data for 3 outcomes (hospitalizations, ED visits, and primary care visits).

[e]Studies used different measures (e.g., per-patient versus proportion of patients).

[f]Physicians had patients in both study groups, contaminating blinding.

[g]Wide confidence intervals.

Table A4: GRADE Evidence Profile for Measures of Efficiency

No. of Studies (Design)	Risk of Bias	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
Proportion of PCPs Receiving Discharge Summary Within 1–7 Days							
1 (RCT)	No serious limitations	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕⊕ High
Time to First Measure of LDL-C							
1 (RCT)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
Time to Change in Statin Prescription							
1 (RCT)	Serious limitations (–1)[a]	Not relevant	No serious limitations	No serious limitations	Undetected	None identified	⊕⊕⊕ Moderate
Time Spent by Providers With Patients							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low
Time Spent by Nurses With Patients							
1 (RCT)	Very serious limitations (–2)[b]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low
Number of Letters From GP to Consultant							
1 (observational)	Serious limitations (–1)[c]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low
Number of Letters From Consultant to GP							
1 (observational)	Serious limitations (–1)[c]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low
Number of Patient Contacts With GP							
1 (observational)	Serious limitations (–1)[c]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low
Number of Patient Contacts With Consultant							
1 (observational)	Serious limitations (–1)[c]	Not relevant	Serious limitations (–1)[d]	No serious limitations	Undetected	None identified	⊕ Very low

Abbreviations: GP, general practitioner; eTool, electronic tool; LDL-C, low-density lipoprotein cholesterol; PCP, primary care physician; No., number; RCT, randomized controlled trial;

[a]Potential bias as a result of cross-contamination of study groups.

[b]Physicians to receive intervention were nominated by the study sites, but with unknown selection methodology. Additionally, while the study design was that of an RCT, this outcome was measured through observational data collected.

[c]Physicians with greatest number of referrals were provided with electronic intervention, while the others were considered the control group.

[d]The correlation between physician time and quality of patient care is unclear. Decrease physician time spent with a patient could be due to improved efficiency or decreased quality of care.

Table A5: Risk of Bias Among Randomized Controlled Trials for the Impact of eTools

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Graumlich, 2009 (34)	No limitations	No limitations[a]	No limitations[b]	No limitations	No limitations
Khan et al, 2010 (35)	No limitations	No limitations[a]	No limitations[b]	No limitations	Serious limitations[c]
Lester et al, 2005 (33)	No limitations	Serious limitations[d]	No limitations[b]	No limitations	No limitations
Montori et al, 2002 (37)	Very serious limitations[e]	No limitations[a]	No limitations[b]	Serious limitations[f]	No limitations[g]

Abbreviation: eTools, electronic tools.

[a]Not feasible to blind due to the obvious nature of receiving of an automated electronic report; a possible limitation for subjective outcomes, but not for definitive outcomes such as hospitalizations.

[b]Conducted analyses on an intention-to-treat principle (including studies where no loss to follow-up occurred).

[c]Calculations did not account for potential recruitment bias as a result of clustering effects.

[d]Individual physicians had patients in both intervention and control arms and received an email only for patients in the intervention group, causing cross-contamination and potential bias in patient care.

[e]Physicians to receive intervention were nominated by the study sites with unknown selection methodology.

[f]Authors did not report data for 3 outcomes (hospitalizations, ED visits, primary care visits).

[g]Performed multivariate analyses to account for potential baseline differences.

Table A6: Risk of Bias Among Observational Trials for the Impact of eTools

Author, Year	Appropriate Eligibility Criteria	Appropriate Measurement of Exposure	Appropriate Measurement of Outcome	Adequate Control for Confounding	Complete Follow-Up
Branger et al, 1999 (32)	Serious limitations[a]	No limitations	No limitations	No limitations	No limitations
Cebul et al, 2011 (38)	Serious limitations[b]	No limitations	No limitations	No limitations[c]	No limitations
Crosson et al, 2012 (39)	Serious limitations[b]	No limitations	No limitations	No limitations[c]	Serious limitations[d]
Henderson et al, 2010 (36)	Serious limitations[b]	No limitations	No limitations	No limitations[c]	No limitations[e]
Herrin et al, 2012 (40)	Serious limitations[f]	No limitations	No limitations	No limitations[c]	No limitations[g]
Walsh et al, 2012 (41)	Serious limitations[b]	No limitations	No limitations	No limitations[c]	No limitations
Wells et al, 1996 (42)	Serious limitations[b]	No limitations	No limitations	No limitations	Serious limitations[d]

Abbreviation: EHR, electronic health record; EMR, electronic medical record; eTools, electronic tools.

[a]Physicians with greatest number of referrals were provided with the electronic intervention, while the others were considered the control group.

[b]Physicians self-selected to use EMRs (or other electronic intervention) and therefore may inherently be different from those who did not.

[c]Statistical modelling was applied to adjust for known or otherwise potential confounding factors.

[d]Intervention was implemented at the level of physician practice, and this resulted in some flux of individual patients within both study groups.

[e]Assessment was conducted at the level of patient encounter; individual patients were not accounted for.

[f]Unknown methodology for selecting practices which were early adopters to EHR and up to 5 years later adoption, introducing potential bias in physician practice type.

[g]Results accounted patient years, not individual patients.

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Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011

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To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

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Abstract

Background

As part of ongoing efforts to improve the Ontario health care system, a mega-analysis examining the optimization of chronic disease management in the community was conducted by Evidence Development and Standards, Health Quality Ontario (previously known as the Medical Advisory Secretariat [MAS]).

Objective

The purpose of this report was to identify health technologies previously evaluated by MAS that may be leveraged in efforts to optimize chronic disease management in the community.

Data Sources

The *Ontario Health Technology Assessment Series* and field evaluations conducted by MAS and its partners between January 1, 2006, and December 31, 2011.

Review Methods

Technologies related to at least 1 of 7 disease areas of interest (type 2 diabetes, coronary artery disease, atrial fibrillation, chronic obstructive pulmonary disease, congestive heart failure, stroke, and chronic wounds) or that may greatly impact health services utilization were reviewed. Only technologies with a moderate to high quality of evidence and associated with a clinically or statistically significant improvement in disease management were included. Technologies related to other topics in the mega-analysis on chronic disease management were excluded. Evidence-based analyses were reviewed, and outcomes of interest were extracted. Outcomes of interest included hospital utilization, mortality, health-related quality of life, disease-specific measures, and economic analysis measures.

Results

Eleven analyses were included and summarized. Technologies fell into 3 categories: those with evidence for the cure of chronic disease, those with evidence for the prevention of chronic disease, and those with evidence for the management of chronic disease.

Conclusions

The impact on patient outcomes and hospitalization rates of new health technologies in chronic disease management is often overlooked. This analysis demonstrates that health technologies can reduce the burden of illness; improve patient outcomes; reduce resource utilization intensity; be cost-effective; and be a viable contributing factor to chronic disease management in the community.

Plain Language Summary

People with chronic diseases rely on the health care system to help manage their illness. Hospital use can be costly, so community-based alternatives are often preferred. Research published in the *Ontario Health Technology Assessment Series* between 2006 and 2011 was reviewed to identify health technologies that have been effective or cost-effective in helping to manage chronic disease in the community. All technologies identified led to better patient outcomes and less use of health services. Most were also cost-effective. Two technologies that can cure chronic disease and 1 that can prevent chronic disease were found. Eight technologies that can help manage chronic disease were also found. Health technologies should be considered an important part of chronic disease management in the community.

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List of Abbreviations

AAD	Antiarrhythmic drug
AF	Atrial fibrillation
ARAT	Action research arm test
ARI	Acute respiratory illness
BIA	Budget impact analysis
BMI	Body mass index
BPD	Biliopancreatic diversion
BPH	Benign prostatic hyperplasia
CAD	Coronary artery disease
CAP	Community-acquired pneumonia
CHF	Congestive heart failure
CI	Confidence interval
CIMT	Constraint-induced movement therapy
COPD	Chronic obstructive pulmonary disease
CSII	Continuous subcutaneous insulin infusion
EBA	Evidence-based analysis
EECP	Enhanced external counterpulsation
FEV_1	Forced expiratory volume in 1 second
FIM	Functional independence measure
FMA	Fugi-Meyer motor assessment
FTE	Full-time equivalent
FY	Fiscal year
HR	Hazard ratio
GI	Gastrointestinal
HRQOL	Health-related quality of life
ICD	Implantable cardioverter defibrillator
ICER	Incremental cost-effectiveness ratio
ICU	Intensive care unit
IMV	Invasive mechanical ventilation
INAHTA	International Agency for Health Technology Assessment/Centre for Review and Dissemination
IQR	Interquartile range
LOS	Length of stay
LTC	Long-term care
MAS	Medical Advisory Secretariat
MI	Myocardial infarction

NA	Not applicable
NPPV	Noninvasive positive pressure ventilation
NPWT	Negative pressure wound therapy
NR	Not reported
NRT	Nicotine replacement therapy
NSVT	Non-sustained ventricular tachycardia
ODEM	Ontario Diabetes Economic Model
OHTAC	Ontario Health Technology Advisory Committee
OHTAS	*Ontario Health Technology Assessment Series*
OR	Odds ratio
OT	Occupational therapy
PATH	Programs for Assessment of Technologies in Health
PCI	Percutaneous coronary intervention
PT	Physiotherapy
PVP	Photoselective vaporization of the prostate
QALY	Quality-adjusted life-year
RCT	Randomized controlled trial
RNAO	Registered Nurses' Association of Ontario
RR	Relative risk
SCD	Sudden cardiac death
SD	Standard deviation
SIS	Stroke impact scale
STEMI	ST-segment elevation myocardial infarction
THETA	Toronto Health Economics and Technology Assessment
TURP	Transurethral resection of the prostate
WMD	Weighted mean difference

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Review

To purpose of this review was to identify health technologies evaluated by the Medical Advisory Secretariat (MAS; now known as Evidence Development and Standards, Health Quality Ontario) between 2006 and 2011 that can effectively improve the management of chronic disease in the community.

As part of a larger mega-analysis examining chronic disease management in the community, (1) a review was conducted of MAS evidence-based analyses (EBAs) that showed statistical or clinical improvements in chronic disease management, with specific focus on the following 7 chronic conditions:

- type 2 diabetes
- coronary artery disease (CAD)
- atrial fibrillation (AF)
- chronic obstructive pulmonary disease (COPD)
- congestive heart failure (CHF)
- stroke
- chronic wounds

Review of Evidence-Based Analyses

Research Question

What MAS-reviewed health technologies are effective and cost-effective in optimizing chronic disease management in the outpatient setting (i.e., in the community)?

Selection of Evidence-Based Analyses

Literature Search

A review was conducted of *Ontario Health Technology Assessment Series* (OHTAS) reports published between January 1, 2006, and December 31, 2011. (2) Field evaluations conducted by the Programs for Assessment of Technologies in Health (PATH) and the Toronto Health Economics and Technology Assessment (THETA) Collaborative were also reviewed. (3;4) EBAs were independently reviewed to identify health technologies that align with the objective of improving chronic disease management, with a focus on those in the 7 areas of interest (type 2 diabetes, CAD, AF, COPD, CHF, stroke, and chronic wounds).

Inclusion Criteria

EBAs were initially selected based on information in the title and executive summary. The full texts of potentially relevant analyses were then reviewed. Analyses of technologies that led to a statistically or clinically significant improvement in chronic disease management (with moderate to high quality evidence for at least 1 of the primary outcomes based on the GRADE process described below), or that were cost-effective, were included.

Exclusion Criteria

Analyses related to the screening or monitoring of disease were excluded. Analyses related to multidisciplinary care, rehabilitation programs, and self-management were also excluded, because they are discussed as part of the Optimizing Chronic Disease Management in the Community (Outpatient) Setting mega-analysis. (1)

Outcomes of Interest

The following outcomes of interest were extracted (where reported):

- hospital utilization
  - hospitalizations
  - rehospitalizations
  - length of stay (LOS)
  - emergency department use
- mortality
- health-related quality of life (HRQOL)
- functional status
- disease-specific measures
- economic analysis measures

- incremental cost-effectiveness ratio (ICER)
- budget impact analysis (BIA)
- post-intervention downstream events avoided (e.g., adverse events, health services utilization)

Methodology of Evidence-Based Analyses

The EBAs follow a consistent review process. A brief description of the MAS approach to systematic reviews and economic evaluations is provided below (the methodologies of individual reports are available in the OHTAS). (2)

Literature Search

A literature search was performed for each EBA using at least 3 of the following databases: OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database to identify potential studies. Search dates varied by individual review. Prior to each literature search, specific inclusion and exclusion criteria and outcomes of interest were defined. Search strategies for individual EBAs are described in Appendices 1 and 2.

Statistical Analysis

When possible, results were pooled using Review Manager. (5) When applicable, continuous and dichotomous data were pooled using a random- or fixed-effects model to calculate relative risk (RR), odds ratio (OR), or weighted mean difference. When data could not be pooled, results were summarized descriptively. Statistical methods for individual EBAs are described in Appendix 2.

Quality of Evidence

The quality of the body of evidence[1] for each outcome was examined according to the GRADE Working Group criteria. (6) The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology. (Note: The GRADE Working Group updated its criteria in the fall of 2011; not all EBAs included in this review will reflect the update.)

Study design was the first consideration; the starting assumption was that randomized controlled trials are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 main factors that may raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding factors. (6) For more detailed information, please refer to the latest series of GRADE articles. (6)

[1]*Quality* refers to the criteria such as adequacy of allocation concealment, blinding, and follow-up. *Consistency* refers to the similarity of estimates of effect across studies. If there are important and unexplained inconsistencies in the results, confidence in the estimate of effect for that outcome decreases. Differences in direction of effect, magnitude of the difference in effect, and significance of the differences guide decisions about whether important inconsistency exists. *Directness* refers to the extent to which interventions and outcome measures are similar to those of interest.

As stated by the GRADE Working Group, the final quality score can be interpreted using the following definitions:

High	Further research is very unlikely to change confidence in the estimate of effect
Moderate	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate
Low	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate
Very Low	Any estimate of effect is very uncertain

Economic Analysis

Details of specific economic analyses can be found in the individual EBAs. (2)

Cost-Effectiveness Analysis

When possible, costs, quality-adjusted life-years (QALYs), and ICERs for each intervention were assessed. Cohorts aligned with the patient populations from the research trials were examined as part of the literature search. Additionally, analyses and models were populated using clinical parameters and summary estimates from the EBAs. Unless otherwise indicated, the perspective of all analyses was that of a publicly funded health care system.

Budget Impact Analysis

When possible, a BIA was conducted to project potential costs, incremental costs, and resource utilization for the Ontario health care system if the technology under review were implemented. Budget impact analyses often considered relevant resources already in place. Often, several assumptions were required to calculate potentially impacted populations; these assumptions were guided by the literature, population-based administrative data, and expert opinion.

Results of Review

The OHTAS search yielded 97 publications completed between January 1, 2006, and December 31, 2011. A total of 9 health technologies were identified for review (Figure 1 and Table 1). Additionally, 1 health technology assessment evaluating photoselective vaporization of the prostate (PVP) was included based the results of an ongoing field evaluation, which demonstrated a significant reduction in hospitalizations and associated cost savings. As well, 1 EBA evaluating implantable cardioverter defibrillators (ICDs) from 2005 was included due to ongoing data collection resulting from an Ontario Health Technology Advisory Committee (OHTAC) recommendation. Appendix 3 lists excluded EBAs and the rationale for their exclusion.

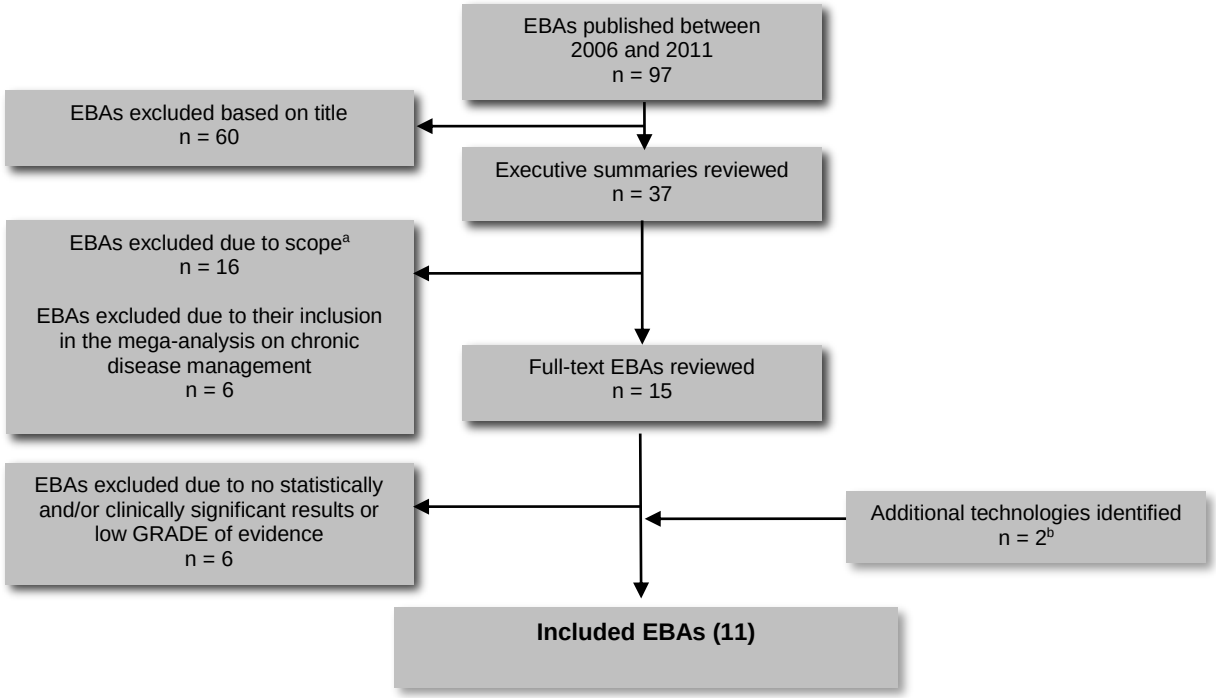

Figure 1: Analysis Flow Chart

Abbreviations: EBA, evidence-based analysis; OHTAC, Ontario Health Technology Advisory Committee.
[a]Includes technologies used for screening and monitoring diseases and conditions.
[b]Additional technologies identified were a field evaluation resulting in a significant reduction in hospitalizations and associated cost savings; and an EBA from 2005 with ongoing data collection resulting from an OHTAC recommendation.

Table 1: Included Evidence-Based Analyses

Year; Volume (Number)	Title
Type 2 Diabetes	
2009;9(22)	Bariatric Surgery for People With Diabetes and Morbid Obesity: An Evidence-Based Analysis (7)
Coronary Artery Disease	
2010;10(17)	Primary Angioplasty and Thrombolysis for the Treatment of Acute ST-Segment Elevated Myocardial Infarction: An Evidence Update (8)
Atrial Fibrillation	
2006;6(7)	Ablation for Atrial Fibrillation: An Evidence-Based Analysis (9)
Chronic Obstructive Pulmonary Disease	
2012;12(3)	Influenza and Pneumococcal Vaccinations for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Review (10)
2012;12(4)	Smoking Cessation for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis (11)
2012;12(8)	Noninvasive Positive Pressure Ventilation for Acute Respiratory Failure Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis (12)
Congestive Heart Failure	
2005;5(14)	Implantable Cardioverter Defibrillators—Prophylactic Use: An Evidence-Based Analysis (13)
Stroke	
2011;11(6)	Constraint-Induced Movement Therapy for Rehabilitation of Arm Dysfunction After Stroke in Adults: An Evidence-Based Analysis (14)
Chronic Wounds	
2009;9(2)	Pressure Ulcer Prevention: An Evidence-Based Analysis (15)
2010;10(23)	Negative Pressure Wound Therapy: An Evidence-Update (16)
Other	
2013;in press (17)	Photoselective Vaporization for the Treatment of Benign Prostatic Hyperplasia

Bariatric Surgery for People With Diabetes and Morbid Obesity: An Evidence-Based Analysis

Background

Clinically severe or morbid obesity is commonly defined by a body mass index (BMI) of at least 40 kg/m^2, or a BMI of at least 35 kg/m^2 with the presence of comorbid conditions, such as type 2 diabetes, cardiovascular disease, or arthritis. Obesity is associated with the development of several diseases, including type 2 diabetes. Surgery for morbid obesity is usually considered a last resort for people who have attempted first-line medical management (e.g., diet, behaviour modification, increased physical activity, and drugs) but who have not permanently lost weight.

Numerous surgical options are available for people with morbid obesity. Bariatric surgery can be grouped into 2 general types—malabsorptive and restrictive—both of which can be performed laparoscopically or as open surgery. Malabsorptive techniques work by bypassing parts of the gastrointestinal tract to limit the absorption of food (e.g., biliopancreatic diversion, Roux-en-Y gastric bypass); restrictive techniques decrease the size of the stomach for the patient to feel satiated with a smaller amount of food (e.g., gastroplasty, gastric banding).

Results

An EBA was conducted to examine the effectiveness and cost-effectiveness of bariatric surgery for the management of diabetes in people with morbid obesity. (7) When possible, results were further stratified by type of bariatric surgery (malabsorptive or restrictive).

The primary outcome of interest was the improvement or resolution of type 2 diabetes, generally defined as the disappearance of diabetes, being able to discontinue all diabetes-related medications, or being able to maintain blood glucose levels in the normal range. A summary of the results is presented in Table 2.

Table 2: Bariatric Surgery for People With Diabetes and Morbid Obesity—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Disease-Specific Measures		
Intervention	**Comparator**		**Δ HbA1c, % (range)[a]**	**Mean Improvement/Resolution of Diabetes**	**Adverse Events**
Bariatric surgery	No control arm evaluated *Recovery*[b] Usual care (no surgery)	Adults with type 2 diabetes and morbid obesity	−2.70 (−5.0 to −0.70)	*Resolution and/or improvement*[c] 86.0% (95% CI 78.4–93.7) *Resolution*[d] 76.8% (95% CI 70.7–82.9) *Recovery*[b] OR 8.42 (95% CI 5.7–12.5) at 2 years OR 3.45 (95% CI 1.6–7.3) at 10 years	*Postoperative complications* Mortality: 0.25% Other (e.g., bleeding, embolism, wound complications, deep infections): 13% Complications requiring re-surgery: 2.2%
Number of studies (sample size)			1 meta-analysis of 134 studies	*Resolution and/or improvement*[c] 1 meta-analysis of 134 studies *Recovery*[b] 1 observational study (n = 4,047 at 2 years and n = 1,703 at 10 years)	1 observational study (n = 4,047 at 2 years and n = 1,703 at 10 years)
GRADE			Moderate	Moderate	NR
Subgroup Analyses					
Malabsorptive interventions	No control arm evaluated		Gastric bypass: −3.99 (−5.0 to −0.70)	*Resolution and/or improvement*[c] Gastric bypass: 93.2% (95% CI 79.3–100.0) *Resolution*[b] Gastric bypass: 83.7% (95% CI 77.3–90.1) BPD/duodenal switch: 98.9% (95% CI 96.8–100.0)	Operative 30-day mortality: 0.5% gastric bypass 1.1% BPD or duodenal switch
Number of studies (sample size)			1 meta-analysis of 134 studies	1 meta-analysis of 134 studies	1 meta-analysis of 134 studies
Restrictive interventions	No control arm evaluated		−1.34 (−1.60 to −0.94)	*Resolution and/or improvement*[c] 90.8% (95% CI 76.2–100.0) *Resolution*[b] 71.6% (95% CI 55.1–88.2)	Operative 30-day mortality**:** 0.1%
Number of studies (sample size)			1 meta-analysis of 134 studies	1 meta-analysis of 134 studies	1 meta-analysis of 134 studies

Abbreviations: BPD, biliopancreatic diversion; CI, confidence interval; HbA1c, glycated hemoglobin; NR, not reported; OR, odds ratio.
[a]From baseline to follow-up.
[b]Fasting plasma glucose level of < 126 mg/dL (7.0 mmol/L).
[c]Studies reporting a combination as well as studies that used only the term "improved," but not the studies reporting only resolution.
[d]Studies reporting diabetes disappeared or no longer required therapy.

Economic Analysis

A cost-effectiveness analysis was conducted using the Ontario Diabetes Economic Model (ODEM). The ODEM was populated using the Ontario Diabetes Database and various other linked databases to measure the prevalence and incidence of complications, healthcare resource utilization (e.g., inpatient and outpatient hospitalizations, outpatient visits, prescription drugs, emergency department visits, and home care), and death. The baseline characteristics for the cohort were obtained from the literature, and the effectiveness of bariatric surgery was taken from the EBA.

The ODEM was used to identify the ICER and the incremental number of events avoided per 1,000 people, based on the implementation of bariatric surgery over a 40-year time horizon. Results from the cost-effectiveness analysis for bariatric surgery compared to usual care are shown in Table 3.

Table 3: Bariatric Surgery for People With Diabetes and Morbid Obesity—Summary of ODEM[a]

Technology Reviewed		Population	ICER (Cost/QALY)	Incremental Number of Events Avoided per 1,000 Population	Ontario Health System Impact, Number of Events Avoided[b]
Intervention	Comparator				
Bariatric surgery	Usual care (no surgery)	Adults with type 2 diabetes and morbid obesity	$15,697/QALY	Ischemic heart disease: 16.1 MI: 80.8 Heart failure: 181.8 Stroke: 52.3 Amputation: 17.5 Blindness: 24.4 Renal failure: 0.1	Ischemic heart disease: 2,757 MI: 13,839 Heart failure: 31,137 Stroke: 8,957 Amputation: 2,997 Blindness: 4,179 Renal failure: 17

Abbreviations: ICER, incremental cost-effectiveness ratio; MI, myocardial infarction; ODEM, Ontario Diabetes Economic Model; QALY, quality-adjusted life-year.
[a]All costs in Canadian dollars. Based on a 40-year time horizon.
[b]Assuming 171,275 adults with morbid obesity and type 2 diabetes.

OHTAC Recommendation[2]

OTHAC made the following recommendation after considering the findings above:

- OHTAC recommends improving access to bariatric surgery for morbidly obese adults with diabetes. Priority for bariatric surgery should be given to morbidly obese people (BMI > 35 kg/m^2) with diabetes over morbidly obese people without diabetes.

Conclusions: Impact on Chronic Disease Management

Based on moderate-quality evidence, bariatric surgery has shown effectiveness in resolving diabetes in adults with morbid obesity. Moderate-quality evidence also found a statistically significant reduction in glycated hemoglobin (HbA1c) of 2.70% among patients receiving bariatric surgery, which is a clinically meaningful outcome. A 1% reduction in HbA1c is associated with a 10% reduction in diabetes-related mortality and a 25% reduction in microvascular endpoints. Overall, these results indicate that bariatric surgery can significantly improve the management of type 2 diabetes in the morbidly obese population, as well as resolve the disease itself.

Diabetes is a highly prevalent chronic metabolic disorder, affecting an estimated 8.8% of Ontario's population (in 2005). Clinically, diabetes is the leading cause of blindness, end-stage renal disease, and nontraumatic amputation in Canadian adults and is a significant cause of cardiovascular complications,

[2]Note: this is part of a recommendation for the larger diabetes evidentiary platform.

hypertension, stroke, cataracts, and glaucoma. Among people with type 2 diabetes, approximately 52% have a BMI ≥ 30 kg/m^2, and 23% have a BMI ≥ 35 kg/m^2.

The ODEM indicated that bariatric surgery had a significant impact on downstream events associated with diabetes and obesity. With an estimated 171,275 morbidly obese adults with type 2 diabetes in Ontario, bariatric surgery is predicted to prevent an additional 13,839 myocardial infarctions (MIs), 31,137 heart failures, 8,957 strokes, 2,997 amputations, 4,179 cases of blindness and 17 renal failures over a 40-year time horizon. Hospital utilization associated with these complications would also be expected to decrease. Overall, bariatric surgery among morbidly obese people with type 2 diabetes was found to be a cost-effective intervention, with an ICER of $15,697 (Cdn) per QALY.

Primary Angioplasty and Thrombolysis for the Treatment of Acute ST-Segment Elevated Myocardial Infarction: An Evidence Update

Background

ST-segment elevation myocardial infarction (STEMI) is 1 type of acute coronary syndrome associated with CAD. A STEMI is identified using an electrocardiogram when a patient experiences chest pain. The best treatment for patients with evolving acute MI (such as that experienced with a STEMI) has been under debate among cardiologists. Percutaneous coronary intervention (PCI) involves surgical treatment to open a blocked artery and restore blood flow. Angioplasty is 1 type of PCI (*primary angioplasty* when performed on patients with an acute MI), and stenting is another type. PCIs are an alternative to thrombolysis (the administration of clot-dissolving drug therapy) for patients with STEMI.

Results

An EBA was conducted to examine the effectiveness of PCI versus thrombolysis for the treatment of people with an acute MI. (8) Two examinations of PCI had statistically significant findings with moderate-quality evidence for at least 1 of the primary outcomes:

- primary PCI versus in-hospital thrombolysis
- routine early PCI (after thrombolysis) versus thrombolysis (and rescue PCI if needed)

The primary outcomes of interest were reductions in mortality, reinfarction, and stroke. A summary of the results of the effectiveness analysis is presented in Table 4.

Three evaluations of PCI were not supported by the evidence, and therefore not included in this review.

- There was low quality evidence for the use of primary PCI versus prehospital thrombolysis.
- There were no statistically significant findings for the use of facilitated PCI (with thrombolytics and glycoprotein IIb/IIIa [GpIIb/IIIa]) versus the use of primary PCI (with GpIIb/IIIa prior to PCI).
- There were no statistically significant findings for the use of rescue PCI after initial thrombolysis versus repeat thrombolysis.

Table 4: Percutaneous Coronary Intervention—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Mortality OR (95% CI)	Disease-Specific Measures			
Intervention	Comparator			Reinfarction OR (95% CI)	Stroke OR (95% CI)	Composite Outcome of Mortality, Reinfarction, or Stroke OR (95% CI)	Complications: Major Bleeding OR (95% CI)
Primary PCI	In-hospital thrombolysis	Patients with acute STEMI and door-to-needle time ≤ 30 minutes and door-to-balloon time ≤ 90 minutes	0.87 (0.61–1.24)	0.27 (0.16–0.45)	0.59 (0.29–1.22)	0.56 (0.42–0.75)	NR
Number of studies (sample size)			4 RCTs (1,985)	4 RCTs (1,985)	3 RCTs (1,845)	4 RCTs (1,985)	—
Overall GRADE: Moderate							
Routine early PCI after thrombolysis	Thrombolysis (and rescue PCI as needed)	Patients with acute STEMI	0.73 (0.47–1.14)	0.55 (0.38–0.80)	0.88 (0.36–2.11)	0.64 (0.49–0.83)	1.11 (0.69–1.79)
Number of studies (sample size)			6 RCTs (2,294)	6 RCTs (2,294)	6 RCTs (2,294)	6 RCTs (2,294)	6 RCTs (2,294)
Overall GRADE: Moderate							

Abbreviations: CI, confidence interval; NR, not reported; OR, odds ratio; PCI, percutaneous coronary intervention; RCT, randomized controlled trial; STEMI, ST-segment elevation myocardial infarction.

Economic Analysis

The cost for a PCI in Ontario is approximately $5,000 (Cdn) per procedure. (8) PCI procedures and associated costs for fiscal year 2008–2009 are shown in Table 5. Provincial programs pay for PCIs but do not differentiate between types of PCI performed. Costs that exceed the cost per procedure are absorbed by hospital budgets and physician billing through the Ontario Schedule of Physician Benefits.

Table 5: Percutaneous Coronary Intervention—Ontario Costs, Fiscal Year 2008/2009[a]

Angioplasty Volumes	Cost per Procedure	Angioplasty Cost	Stent Volumes[b]	Cost per Procedure	Stent Cost	Total Cost
19,993	$4,915	$98,265,595	4,998	$2,338	$11,685,909	$109,951,504

[a]All costs in Canadian dollars.
[b]Ontario funds drug-eluting stents at 25% of angioplasty volumes.

By comparison, expert opinion estimates the cost of a dose of tenecteplase (a thrombolytic agent) at approximately $2,700 (Cdn).

Although an economic analysis was not conducted at the time of this EBA, an analysis was conducted as part of a previous EBA on PCI and thrombolytic agents in 2004. (18) This earlier analysis estimated a cost savings to the Ontario hospital budget of between $2,820 (Cdn) and $5,259 (Cdn) per capita due to reduced hospitalizations for acute MI with primary angioplasty.

OHTAC Recommendations

OHTAC made the following recommendations after considering the findings above:

- Hospitals must provide timely access to reperfusion (within 90 minutes for primary PCI or within 30 minutes for thrombolysis) for optimal outcomes in patients with STEMI.
- For patients undergoing thrombolytic reperfusion, attempts should be made to refer them subsequently to a PCI facility with a level of urgency most appropriate for the patient's condition. In particular, patients who are eligible for rescue PCI should be transferred in a timely manner. The routine use of thrombolysis is followed immediately by PCI (facilitated PCI) should not be encouraged due to increased risk of major bleeding.
- When indicated, thrombolysis should be administered as first-line treatment if it is unlikely that primary PCI will be available within the maximum recommended delay (as stated above) for patients being considered for primary PCI.
- Thrombolysis should be available in ambulances for those Ontarians who do not have timely access to a PCI facility or an emergency room due to their geographic location.
- There is uncertainty regarding: 1) the number of STEMI patients in Ontario who receive no reperfusion treatment; and 2) the penetration rate and timeliness of primary PCI and thrombolysis in Ontario. Therefore, through the LHINs, referral and PCI hospitals should be asked to work together with other key partners to track information on the timeliness, management, and outcomes of STEMI patients in Ontario, and these data should be publicly reported back to all hospitals and other relevant stakeholders who are involved in or have a responsibility for the optimal management of STEMI patients.
- Through continuing education, health professionals should follow state-of-the-art thrombolysis management in order to maintain skills related to the timely use of thrombolysis, where appropriate.

Conclusions: Impact on Chronic Disease Management

Based on moderate-quality evidence, primary PCI has significant advantages over in-hospital thrombolysis. Additionally, based on moderate-quality evidence, routine early PCI has advantages over thrombolysis (with rescue PCI as needed). Advantageous treatment for an acute MI among patients presenting with STEMI significantly reduced rates of mortality, reinfarction, stroke, or a composite outcome of the 3.

Currently, the penetration rate and timeliness of primary PCI versus thrombolysis in Ontario is unknown. It has been demonstrated by 1 study that timeliness of treatment is more important than choice of treatment. Approximately 50% of all patients receive primary PCI or thrombolysis within the recommended periods (≤ 90 minutes for thrombolysis and ≤ 30 minutes for PCI). However, the Cardiac Care Network provincial primary PCI registry showed that in 2008–2009, the median door-to-balloon time in Ontario was 101 minutes. Additionally, it should be noted that in 2004, an estimated 50% of STEMI patients in Ontario self-presented to local hospitals rather than calling emergency medical services.

Cardiovascular disease is the leading cause of death among residents of Ontario, with most cardiovascular disease mortality due to acute MI. The estimated number of patients with STEMI in Ontario in 2003 was 1,100. A 2004 economic analysis estimated a cost savings of between $2,820 (Cdn) and $5,259 (Cdn) due to reduced hospitalizations for acute MI. The total costs for angioplasty and stenting in Ontario in fiscal year 2008–2009 was $110 million (Cdn), with total costs unknown for thrombolytic interventions. The estimated cost per treatment for a thrombolytic agent is $2,700 (Cdn), while stenting costs are $2,338 (Cdn) per procedure and angioplasty is $4,915 (Cdn).

Ablation for Atrial Fibrillation: An Evidence-Based Analysis

Background

Currently, the first-line therapy for AF is medical therapy with antiarrhythmic drugs (AADs). There are several AADs available, because no AAD is effective for all patients; however, AADs have critical adverse effects that can aggravate existing arrhythmias. The drug selection process frequently involves trial and error until the patient's symptoms subside.

Ablation has been frequently described as a cure for AF (compared with drug therapy, which controls AF but does not cure it). Ablation involves directing an energy source at cardiac tissue. For instance, radiofrequency energy uses heat to burn tissue near the source of the arrhythmia. The purpose is to create an area of scar tissue so that the aberrant electrical pathways no longer exist. There are 2 methods of ablation: catheter ablation and surgical (operative) ablation. Radiofrequency energy was the most commonly used ablation technique at the time of this EBA. *Catheter ablation* involves inserting a catheter through the femoral vein to access the heart and burn abnormal foci of electrical activity by direct contact or by isolating them from the rest of the atrium. *Surgical ablation* is minimally invasive, performed via direct visualization or with the assistance of a special scope for patients with lone AF.

Results

An EBA was conducted to examine the effectiveness of ablation therapies among patients with atrial fibrillation or flutter. (9) Three separate groups were evaluated:

- catheter ablation as first-line treatment for AF and atrial flutter
- ablation in patients with drug-refractory AF who *do not* require additional surgery
- ablation in patients with drug-refractory AF who require additional heart surgery

The primary outcome of interest was freedom from arrhythmia, measured as the proportion of the treatment group free of arrhythmia and compared to the proportion free of arrhythmia in the control group. A summary of the results from the effectiveness analysis is presented in Table 6.

Additionally, there was 1 observation study (n = 1,171) included in the EBA that examined mortality, complication rates, and HRQOL among individuals who received ablation versus those with drug-refractory AF when no additional heart surgery was required. The ablation group had a mortality rate of 6.5% versus the drug therapy group, which had a mortality rate of 14.3%. Additionally, the ablation group had a complication rate of 9.2% versus the drug therapy group, which had a complication rate of 20.1%. Finally, this study found a significantly improved HRQOL ($P = 0.004$) in the ablation group versus the drug therapy group.

Table 6: Ablation for Atrial Fibrillation—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	HRQOL	Disease-Specific Measures	
Intervention	Comparator			Long-Term Freedom From Arrhythmia RR (95% CI)	Complications[a]
First-Line Treatment With Ablation					
Catheter ablation	Medical therapy	Patients with AF or atrial flutter	Ablation: significant improvement Medical therapy: no significant difference	AF: 0.24 (0.09–0.59) Atrial flutter: 0.35 (0.17–0.72)	No substantial long-term adverse effects were reported among patients undergoing catheter ablation
Number of studies (sample size)			2 RCTs (131)	2 RCTs (131)	2 RCTs (131)
GRADE			NR	Moderate	NR
Ablation for Drug Refractory Fibrillation, No Additional Surgery Required					
Catheter radiofrequency ablation	Drug therapy	Drug-refractory AF, no additional heart surgery required	Significantly greater improvement in general health score with ablation (P = 0.007)	0.32 (0.21–0.43)	Ablation: 5 atrial flutter, 2 stroke, 1 transient phrenic paralysis, 1 pericardial effusion, 1 groin hematoma Drug therapy: 1 transischemic attack, 2 cancer (1 death), 1 sudden cardiac death, side effects of medical therapy of nausea, sinus node dysfunction and hypothyroidism
Number of studies (sample size)			1 RCT (30)	3 RCTs (313)	3 RCTs (313)
GRADE			NR	Moderate	NR
Ablation for Drug Refractory Fibrillation, Additional Heart Surgery Required					
Radiofrequency surgical ablation with mitral valve surgery	Mitral valve surgery	Drug-refractory AF, additional heart surgery required	NR	0.13 (0.05–0.30)	Ablation: 6 deaths, 1 reoperation for bleeding, 1 late pericardial tamponade, 1 postoperative pacemaker Mitral valve surgery: 4 deaths, 1 reoperation for bleeding, 2 late pericardial tamponade, 1 postoperative pacemaker
Number of studies and study type (sample size)			—	2 RCTs (97)	2 RCTs (97)
GRADE			—	High	NR
Surgical ablation maze plus mitral valve surgery	Mitral valve surgery	Drug-refractory AF, additional heart surgery required	Marked improvement after surgery, no difference between groups	0.30 (0.11–0.79)	Ablation: 1 stroke, 1 inotropic drugs due to intra-operative MI Mitral valve surgery: 1 death, 1 stroke
Number of studies (sample size)			1 RCT (35)	2 RCTs (62)	2 RCTs (62)
GRADE			NR	High	NR

Technology Reviewed		Population	HRQOL	Disease-Specific Measures	
Intervention	**Comparator**			**Long-Term Freedom From Arrhythmia RR (95% CI)**	**Complications[a]**
Microwave ablation and heart surgery	Heart surgery	Drug-refractory AF, additional heart surgery required	NR	0.30 (0.13–0.70)	Ablation: 1 death Heart surgery: 1 death
Number of studies (sample size)			—	1 RCT (43)	1 RCT (43)
GRADE			—	Moderate	NR
Linear atrial cryoablation of left atrium	Pulmonary vein cryoisolation	Drug-refractory AF, additional heart surgery required	NR	0.53 (0.39–0.73)	Ablation: 4 deaths Pulmonary vein cryoisolation: 1 death
Number of studies (sample size)			—	1 RCT (105)	1 RCT (105)
GRADE			—	Moderate	NR

Abbreviations: AF, atrial fibrillation; CI, confidence interval; HRQOL, health-related quality of life; MI, myocardial infarction; NR, not reported; RR, relative risk; RCT, randomized controlled trial.

[a]Includes, but not limited to: death, transient ischemic attack, ischemic stroke, hemorrhagic stroke, congestive heart failure, myocardial infarction, or peripheral embolism. *Causes of patient deaths*
Ablation group, n: perioperative, 2; heart failure, 1; renal bleeding, 1; mediastinitis, 1; sudden cardiac death, 1; severe lung fibrosis, 1; valvular endocarditis, 1; hemorrhagic stroke, 1; multiorgan failure, 1; traffic accident, 1; cerebral air embolism of unknown origin, 1. Control group, n: perioperative, 1; refractory heart failure, 1; gastrointestinal complication, 1; sudden cardiac death, 1; stroke, 1; severe chronic obstructive bronchial disease, 1.

Economic Analysis

An Ontario-based economic analysis was conducted to assess the costs of ablation for AF. The analysis was developed in conjunction with the EBA on advanced mapping systems for catheter ablation, and thus the economic analysis includes the costs of advanced mapping systems in addition to the costs of ablation procedures. (9) Hospital costs were based on data from the Ontario Case Costing Initiative, with nonhospital costs obtained from the Provider Services Branch of the Ontario Ministry of Health and Long-Term Care (physician services), local health care institutions (device costs), and the Ontario Drug Benefit formulary (drug costs). Results from the economic analysis are presented in Table 7.

Table 7: Ablation for Atrial Fibrillation—Per-Patient Costing Estimates and Avoided Hospitalizations[a]

Intervention	Comparator	Per-Patient Costing Analysis			
		Up-Front Cost (Year 1)	Cumulative Annual Cost of Ablation	Cumulative Annual Cost of Medical Treatment	Cumulative Annual Cost Difference (Ablation–Medical Treatment)
Ablation for atrial fibrillation	Medical treatment	Ablation: $22,465 Medical treatment: $6,475	Year 1: $22,465 Year 2: $24,560 Year 3: $26,697 Year 4: $28,876 Year 5: $31,100	Year 1: $6,475 Year 2: $13,080 Year 3: $19,817 Year 4: $26,688 Year 5: $33,697	Year 1: −$15,990 Year 2: −$11,480 Year 3: −$6,880 Year 4: −$2,188 Year 5: $2,597

[a]All costs in Canadian dollars.

OHTAC Recommendation

OHTAC made the following recommendation after considering the findings above:

- OHTAC recommends increased access to ablation with advanced mapping so the prevalent population with drug-refractory atrial fibrillation can be treated over 5 years.

Conclusions: Impact on Chronic Disease Management

Based on moderate to high quality evidence, catheter ablation as a first-line treatment for AF has been shown to result in greater long-term freedom from arrhythmia than medical treatment alone. Several studies also identified a significant increase in HRQOL and a decrease in mortality among patients receiving ablation. As such, ablation for AF results in a direct impact on chronic disease management by avoiding downstream effects and health services utilization.

Atrial fibrillation is a highly prevalent chronic condition that is often associated with other diseases, such as high blood pressure, abnormal heart muscle function, chronic lung diseases, and CHF. AF is associated with higher morbidity and mortality, because it increases the risk of stroke and other thromboembolic events and CHF. AF increases the risk of stroke 4- to 5-fold in all age groups, leading to 10% to 15% of all ischemic strokes, and 25% of strokes in patients age 80 years or older. The rate of hospitalization for AF in Canada is approximately 583 per 100,000 people and for patients discharged alive, 3% are readmitted for stroke within 1 year. There is an indication that the prevalence of complex arrhythmias is increasing in Ontario. Average annual hospital admissions with a diagnosis of AF or flutter rose from 43,680 in 2000 to 50,640 in 2004.

Ablation provides an opportunity to cure AF, as opposed to treating it with drugs or electrical cardioversion. Results from the economic analysis estimate an average annual cost savings of $971 (Cdn) per treated patient due to avoided hospitalizations related to stroke and CHF, and approximately $700

(Cdn) per treated patient in annual cost savings due to the reduced use of anticoagulants and antiarrhythmics. Since 78% (76,000/98,000) of the Ontario population with AF is over the age of 65, cost savings due to reduced medication use will largely accrue directly to the Ontario Drug Benefit program. When physician fees, other drug costs, and diagnostic testing are factored into the costing estimates, the added up-front cost of ablation, compared to treatment with medial therapy alone, is recouped at 4.5 years after the procedure. Since baseline life expectancy remains in excess of 5 years for most individuals with AF treated with advanced mapping ablation, they will survive beyond the point at which the added up-front costs are recouped.

Influenza and Pneumococcal Vaccinations for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Review

Background

Influenza Vaccination

The selection of influenza viruses for seasonal influenza vaccine is based on the type of influenza viruses that circulated during the previous year. Every year, the World Health Organization convenes technical meetings and makes recommendations about the selection of virus strains. In Canada, there are currently 5 trivalent influenza vaccines authorized for use by injection.

Pneumococcal Vaccination

Streptococcus pneumonia, also known as pneumococcus, is an encapsulated Gram-positive bacterium that colonizes in the nasopharynx of healthy children and adults. The current pneumococcal polysaccharide vaccines are targeted to prevent diseases caused by 23 of the most common serotypes of streptococcus pneumonia. Canada-wide estimates suggest that approximately 90% of cases of pneumococcal bacteria and meningitis are caused by these 23 serotypes.

The United States Centers for Disease Control and Prevention provided recommendations for the use of the vaccine among all adults aged 65 years and older and among adults aged 19 to 64 years with underlying medical conditions that put them at greater risk for serious pneumococcal infection, including chronic lung disease (COPD), emphysema, and asthma.

Results

An EBA was conducted to determine the effectiveness of the influenza vaccination and the pneumococcal vaccination in patients with COPD in reducing the incidence of influenza-related illness or pneumococcal pneumonia. (10) Results were stratified by type of vaccination: influenza vaccination or pneumococcal vaccination.

The primary outcome of interest for the influenza vaccination was episodes of acute respiratory illness (ARI) due to the influenza virus. The primary outcome of interest for the pneumococcal vaccination was time to the first episode of community-acquired pneumonia (CAP) of pneumococcal or unknown etiology. Secondary outcomes for both vaccination types were rate of hospitalization and mechanical ventilation, mortality rate, and adverse events. A summary of the results is presented in Table 8.

Table 8: Vaccinations for COPD—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Mortality	Hospital Utilization		Disease-Specific Measures			
Intervention	**Comparator**			**Hospitalization**	**Length of Stay**	**Incidence Density of Influenza-Related ARI, RR (95% CI)**	**First Episode of CAP**	**Mechanical Ventilation RR (95% CI)**	**Adverse Events**
Influenza vaccination	No vaccination	COPD patients	NR	*Influenza-related ARI* RR 0.41 (95% CI 0.08–2.02)	NR	0.2 (0.06–0.70)	NA	0.15 (0.01–2.75)	*Local* 27% vaccinated 6% control (*P* = 0.002) *Systemic* 76% vaccinated 81% control (*P* = 0.5)
Number of studies (sample size)			—	1 RCT (125)	—	1 RCT (125)	—	1 RCT (125)	1 RCT (125)
GRADE			—	Low	—	High	—	Low	Low
Pneumococcal vaccination	No vaccination	COPD patients	No significant difference (19% in both groups)	*CAP-related* 76% vaccinated 81% control (*P* = 0.59)	9.5 days vaccinated, 12 days control (*P* = 0.16)	NA	*Pneumococcal and unknown etiology* RR 0.76 (95% CI 0.46–1.24)[a] *Pneumococcal pneumonia* 0% vs. 1.68%; log rank test 5.03 (*P* = 0.025)[a] *Time to first episode of CAP* log rank test 1.15 (*P* = 0.28)	NR	No reported local or systemic reactions in either group
Number of studies (sample size)			1 RCT (596)	1 RCT (596)	1 RCT (596)	—	1 RCT (596)	—	1 RCT (596)
GRADE			NR	Low	NR	—	High	—	Low
Subanalyses by Age and Severity[b] of COPD for Incidence of ARI and CAP									
Influenza vaccination	No vaccination	Mild COPD				0.2 (0.003–1.3)			
		Moderate COPD				0.5 (0.05–3.8)			
		Severe COPD				0.1 (0.003–1.1)			
Pneumococcal vaccination	No vaccination	COPD < 65 years					RR 0.24 (95% CI 0.07–0.80)		
		COPD > 65 years					RR 1.14 (95% CI 0.62–2.07)		
		Mild–moderate COPD					RR 1.11 (95% CI 0.53–2.32)		
		Severe COPD					RR 0.52 (95% CI 0.27–1.01)		
		Severe COPD < 65 years					RR 0.09 (95% CI 0.01–0.65)		

Abbreviations: ARI, acute respiratory illness; CAP, community-acquired pneumonia; CI, confidence interval; COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 second; NA, not applicable; NR, not reported; RCT, randomized controlled trial; RR, relative risk.

[a]No GRADE reported for outcome.

[b]Mild COPD, $FEV_1 \geq 70\%$ predicted; moderate COPD, FEV_1 50%–69% predicted; severe COPD, $FEV_1 < 50\%$ predicted).

Economic Analysis

A cost-effectiveness analysis was not conducted, because the appropriate inputs were not reported in the published literature.

OHTAC Recommendations[3]

OHTAC made the following recommendations after considering the findings above:

- OHTAC recommends maximizing the use of pneumococcal and influenza vaccines in patients with COPD, ensuring that vaccination reflects the established guidelines and recommendations for immunization.
- OHTAC recommends that any barriers to making the pneumococcal vaccine easily available through physician offices should be removed, thereby making the pneumococcal vaccine more accessible to patients.
- Other opportunities to optimize access to influenza and pneumococcal vaccines, including patients with acute exacerbations of COPD admitted to hospital, should be explored.

Conclusions: Impact on Chronic Disease Management

In 2007, the age- and sex- standardized prevalence of COPD among Ontarians was estimated at 9.5%. Both influenza and pneumonia can lead to acute exacerbations of COPD, which are a major cause of morbidity and mortality in COPD patients. The prevention of these 2 conditions among individuals with COPD is predicted to significantly reduce acute exacerbations, as well as hospitalizations related to ARI and pneumonia.

Influenza Vaccination

Based on high quality evidence, influenza vaccination significantly reduces the risk of acquiring influenza-related ARI in patients with COPD. No significant difference was found between the vaccination and non-vaccination groups for rates of hospitalization due to episodes of influenza-related ARI and mechanical ventilation episodes. However, this was based on low quality evidence from a single study, which did not have sufficient power for these outcomes. Although there were insufficient data to show a significant reduction in hospitalizations or mechanical ventilation episodes, this would be expected as a result of the significant reduction in ARIs subsequent to influenza vaccination.

The effectiveness of the influenza vaccination for patients with COPD is important for the management of the disease in the community. Influenza is a global threat, with 3 pandemics occurring in the 20th century and a fourth pandemic of H1N1 influenza in 2009. Complications of influenza infection include viral pneumonia, secondary bacterial pneumonia, and other secondary bacterial infections, such as bronchitis, sinusitis, and otitis media. Rates of serious illness due to influenza viruses are particularly high among older people and patients with chronic conditions such as COPD, often resulting in hospitalization and in some cases, death. Influenza infection can also lead to exacerbation of COPD or underlying heart disease.

Pneumococcal Vaccination

Based on high quality evidence, pneumococcal vaccination significantly reduces the risk of acquiring pneumococcus pneumonia in patients with COPD, but does not significantly reduce the risk of acquiring CAP of pneumococcal or unknown etiology. However, for pneumonia of unknown etiology and pneumococcus, there were significant reductions in CAP among patients aged < 65 years, as well as among those with severe COPD. There was no statistically significant difference among study groups for total hospitalizations or LOS, but this was based on a single study with low quality evidence for these outcomes. Mortality rates were similar between individuals with and without vaccination. Although there is sparse evidence evaluating the impact of pneumococcal vaccination on hospitalizations, the observed

[3] Note: These are part of a larger recommendation for COPD.

reduction in pneumococcus pneumonia would be expected to reduce overall hospitalizations among this population.

The effectiveness of the pneumococcal vaccination in preventing CAP is of importance in managing patients with COPD. The rate of pneumococcal pneumonia in developed countries remains unknown due to the lack of accurate diagnostic tests. However, in the United States Veterans' Administration Trial, among people aged 55 years and older, the incidence of pneumococcal pneumonia per 1,000 person years was 1.7 in people with no underlying disease, 3.4 in those with 1 underlying disease, and 15 in those with 3 underlying diseases. Pneumococcus bacteria can cause illnesses such as otitis media and sinusitis, and may even become more aggressive and affect other areas of the body such as the lungs, brain, joints, and bloodstream. More severe infections caused by pneumococcus include pneumonia, bacterial sepsis, meningitis, peritonitis, arthritis, osteomyelitis, and in rare cases endocarditis and pericarditis. Individuals with underlying medical conditions, including those chronic lung or heart disease, are at higher risk for acquiring pneumococcal pneumonia.

Smoking Cessation for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis

Background

Airflow limitation in individuals with COPD is usually progressive and is generally associated with an abnormal inflammatory response to noxious particles or gases. Tobacco smoke is the main risk factor for COPD and COPD-associated morbidity.

Smoking cessation is the process of discontinuing the practice of inhaling a smoked substance. Smoking cessation strategies include both pharmacological and nonpharmacological (behavioural or psychosocial) approaches. The basic components of smoking cessation interventions include simple advice, written self-help materials, individual and group behavioural support, telephone quit lines, nicotine replacement therapy (NRT), and antidepressants. Smoking cessation can help to slow or halt the progression of COPD.

Results

An EBA was conducted to examine the effectiveness and cost-effectiveness of smoking cessation interventions for patients with COPD in comparison to usual care or placebo. (11)

The primary outcome of interest was abstinence from smoking. A summary of the results from the primary analysis is presented in Table 9.

Additionally, there was 1 trial with long-term follow-up, which examined mortality and lung function (using forced expiratory volume in 1 second [FEV_1]). This study found that patients with COPD who were sustained quitters from smoking had a RR of mortality of 0.54 compared with those who did not quit. Quitters were also found to have improved lung function compared with non-quitters, with a difference in FEV_1 of 11.68 mL at 1-year follow-up and 3.33 mL at 2-year follow-up.

Table 9: Smoking Cessation Strategies for Patients With COPD—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Disease-Specific Measures
Intervention	**Comparator**	**Abstinence Rates RR (95% CI)**
Counselling		
Counselling	Usual care	5.85 (3.81–8.97)
Number of studies (sample size)		2 RCTs (501)
GRADE		Moderate
Subgroups by Intensity		
Intensive counselling (≥ 90 minutes)	Usual care	7.70 (4.64–12.79)
Number of studies (sample size)		1 RCT (443)
GRADE		Moderate
Minimal counselling (< 90 minutes)	Usual care	1.56 (0.65–3.72)
Number of studies (sample size)		1 RCT (58)
GRADE		Moderate
Counselling + NRT		
Counselling + NRT	Usual care	4.28 (3.51–5.20)
Number of studies (sample size)		3 RCTs (6,342)
GRADE		Moderate
Subgroups by Intensity		
Intensive counselling (≥ 90 minutes) + NRT	Usual care	4.41 (3.60–5.39)
Number of studies (sample size)		1 RCT (5,887)
GRADE		Moderate
Minimal counselling (< 90 minutes) + NRT	Usual care	2.11 (0.90–4.91)
Number of studies (sample size)		2 RCTs (455)
GRADE		Moderate
Minimal counselling (< 90 minutes) + antidepressant	Usual care	1.91 (0.65–5.61)
Number of studies (sample size)		1 RCT (184)
GRADE		Low
Minimal counselling (< 90 min) + NRT + antidepressant	Usual care	2.25 (0.87–5.85)
Number of studies (sample size)		1 RCT (424)
GRADE		Low
NRT		
NRT	Placebo	3.01 (1.02–8.89)
Number of studies (sample size)		1 RCT (183)
GRADE		Moderate
Antidepressant		
Antidepressant	Placebo	2.09 (1.35–3.24)
Number of studies (sample size)		2 RCTs (596)
GRADE		Moderate
Subgroups by Specific Antidepressant		
Nortriptyline	Placebo	2.54 (0.87–7.44)
Number of studies (sample size)		1 RCT (100)
GRADE		Moderate
Bupropion	Placebo	2.01 (1.24–3.24)
Number of studies (sample size)		2 RCTs (496)
GRADE		Moderate

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; NRT, nicotine replacement therapy; RCT, randomized controlled trial; RR, relative risk.

Economic Analysis

An economic evaluation was conducted to assess the cost-effectiveness and health system impact of COPD treatment strategies. The cost-effectiveness of smoking cessation therapies was assessed in comparison to usual care among individuals with COPD. Costing estimates were based on expert opinion and physician billing in the 2011 Ontario Schedule of Physician Benefits. Ontario currently pays for intensive counselling via physician billing—translating to a current burden of $8.4 (Cdn) million—and bupropion through the Ontario Drug Benefit formulary—translating to a current burden of $1.9 (Cdn) million. The burden of NRT was projected to be $10.4 (Cdn) million, with future expenditures of up to $0.9 (Cdn) million in years 1 to 3 for incident cases. Results from the economic analysis are presented in Table 10.

Table 10: Smoking Cessation Strategies for Patients With COPD—Summary of Ontario Economic Analysis[a]

Intervention	Comparator	ICER (Cost/QALY)	Budget Impact
Intensive counselling	Usual care	Dominant	$10.4 million for Ontario to fund NRT[b]
Intensive counselling + NRT	Placebo	Dominant	
NRT	Usual care	Dominant	
Bupropion	Placebo	Dominant	

Abbreviations: COPD, chronic obstructive pulmonary disease; ICER, incremental cost-effectiveness ratio; NRT, nicotine replacement therapy; QALY, quality-adjusted life-year.
[a]All costs in Canadian dollars.
[b]Based on an estimated 51,029 highly motivated moderate to severe COPD smokers, as estimated by a clinical expert.

OHTAC Recommendations[4]

OHTAC made the following recommendations after considering the findings above:

- OHTAC strongly endorses evidence-based strategies aimed at encouraging smoking cessation in patients with COPD.
- Intensive counselling (≥ 90 minutes) is the most effective and cost-effective strategy, and should continue to be encouraged.
- OHTAC recommends that consideration should be made to providing training programs to health care professionals involved in providing intensive counselling.
- OHTAC recommends bupropion or nicotine replacement therapies for smoking cessation.

Conclusions: Impact on Chronic Disease Management

Based on moderate quality evidence, smoking cessation therapies have shown effectiveness in achieving prolonged abstinence from smoking in patients with COPD compared with usual care. Abstinence rates are significantly higher in patients with COPD receiving intensive counselling (≥ 90 minutes) or a combination of intensive counselling and NRT. Based on limited and moderate quality evidence, abstinence rates are significantly higher in patients with COPD receiving NRT compared with placebo. As well, based on moderate quality evidence, abstinence rates are significantly higher in patients with COPD receiving the antidepressant bupropion compared to placebo. Interventions resulting in the abstinence from smoking are important for the management of COPD in the community. Prior studies have found abstinence from smoking to result in improved outcomes among individuals with COPD. One study demonstrated that the benefit to lung function gained during a smoking intervention program compared to usual care persisted for 11 years after the start of the study.

[4] Note: These are part of a larger recommendation for COPD.

It is estimated that 50% of older smokers develop COPD, and more than 80% of COPD-associated morbidity is attributed to tobacco smoking. According to the Canadian Community Health Survey, 38.5% of Ontarians who smoke have COPD. Despite severe symptoms—including shortness of breath, cough, and sputum production—the majority of patients with COPD are unable to quit smoking on their own. Each year only about 1% of smokers succeed in quitting on their own. Smoking cessation can help to slow or halt the progression of COPD.

An Ontario-based economic analysis found that intensive counselling (≥ 90 minutes) with or without NRT was a dominant strategy (less expensive and more effective) in comparison to usual care. As well, NRT or bupropion compared to usual care or placebo were found to be dominant strategies for achieving smoking abstinence in patients with COPD. Given currently funded healthcare resources in Ontario, the budget impact to fund NRT for Ontario would be $10.4 million (Cdn).

Noninvasive Positive Pressure Ventilation for Acute Respiratory Failure Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis

Background

Respiratory failure occurs when the respiratory system cannot oxygenate the blood and/or remove carbon dioxide from the blood. It can be either acute or chronic and is classified as either hypoxemic (type I) or hypercapnic (type II). Acute hypercapnic respiratory failure frequently occurs in COPD patients experiencing acute exacerbations of COPD; it occurs due to a decrease in the drive to breathe, typically due to increased work to breathe in COPD patients.

Noninvasive positive pressure ventilation (NPPV) provides ventilatory support through a facial or nasal mask and reduces inspiratory work; it may be used intermittently for short periods of time to treat respiratory failure. Unlike more invasive forms of respiratory support, patients do not require sedation, airway defense mechanisms and swallowing functions are maintained, and trauma to the trachea and larynx are avoided. NPPV does not allow direct access to the airway to drain secretions and requires patient cooperation.

NPPV may also be used to wean patients from invasive mechanical ventilation (IMV) via the gradual removal of ventilation support until the patient can breathe spontaneously. Following extubation from IMV, acute respiratory failure may recur, leading to extubation failure and the need for reintubation. Reintubations have been associated with increased risk of nosocomial pneumonia and mortality. To avoid such complications, the use of NPPV has been proposed to help prevent acute respiratory failure recurrence and/or to treat respiratory failure when it recurs, thereby reducing the need for reintubation.

Results

An EBA was conducted to examine the effectiveness and safety of NPPV. A total of 5 comparisons were conducted, of which 2 had moderate to high quality evidence for chronic disease management. (12)

- NPPV plus usual care versus usual care alone for the treatment of acute hypercapnic respiratory failure due to exacerbations of COPD, where usual care typically consists of supplemental oxygen and a variety of medications, such as bronchodilators, corticosteroids, and antibiotics aimed to facilitate adequate oxygenation and treat the cause of the exacerbation
- NPPV compared with IMV for weaning persons with COPD from mechanical ventilation, where IMV involves sedating the patient, creating an artificial airway through endotracheal intubation, and attaching the patient to a ventilator

The outcomes of interest were mortality, intubation rates, length of hospital and intensive care unit stay, HRQOL, breathlessness, duration of mechanical ventilation, weaning failure, complications, and NPPV tolerance and compliance. A summary of the results is presented in Table 11.

Three evaluations of NPPV were not supported by the evidence:

- There was insufficient evidence to draw conclusions on the comparison of NPPV versus IMV for the treatment of acute respiratory failure among patients who have failed IMV, due to inconsistent and low to very low quality evidence.
- There was low quality evidence that showed a nonsignificant reduction in rate of reintubation for NPPV compared to usual care for the treatment of acute respiratory failure after extubation from IMV. As such, there was inadequate evidence to draw conclusions on the effectiveness of NPPV for the treatment of acute respiratory failure among these individuals.
- No evidence evaluated NPPV for the prevention of acute respiratory failure after extubation from IMV.

Table 11: NPPV for Patients With COPD—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Mortality	Hospital Utilization, Length of Stay	HRQOL	Disease-Specific Measures				
Intervention	Comparator					Endo-tracheal Intubation	Duration of Mechanical Ventilation	Weaning Failure	Tolerance/ Compliance	Complications
NPPV + usual care	Usual care	COPD patients with acute respiratory failure due to acute exacerbations	*In-hospital* RR 0.53 (95% CI 0.35–0.81)	WMD −2.68 days (95% CI −4.41 to −0.94)	No significant difference in quality of sleep or general well-being[a]	RR 0.38 (95% CI 0.28–0.50)	NA	NA	NPPV intolerance 5%–29% Compliance with NPPV decreased over time	Overall, fewer complications with NPPV (e.g., pneumonia, sepsis, GI disorders, or bleeds)
Number of studies (sample size)			9 RCTs (917)	11 RCTs (1,000)	1 RCT (60)	11 RCTs (1,000)	—	—	*Intolerance* 8 RCTs *Compliance* 2 RCTs	5 RCTs
GRADE			Moderate	Moderate	NR	Moderate	—	—	NR	Low
Weaning from IMV using NPPV	IMV	COPD patients invasively ventilated who failed T-piece weaning trials	RR 0.47 (95% CI 0.23–0.97)	*In ICU* WMD −5.21 days (95% CI −11.60 to 1.18)	Poor sleep quality in NPPV group	NA	WMD −3.55 days (95% CI −8.55 to 1.44)	Significant reduction	NR	*Nosocomial pneumonia* RR 0.14 (95% CI 0.03–0.71)
Number of studies (sample size)			2 RCTs (80)	2 RCTs (80)	1 RCT (50)	—	2 RCTs (80)	1 RCT (50)	—	2 RCTs (80)
GRADE			Moderate	Low	NR	—	Low	Moderate	—	Moderate

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; GI, gastrointestinal; HRQOL, health-related quality of life; ICU, intensive care unit; IMV, invasive mechanical ventilation; NPPV, noninvasive positive pressure ventilation; NA, not applicable; NR, not reported; RCT, randomized controlled trial; RR, relative risk; WMD, weighted mean difference.
[a]Based on visual analogue scale.

Economic Analysis

An economic evaluation was conducted to assess the cost-effectiveness and health system impact of COPD treatment strategies. Two economic evaluations were conducted for NPPV for the treatment of acute respiratory failure due to acute exacerbations of COPD:

- NPPV plus usual care versus usual care for first-line treatment
- NPPV for weaning from IMV

A cost-utility analysis using a Markov model with a lifetime horizon was conducted to estimate the ICER for each intervention. Costs for acute inpatient, day surgery, and ambulatory care cases were obtained from the Ontario Case Costing Initiative. The cost for usual medical care for a COPD hospitalization was obtained from Canadian literature. Based on average LOS reported in the trials, total costs for the hospitalization episode of each arm were calculated and cost savings were reported. Results from the cost-effectiveness model and budget impact analyses for NPPV are shown in Table 12**.**

Table 12: NPPV for Patients With COPD—Summary of Ontario Economic Analysis[a]

Technology Reviewed		Population	ICER (Cost/QALY)	Budget Impact Analysis
Intervention	Comparator			Cost Savings to Province From Hospital Perspective
NPPV + usual care	Usual care	COPD patients with acute respiratory failure due to acute exacerbations	Dominant	$42 million[b]
Weaning from IMV using NPPV	Pressure support IMV	COPD patients invasively ventilated who fail T-piece weaning trials	Dominant	$12 million[c]

Abbreviations: COPD, chronic obstructive pulmonary disease; ICER, incremental cost effectiveness ratio; IMV, invasive mechanical ventilation; NPPV, noninvasive positive pressure ventilation; QALY, quality-adjusted life-year.

[a]All costs in Canadian dollars.

[b]Based on estimated 11,163 patients who can benefit from NPPV (assuming 10%–20% of the patient population at risk is eligible for ventilation, and 50%–60% choose to be ventilated).

[c]Based on estimated 1,435 patients can benefit from weaning with NPPV (assuming 10%–20% of the patient population at risk is eligible for ventilation, and 50%–60% choose to be ventilated, and 15% will fail spontaneous breathing tests).

OHTAC Recommendations[5]

OHTAC made the following recommendations after considering the findings above:

- OHTAC recommends the use of NPPV as an adjunct to usual medical care as a first line treatment for patients with acute respiratory failure due to acute exacerbations of COPD who do not require immediate access to IMV. NPPV should be made widely available with appropriate support systems and human resources for this indication.
- OHTAC recommends the use of NPPV to wean COPD patients who have failed spontaneous breathing tests following IMV.
- OHTAC recommends that patient preferences regarding mechanical ventilation be sought prior to acute respiratory decompensation, and should serve as a guide for the provision of this service.

[5] Note: These are part of a larger recommendation for COPD.

Conclusions: Impact on Chronic Disease Management

Based on moderate quality evidence, NPPV plus usual medical care significantly reduced the need for endotracheal intubation, in-hospital mortality, and the mean length of hospital stay in comparison to usual care alone. Low quality evidence also showed a lower rate of complications among individuals receiving NPPV and usual medical care. Additionally, moderate quality evidence showed that weaning from IMV using NPPV resulted in significant reductions in mortality, nosocomial pneumonia, and weaning failure compared to weaning with IMV. There was low quality evidence that weaning from IMV with NPPV resulted in a nonsignificant reduction in mean LOS and mean duration of mechanical ventilation compared to the IMV group. There was insufficient evidence to draw conclusions on the comparison of NPPV versus IMV for patients who have failed IMV. Overall, these results indicate that NPPV for the treatment of acute respiratory failure due to acute exacerbations of COPD can greatly improve the management of COPD, with a direct impact on reducing mortality and hospitalizations.

In 2007, the age- and sex- standardized prevalence of COPD among Ontarians was estimated at 9.5%. Persons with COPD typically have impaired oxygenation due to loss of alveolar volume and impaired ventilation from dead space and poor respiratory mechanics, putting them at high risk of developing respiratory failure when faced with additional pulmonary challenges such as an acute exacerbation. Acute respiratory failure develops quickly, and can lead to life-threatening changes in arterial blood gases and acid-base status.

The economic analysis found NPPV plus usual medical care to be a dominant strategy (i.e., more effective and less costly) when compared to usual medical care alone. This was reflected by clinical evidence showing significant in-hospital days avoided in individuals receiving NPPV. Assuming 10% to 20% of the COPD patient population at risk is eligible for ventilation and 50% to 60% will choose to be ventilated, this would correspond to an estimated 11,163 patients in Ontario who could benefit from NPPV. Overall, this would translate to a cost savings from the hospital perspective of $42 million (Cdn). Weaning with NPPV was also found to be a dominant strategy compared to weaning with IMV (as reflected by reduced inpatient mortality in the study group). With 15% of patients estimated to fail spontaneous breathing tests, an estimated 1,435 patients could benefit from weaning with NPPV, translating to a cost savings from the hospital perspective of $12 million (Cdn).

Implantable Cardioverter Defibrillators—Prophylactic Use: An Evidence-Based Analysis

Background

An ICD is a battery-powered device that monitors heart rhythm and can deliver an electric shock to restore normal sinus rhythm when potentially fatal arrhythmias are detected, thus preventing sudden cardiac death (SCD). Devices are implanted in the pectoral region and last from 5 to 8 years before they need to be replaced. Primary prevention of SCD with an ICD involves identification of and preventative therapy for patients who are at high risk for SCD, including individuals with ischemic heart disease, and in particular those with CHF.

Results

An EBA was conducted to examine the effectiveness, safety, and cost-effectiveness of ICDs for the primary prevention of SCD. (13) The primary outcomes of interest were all-cause mortality, adverse effects, and HRQOL. The EBA did not report findings for adverse effects and HRQOL.

A summary of the results from the effectiveness analysis is presented in Table 13. Results were reported by individual RCT, and not combined due to differing patient populations.

Table 13: ICDs for Prophylactic Use—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Mortality Hazard Ratio (95% CI)
Intervention	**Comparator**		
ICD	Conventional therapy	Ischemic cardiomyopathy, prior MI, ejection fraction ≤ 0.35, NSVT identified by electrophysiological screening	0.46 (0.26–0.82)
Number of studies (sample size)			1 RCT (196)
GRADE			Moderate
ICD	Conventional therapy	Ischemic cardiomyopathy, prior MI, ejection fraction ≤ 0.30	0.69 (0.51–0.93)
Number of studies (sample size)			1 RCT (1,232)
GRADE			Low
ICD	Conventional therapy	Ischemic and nonischemic cardiomyopathy, ejection fraction ≤ 0.35	0.77 (0.62–0.96)
Number of studies (sample size)			1 RCT (2,521)
GRADE			Moderate

Abbreviations: CI, confidence interval; ICD, implantable cardioverter defibrillator; MI, myocardial infarction; NSVT, non-sustained ventricular tachycardia; RCT, randomized controlled trial.

Economic Analysis

Cost-Effectiveness

A literature review was conducted to identify studies that evaluated the cost-effectiveness of ICDs.

Sanders et al reviewed the cost-effectiveness of ICDs based on 8 individual trial populations. Two randomized controlled trials (RCTs) found that ICDs did not reduce risk of death, and that they were more expensive and less effective than control therapy. Six other RCTs found ICD use to add between 1.01 and 2.99 QALYs, and between $68,300 (US) and $101,500 (US) in comparison to controls. The cost per QALY ranged from $34,000 (US) to $70,200 (US) across trials. Sensitivity analyses showed that this cost-effectiveness ratio would remain below $100,000 (US) per QALY as long as the ICD reduced mortality for 7 or more years.

Using a societal perspective and data from the RCT evaluating ischemic individuals with an ejection fraction ≤ 0.30, the Blue Cross Blue Shield Technology Evaluation Centre found the ICER for ICDs relative to conventional therapy to be $50,900 (US) per QALY.

Budget Impact Analysis

An Ontario BIA was conducted based on the study populations of the 3 major RCTs evaluated in the EBA in order to analyze options for implementing ICDs for primary prevention of SCD. Costs included in the analysis were for hospital, physician services, drugs, and downstream cost savings due to avoidance of healthcare utilization. Results from the BIA are presented in Table 14.

Table 14: ICDs for Prophylactic Use—Summary of Ontario Budget Impact Analysis Based on Individual Trial Populations[a]

Technology Reviewed		Population	Estimated Number of Individuals in Ontario	Total Cost in Ontario, $ Millions
Intervention	Comparator			
ICD	Conventional therapy	Ischemic cardiomyopathy, prior MI, ejection fraction ≤ 0.35, NSVT identified by electrophysiological screening	4,740	~$156
		Ischemic cardiomyopathy, prior MI, ejection fraction ≤ 0.30	(> 4,740)	> $156
		Ischemic and nonischemic cardiomyopathy, ejection fraction ≤ 0.35	~23,700	~$770

Abbreviations: ICD, implantable cardiac defibrillator; MI, myocardial infarction; NSVT, non-sustained ventricular tachycardia.
[a]All costs in Canadian dollars.

OHTAC Recommendations

OHTAC made the following recommendations after considering the findings above:

- OHTAC recommends that conditional and reviewable funding be provided for up to 1,600 ICDs per year over the next 2 years to be used in a field evaluation examining the use of ICDs for primary prevention of SCD. The field evaluation will explore/verify the wide QRS interval as a screen to risk-stratify patients with ischemic heart failure who could derive most benefit from ICDs in the primary prevention of SCD.
- OHTAC recommends that hospitals funded to provide ICD services be expected to participate in the field evaluation and to collect and report ICD data to the database.
- OHTAC recommends that eligibility criteria for patients to receive an ICD for primary prevention include only patients with an ejection fraction ≤ 30% and on optimized medical therapy.
- OHTAC recommends that the ministry support an ICD database for the purpose of monitoring utilization, patient characteristics, uptake, and long-term outcomes.
- OHTAC recommends that ICDs be inserted at advanced arrhythmia centres with the involvement of a cardiac electrophysiologist. ICD centres must insert a minimum of 100 devices annually.
- OHTAC recommends that the ministry revise the current ICD funding rate to reflect changes in practice, replacement devices and follow-up costs.
- OHTAC will appoint an expert panel to make recommendations regarding the integration of technologies to treat HF, excluding drugs.

Conclusions: Impact on Chronic Disease Management

Based on low to moderate quality evidence, ICDs were found to be effective for the primary prevention of SCD when compared to individuals receiving conventional therapy. Quality of evidence was dependent upon the individual RCT and the patient population evaluated for ICD use. The strongest evidence and greatest relative reduction in mortality (54%) was for the RCT evaluating ICD use among individuals with ischemic cardiomyopathy, prior MI, ejection fraction ≤ 0.35, and non-sustained ventricular tachycardia (NSVT) by electrophysiological screening to identify high-risk patients. Overall, the clinical evidence suggested that ICDs can significantly improve the management of CAD and HF patients in the community by reducing the risk of mortality due to SCD. The risk of SCD is higher in patients with chronic HF than in any other definable subset of patients in cardiovascular medicine, with a 5-fold higher risk than in the general population.

The true mortality burden of SCD is not well established. Various sources have estimated the annual number of deaths in the United States to be between 184,000 and 462,000, accounting for a mean of 1 to 2 deaths per 1,000 adults aged over 35 years annually, and 50% of all heart-related deaths. Survival rates following an outside-of-hospital cardiac arrest in Ontario range from 0% to 11.8%. Most SCDs are caused by acute fatal arrhythmias or abnormal heart rhythms (ventricular tachycardia and ventricular fibrillation).

Although a cost-effectiveness analysis was not conducted, prior economic analyses based on the specific RCTs evaluated in the EBA found ICDs to be generally cost-effective compared to conventional treatment ($34,000–$70,200 [US] per QALY). An Ontario BIA showed that overall costs are highly dependent on the eligible patient population. Using a broad implementation strategy, providing ICD implantation for all individuals in Ontario with HF and left ventricular ejection fraction ≤ 0.30, would cost the province as much as $770 million (Cdn). Due to a high number needed to treat at 5 years, a high prevalent population, and a high budget impact, the overall strength of this recommendation was stated to be weak. Providing ICDs only for ischemic patients with left ventricular ejection fraction ≤ 0.35, as well as screening for NSVT, was estimated to cost approximately $156 million (Cdn), and was found to be a moderate strength recommendation when considered in conjunction with the effectiveness data. However, using a similar

base population of ischemic patients with left ventricular ejection fraction ≤ 0.30 and *without* the additional screening for NSVT, was found to result in greater costs and greater numbers needed to treat. Therefore, although ICDs are effective in preventing SCD, uptake and diffusion of the device for primary prevention of SCD needs to be optimized to identify those at true risk of SCD and who might benefit most to be generalizable to the Ontario prevalent population.

Constraint-Induced Movement Therapy for Rehabilitation of Arm Dysfunction After Stroke in Adults: An Evidence-Based Analysis

Background

Rehabilitation interventions are the cornerstones of care and recovery after stroke. Constraint-induced movement therapy (CIMT) is a behavioural approach to neurorehabilitation. The major components of CIMT include i) intense repetitive task-oriented training of the impaired limb; ii) immobilization of the unimpaired arm; and iii) shaping. With task-oriented training, people may train the affected arm for several hours a day for up to 10 to 15 consecutive days. With immobilization, the unaffected arm may be restrained for up to 90% of waking hours. With shaping, the difficulty of training tasks is progressively increased as performance improves and encouraging feedback is provided immediately when small gains are achieved.

Results

An evidence-based analysis was conducted to examine the effectiveness and cost-effectiveness of CIMT for persons with arm dysfunction after a stroke. (14)

The primary outcome of interest was arm motor function, with secondary outcomes assessing arm motor impairment; activities of daily living based on the functional independence measure (FIM); perceived motor function (self-reported amount and quality of arm use); and HRQOL. When possible, analyses were further stratified by intensity and duration of treatment, restraint position, and time from onset of stroke. A summary of the results for the effectiveness analysis is presented in Table 15: .

Table 15: CIMT for Stroke Rehabilitation—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Health Quality				Disease-Specific Measures	
Intervention	**Comparator**		**HRQOL, Mean Difference in Final SIS (95% CI)**	**Functional Status, Mean Difference in FIM (95% CI)**	**Perceived Motor Function, Mean Difference in Amount of Arm Use (95% CI)**	**Perceived Motor Function, Mean Difference in Quality of Arm Use (95% CI)**	**Arm Motor Function, Mean Difference in ARAT (95% CI)**	**Arm Motor Impairment, Mean Difference in FMA (95% CI)**
CIMT	Usual care (PT or OT)	Adults with arm dysfunction after stroke	3.9 (–5.6 to 13.5)	3.6 (–0.22 to 7.44)	1.1 (0.6–1.7)	0.97 (0.7–1.3)	13.6 (8.7–18.6)	6.5 (2.3–10.7)
Number of studies (sample size)			2 RCTs (66)	4 RCTs (128)	8 RCTs (241)	8 RCTs (241)	4 RCTs (43)	8 RCTs (169)
GRADE			Very low	Low	Low	Low	Moderate	Low
Subgroup Analyses of CIMT								
Program: high intensity/short duration	Usual care		NR	3.6 (–0.22 to 7.44)	0.95 (0.77–1.1)	0.84 (0.64–1.1)	13.6 (8.7–18.6)	4.1 (2.1–6.1)
Number of studies (sample size)			—	4 RCTs (128)	7 RCTs (231)	7 RCTs (231)	4 RCTs (43)	4RCTs (126)
Program: low intensity/long duration	Usual care		NR	NR	2.4 (2.1–2.6)	1.5 (1.1–1.9)	NR	11.0 (6.3–15.7)
Number of studies (sample size)			—	—	1 RCT (10)	1 RCT (10)	—	4 RCT (57)
Restraint position: hand	Usual care		NR	NR	0.93 (0.72–1.15)	0.96 (0.7–1.2)	NR	4.1 (2.1–6.1)
Number of studies (sample size)			—	—	6 RCTs (188)	6 RCTs (188)	—	4 RCTs (126)
Restraint position: hand and arm	Usual care		NR	3.6 (–0.22 to 7.44)	1.67 (0.34–3.0)	0.98 (–0.07 to 2.0)	13.6 (8.7–18.6)	11.0 (6.3–15.7)
Number of studies (sample size)			—	4 RCTs (128)	2 RCTs (53)	2 RCTs (53)	4 RCTs (43)	4 RCTs (57)
Time from onset of stroke: 1–12 months	Usual care		NR	3.6 (–0.22 to 7.44)	1.3 (0.52–2.1)	1.0 (0.6–1.4)	13.6 (8.7–18.6)	9.5 (3.6–15.4)
Number of studies (sample size)			—	4 RCTs (128)	4 RCTs (126)	4 RCTs (126)	4 RCTs (43)	4 RCTs (44)
Time from onset of stroke: > 12 months	Usual care		NR	NR	0.90 (0.54–1.25)	0.86 (0.48–1.3)	NR	3.5 (1.1–6.0)
Number of atudies (sample size)			—	—	4 RCTs (115)	4 RCTs (115)	—	3 RCTs (100)

Abbreviations: ARAT, action research arm test score; CI, confidence interval; CIMT, constraint-induced movement therapy; FIM, functional independence measure; FMA, Fugl-Meyer motor assessment; HRQOL, health-related quality of life; NR, not reported; OT, occupational therapy; PT, physiotherapy; RCT, randomized controlled trial; SIS, stroke impact scale.

Economic Analysis

An Ontario-based cost impact analysis was developed to assess the costs associated with CIMT for rehabilitation of arm dysfunction after stroke in adults in Ontario. The costs of providing CIMT for inpatient stroke rehabilitation of arm dysfunction were based on both the duration and intensity of the program; the costs were calculated in addition to current rehabilitation care in Ontario. Table 16 shows the total costs of combining current rehabilitation care and CIMT for stroke inpatients in Ontario in fiscal year 2011.

Table 16: CIMT for Stroke Rehabilitation—Annual Incremental Costs[a]

Description	Per Patient Cost		Total CIMT-Eligible Patient Costs ($ and FTEs)			
	Total Care Hours	Total Cost	FY 2011 (Low)[a], Millions	FY 2011 (High)[a], Millions	Average Annual, Millions	FTEs[b]
2-Week CIMT Comparisons (10 Days of Care)						
Ontario (current care)	5.0	$177	$0.06	$0.12	$0.09	1.5
Low-intensity CIMT (2 h/day)	25.0	$884	$0.31	$0.62	$0.46	7.6
Medium-intensity CIMT (3 h/day)	35.0	$1,238	$0.43	$0.86	$0.65	10.7
High-intensity CIMT (3.5 h/day)	40.0	$1,415	$0.49	$0.99	$0.74	12.2
3-Week CIMT Comparisons (15 Days of Care)						
Ontario (current care)	7.5	$265	$0.09	$0.19	$0.14	2.3
Low-intensity CIMT (2 h/day)	30.0	$1,061	$0.37	$0.74	$0.56	9.2
Medium-intensity CIMT (3 h/day)	45.0	$1,592	$0.56	$1.11	$0.83	13.7
High-intensity CIMT (3.5 h/day)	52.5	$1,857	$0.65	$1.30	$0.97	16.0

Abbreviations: CIMT, constraint-induced movement therapy; FTE, full-time equivalent; FY, fiscal year.

[a]All costs in Canadian dollars.

[b]Note: *Low* and *high* refer to cost estimations based on 349 and 698 CIMT-eligible patients, respectively; FTE represents full-time equivalent figures obtained by dividing the average annual costs by the average annual income of occupational therapists or physiotherapists.

OHTAC Recommendations

OHTAC made the following recommendations after considering the findings above:

- CIMT shows short-term effectiveness on arm function and should be considered in the stroke rehabilitation regimen beginning no earlier than 1 month after the onset of stroke.
- Contextualization of these findings in terms of the management of stroke rehabilitation in Ontario is required.
- OHTAC supports the 2010 Institute for Clinical Evaluative Sciences *Ontario Stroke Evaluation Report* recommendations regarding access and tracking of outpatient stroke rehabilitation care in the province.

Conclusions: Impact on Chronic Disease Management

Based on moderate quality evidence, CIMT was found to significantly improve arm motor function measured with the action research arm test compared to usual care delivered with the same intensity and duration. Significant differences were also found for arm motor impairment and perceived motor function (amount of use and quality of use). There was a nonsignificant effect found for functional status using the FIM score or HRQOL outcome measures. The nonsignificant effect found with the FIM score and the HRQOL score may be a factor of a nonresponsive outcome measure (FIM scale) and/or a type II statistical error from an inadequate sample size. The quality of evidence was low for all secondary outcome measures except HRQOL, which was very low. Overall, these findings suggest that CIMT may

be an important technology for the overall management of stroke in the community by improving arm motor function, but current evidence is not sufficient to suggest that these improvements translate to improved HRQOL or functional status.

Stroke is the leading cause of adult neurological disability in Canada, with 300,000 people or 1% of the population living with its effects. In Ontario, there were 19,395 persons with stroke (this includes intracerebral hemorrhage, ischemic stroke, subarachnoid hemorrhage, and transient ischemic attack) presenting to emergency departments in 2007/2008, with 15,514 admitted to the hospital. It is estimated that up to 85% of persons experiencing a complete stroke have residual arm dysfunction, which will interfere with their ability to live independently. Clinical experts estimated that approximately 40% of stroke inpatients would require rehabilitation for arm dysfunction and about 5% to 10% of these patients would be eligible for CIMT programs specifically. As a result, the annual volume of CIMT-eligible stroke patients in Ontario in fiscal year 2011 was estimated to be in the range of 349 to 698 patients.

Economic utility analyses estimates an average annual cost for Ontario to implement CIMT of $0.46 million to $0.97 million (Cdn) for 2 to 3 weeks of therapy. However, CIMT need not occur only in an inpatient setting. According to expert consultation, CIMT would be administered *after* 30 days of inpatient care. In Ontario's current care model, for the first 30 days of inpatient stroke rehabilitation, approximately 10 hours would be spent with patients. Therefore, total costs for CIMT (including current care) is estimated to range from $0.59 million (Cdn) for a 2-week low-intensity program and an estimated 349 CIMT-eligible stroke patients to $1.22 million (Cdn) for a 3-week high-intensity program and 698 CIMT eligible stroke patients.

Pressure Ulcer Prevention: An Evidence-Based Analysis

Background

A pressure ulcer is defined as a localized injury to the skin/and or underlying tissue, occurring most often over a bony prominence and caused by pressure, shear, or friction—either alone or in combination. Those at risk for developing pressure ulcers include the elderly and critically ill, as well as persons with neurological impairments and those with conditions associated with immobility. Pressure ulcers are graded or staged along a 4-point classification system denoting severity. Stage I represents the beginnings of a pressure ulcer and stage IV consists of tissue loss with exposed bone, tendon, and/or muscle.

Numerous health technologies have been developed for the prevention of pressure ulcers, some of which are currently being used in Ontario. These technologies include various mattress types, skin cleaning procedures, and alternative care schedules for patients.

Results

An EBA was conducted to examine the effectiveness of pressure ulcer preventative interventions. (15) A total of 14 analyses were conducted as part of the EBA, of which 3 health technologies were identified as falling within the scope of this summary report:

- alternative foam mattress—a number of alternative mattresses comprised of unique foam types and densities have entered the health care market targeting the prevention of pressure ulcers
- repositioning schedule—Registered Nurses' Association of Ontario (RNAO) 2005 nursing best practice guidelines state that individuals restricted to bed be repositioned at least every 2 hours or sooner. Given advancements in high-quality foam mattresses, alternative repositioning schedules have been proposed
- dry vesico-elastic polymer pad (gel pad)—an alternative to the standard operating table mattress

The primary outcome measure in each analysis was the incidence of pressure ulcers measured as the number (proportion) of participants developing a new pressure ulcer. The effectiveness of alternative repositioning schedules and gel pads alone were based on low quality data, but were included in this review because of optimal cost-effectiveness and positive OHTAC recommendations. (19;20) A summary of the results from the effectiveness analysis is presented in Table 17.

Other interventions examined in the EBA were not included this summary report as they showed no statistically or clinically significant findings based on moderate to high quality data for at least 1 of the primary outcomes of interest. These included the following:

- alternative mattresses (air suspension bed in the intensive care unit, Micropulse System alternating mattress used intraoperatively and postoperatively, alternating pressure mattresses and alternating pressure overlays). The evidence did not support the superiority of 1 particular type of alternative foam mattress
- sheepskin (specifically Australian sheepskin)
- risk assessment and allocation of pressure-relieving equipment according to the person's level of pressure ulcer risk
- structured skin care protocols or pH-balanced cleansers among persons with urinary and/or fecal incontinence
- nutritional supplementation

Table 17: Technologies for Pressure Ulcer Prevention—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population	Disease-Specific Measures
Intervention	**Comparator**		**Incidence of Pressure Ulcers, RR (95% CI)**
Alternative foam mattress	Standard foam mattress	Patients admitted to an acute care setting	0.31 (0.21–0.46)
Number of studies (sample size)			4 RCTs (801)
GRADE			Moderate
Repositioning every 4 hours plus a pressure redistribution mattress	Standard care (2- or 3-hour turning schedule with a standard mattress)	Patients admitted to an acute care setting	0.70 (0.52–0.93)
Number of studies (sample size)			1 RCT (187)
GRADE			Low
Dry vesico-elastic polymer pad (gel pad)	Standard operating table foam mattress	Patients in a perioperative and operative setting with surgeries of at least 90 minutes in duration	0.53 (0.33–0.85)
Number of studies (sample size)			1 RCT (416)
GRADE			Low

Abbreviations: CI, confidence interval; RCT, randomized controlled trial; RR, relative risk.

Economic Analysis

Using the low-moderate quality effectiveness data from the EBAs, a cost-effectiveness analysis was conducted for each of the 3 health technologies evaluated for the prevention of pressure ulcers (alternative foam mattresses, alternative turning schedules, and gel pads) (Table 18). A Markov cohort model was developed to simulate the natural history of pressure ulcers. The model was structured to be consistent with the current biologic and clinical understanding of the development and management of pressure ulcers. The first economic analysis examined the use of alternative foam mattresses or alternative turning schedules for the prevention of pressure ulcers in a long-term care (LTC) setting using a lifetime horizon. The second evaluated gel-filled overlays in operating rooms for hospitalized patients undergoing planned major surgical procedures using a 1-year time horizon. Analyses were conducted from the Ontario public health system perspective.

Alternative Foam Mattresses or Alternative Turning Schedules in LTC

On the assumption that approximately 46% of LTC facility beds in Ontario currently use alternative foam mattresses, it was assumed that approximately 48,600 cases remain at risk for pressure ulcers. Introduction of alternative foam mattresses to all Ontario LTC beds is estimated to have a 1-time cost of $22 million (Cdn). (20) Table 18 summarizes the cost-effectiveness and health system implications of alternative foam mattress or alternative turning schedules for the prevention of pressure ulcers in LTC.

Gel Pads in Operating Rooms

On the assumption that approximately 8% to 20% of operating room tables are currently equipped with gel-filled overlays, approximately 121,000 to 140,000 inpatient surgical cases remain at risk for pressure-ulcers intraoperatively. The implementation of gel-filled overlays to cover all remaining operating room tables in Ontario would cost approximately $1.6 to $1.9 million (Cdn). Table 18 summarizes the cost-

effectiveness and health system implications of alternative operating room gel-filled overlays for pressure ulcer prevention.

Updated Economic Analysis

Since the EBA was published, THETA has updated the economic analyses on pressure ulcer prevention in LTC facilities and in the operating room based on an updated knowledge base. The updated economic analysis for alternative foam mattresses in the LTC setting reported an estimated 1,597 facility-acquired pressure ulcer cases averted per year, saving approximately $1.3 million (Cdn) in health care costs. (21) Similarly, the updated economic analysis evaluating gel pads in operating rooms reported 974 pressure ulcer cases prevented per year, with an estimated $500,000 (Cdn) savings per year. (22)

Table 18: Technologies for Pressure Ulcer Prevention—Summary of Economic Evaluation[a]

Technology Reviewed		Population	ICER: Cost/QALY	Aggregated QALYs Gained	Net Pressure-Ulcer Related Healthcare Cost Savings Per Year,[a] Millions	Events Avoided	
Intervention	Comparator					Pressure-Ulcer Cases Averted	Reduction in Pressure Ulcer–Related Deaths
Alternative foam mattress	Standard foam mattress	Patients admitted to a LTC setting	$6,328/QALY	173[b]	$17.3[b]	2,984[b]	NR
Repositioning every 4 hours plus a pressure redistribution mattress	Standard care (2- or 3-hour turning schedule with a standard mattress)	Patients admitted to a LTC setting	$5,234/QALY (Dominant when assuming a cost saving due to reduction in personal support worker time)	192[b]	$19.7[b]	3,381[b]	47% over 5 years (intervention: 270 deaths estimated; control: 508 deaths projected)
Dry vesico-elastic polymer pad (gel pad)	Standard operating-table foam mattress	Patients in a perioperative and operative setting with surgical duration ≥ 90 minutes	Dominant (Mean QALY increase of 0.00003; mean cost savings of $224)	3.8–4.4[c]	$26–$29[c]	4,233–4,868[c]	No change in absolute life expectancy

Abbreviations: ICER, incremental cost-effectiveness ratio; LTC, long-term care; NR, not reported; QALY, quality-adjusted life-year.
[a]All costs in Canadian dollars.
[b]Not including 1-time implementation costs of $22 million for alternative foam mattress and repositioning in LTC facilities, and $2 million for gel-filled overlays in operating rooms.
[c]Assuming a current use of alternative foam mattresses of 46% in Ontario LTC facilities.
[d]Assuming a current use of gel-filled overlays of 8%–20% in Ontario operating departments.

OHTAC Recommendations[6]

OHTAC made the following recommendations after considering the findings above:

- For the prevention of pressure ulcers, OHTAC recommends that a high quality foam mattress be provided to all persons in an acute care setting.
- For the prevention of pressure ulcers, a high quality support surface (foam or gel) should be used during surgical procedures of greater than 90 minutes in duration. Strongest evidence exists for using a gel pad for this population.
- For the prevention of pressure ulcers, a high quality foam mattress should be provided to all residents in long-term care facilities. The Community Care Access Centre (CCAC) should use the Pressure Ulcer Risk Score (PURS) to assess a client's risk for developing a pressure ulcer.
- Where risk is identified, a high-density foam mattress should be used to prevent the development of pressure ulcers.
- There is low quality evidence to suggest that persons using a high quality foam mattress may be turned at a minimum of every 4 hours. Therefore, OHTAC recommends a field study be undertaken to determine the optimal turning schedule (2 hour versus 4 hour) for persons using a high-density foam mattress. Until better evidence is available, all healthcare facilities should follow the current RNAO 2005 nursing best practice guidelines, which state that individuals restricted to bed be repositioned at least every 2 hours or sooner if at high risk for pressure ulcers. This complies with the current Ontario long-term care home standard.

Conclusion: Impact on Chronic Disease Management

There is moderate quality evidence that an alternative foam mattress is effective in preventing the development of pressure ulcers compared with a standard hospital foam mattress. Overall, there remains a paucity of moderate or high quality evidence in the literature to also support many of the other preventative interventions, including alternative repositioning strategies and gel pad mattresses. Until better quality evidence is available, pressure ulcer preventive care must be guided by expert opinion for interventions where low or very low quality evidence supports the effectiveness of such interventions.

The prevalence of pressure ulcers at stage 1 or greater in health care settings in Ontario (2004) ranged from 13.1% to 53.3% with non-acute health care settings having the highest prevalence rate. An economic analysis model estimated lifetime probability of pressure ulcers at 49.2% and the probability of pressure ulcer–related death at 0.08%. (19;20) Pressure ulcers are treatable if found early, but left untreated they are associated with adverse health outcomes and in rare instances, can lead to fatal infections. Furthermore, pressure ulcers can delay functional recovery, impair HRQOL, and cause complications that require hospitalization and prolonged LOS.

The use of alternative foam mattresses, both with and without 4-hourly turning/repositioning, was found to be economically attractive as a preventative measure of pressure ulcers for individuals in LTC (ICERs: $6,328 [Cdn] per QALY and $5,234 [Cdn] per QALY, respectively). Overall, the economic evaluation found these strategies to improve the management of pressure ulcers by avoiding approximately 3,000 pressure ulcer cases and gaining nearly 200 QALYs. The implementation of alternative foam mattresses in addition to 4-hour repositioning was also predicted to decrease pressure ulcer–related deaths by 47%. After accounting for an implementation cost of nearly $22 million (Cdn), alternative foam mattresses resulted in a total healthcare cost savings of $17 million (Cdn) alone, or $20 million (Cdn) with the addition of a 4-hourly turning schedule.

[6]Note: These are part of a larger recommendation for the evidentiary platform for pressure ulcers.

Gel-filled overlays are currently used in 8% to 20% of operating departments in Ontario (an estimated 2,205 operating tables). The expanded use of gel-filled overlays to cover all operating tables would result in greater health benefits, with a substantial reduction in healthcare costs. Based on the economic evaluation, the implantation cost was estimated at approximately $2 million (Cdn) and resulted in the prevention of 4,233 to 4,868 cases of pressure ulcers per year, with a corresponding gain in HRQOL. Direct healthcare costs would be reduced and result in a cost saving to hospitals' annual budgets.

Negative Pressure Wound Therapy: An Evidence Update

Background

Negative pressure wound therapy (NPWT) is a procedure that uses negative pressure to create suction and drain the wound of exudates (i.e., fluid, cells, and cellular waste that has escaped from blood vessels and seeped into tissue). The procedure subsequently influences the shape and growth of the surface tissues in a way that helps healing. Negative pressure wound therapy may be used for patients with chronic and acute wounds; subacute wounds (dehisced incisions); chronic diabetes-related wounds or pressure ulcers; meshed grafts (before and after); or flaps.

Results

An EBA was conducted to assess the effectiveness of NPWT for chronic wound treatment. (16) Two separate groups were evaluated:

- patients with diabetic foot ulcer
- patients hospitalized for skin grafting

The primary outcome of interest was proportion of patients who achieved complete wound closure. Secondary outcomes included HRQOL, median time to complete wound closure, reduction in wound area, graft survival/loss, the proportion of patients with granulation tissue formation, mean time to achieve 76% to 100% granulation tissue formation, and rates of secondary amputations and adverse events. A summary of the results from the effectiveness analysis is presented in Table 19.

Table 19: NPWT for Treatment of Chronic Wounds—Summary of Outcomes and GRADE Quality of Evidence

Technology Reviewed		Population (Type of Wound)	Health Quality		Hospital Length of Stay Median Days (Range)	Disease Specific Measures							
						Complete (100%) Wound Closure		Reduction in Wound Area, cm^2	Granulation Formation/ Wound Bed Preparation			Rates of Secondary Ampu-tation	Adverse Events[a]
Inter-vention	Com-parator		HRQOL	Pain Scores		Proportion of Patients, %	Median Time, Days		Graft Survival/Loss	% of Patients Achieving 76%–100%	Median Time to Achieve 76–100%, days		
Diabetic Foot Ulcers													
NPWT	Usual care	Foot ulcer	NR	NR	NR	NPWT 43.2 Usual care 28.9 (*P* = 0.007)	NPWT 96 (95% CI 75–114) Usual care not estimable (*P* = 0.001)	NPWT 4.3 Usual care 2.5 (*P* = 0.021)	NR	NPWT 70.8 Usual care 36.4 (*P* = 0.019)	NPWT 56 Usual care 114 (*P* = 0.022)	Significantly lower in NPWT group	Significantly higher in NPWT group
Number of studies (combined sample size)			—	—	—	1 RCT (341)	1 RCT (341)	1 RCT (341)	—	1 RCT (341)	1 RCT (341)	1 RCT (341)	1 RCT (341)
NPWT	Usual care	Foot amputation	NR	NR	NR	NPWT 56 Usual care 39 (*P* = 0.04)	NPWT 56 (IQR 26–92) Usual care 77 (IQR 40–112) (*P* = 0.005)	NR	NR	NR	NPWT 42 (IQR 40–56) Usual care 84 (IQR 57–112) (*P* = 0.002)	Non-significant, fewer amputations in NPWT	No difference
Number of studies (combined sample size)			—	—	—	1 RCT (162)	1 RCT (162)	—	—	—	1 RCT (162)	1 RCT (341)	1 RCT (341)
GRADE[b]			—	—	—	Moderate	Moderate	—	—	—	NR	NR	NR
Skin Grafting													
NPWT	Usual care	Leg ulcers	Lower in NPWT group in first week (*P* = 0.031); no difference at end of study	Lower in NPWT group in first week; no difference at end of study	Equal to complete healing time (discharge only upon complete healing)	NR	NPWT 29 (95% CI 26–33) Usual care 45 (95% CI 36–54) (*P* = 0.0001)	NR	Graft **survival** (% ± SD) NPWT 83 ± 14 Usual care 70 ± 31 (*P* = 0.011)	NR	NPWT 7 (95% CI 5.7–8.3) Usual care 17 (95% CI 10–24) (*P* = 0.005)	None	Significantly higher in NPWT group
Number of studies (combined sample size)			1 RCT (60)	1 RCT (60)	1 RCT (60)	—	1 RCT (60)	—	1 RCT (60)	—	1 RCT (60)	1 RCT (60)	1 RCT (60)
GRADE			NR	NR	NR	—	Moderate	—	NR	—	NR	NR	NR
NPWT	Usual care	Ulcers caused by wounds	NR	NR	NPWT 13.5 (11–22) Usual care 17 (10–31) (*P* = 0.01)	NR	NR	NR	Graft **loss** (%) NPWT 0 (95% CI 0–62) Usual care 12.8 (95% CI 0–75.9) (*P* < 0.001)	NR	NR	None	NR
Number of studies (combined sample size)			—	—	1 RCT (60)	—	—	—	1 RCT (60)	—	—	1 RCT (60)	—
GRADE			—	—	NR	—	—	—	Moderate	—	—	NR	—

Abbreviations: CI, confidence interval; HRQOL, health-related quality of life; IQR, interquartile range; NPWT, negative pressure wound therapy; NR, not reported; RCT, randomized controlled trial; SD, standard deviation.

[a]Adverse events includes but is not limited to: wound infection, pain, osteomyellitis, staphlococcus infection, and bleeding at donor site.

[b]GRADE of quality of evidence was conducted for body of evidence related to NPWT among individuals with diabetic foot ulcers.

Economic Analysis

An economic analysis was not conducted for NPWT. However, other studies reported NPWT as cost saving compared to control treatment regimens. One study found the incremental cost difference of NPWT for the treatment of diabetic foot ulcers to be $12,852 (US) based on total costs to achieve complete healing. Using an intention-to-treat sample size, the incremental cost difference was $9,915 (US). Additionally, 1 study examined NPWT for the treatment of chronic leg ulcers. This study reported a cost savings of $1,571 (US) for the average cost of treatment, accounting for disposables such as bandages and personnel time including nursing costs when NPWT is used in comparison to usual care.

OHTAC Recommendations

OHTAC made the following recommendations after considering the findings above:

- Negative pressure wound therapy is an effective option in the management of diabetes foot ulcers.
- Negative pressure wound therapy is an appropriate option for use following skin grafting of medium sized (around 30 cm^2) vascular ulcers and burns.
- To optimize patient outcomes and safety, appropriate guidelines should be adhered to in the application of this technology.

Conclusion: Impact on Chronic Disease Management

There is moderate quality evidence that NPWT is an effective option in the management and treatment of certain chronic wounds. As a result, NPWT has been shown to decrease hospital LOS, and may lead to other downstream health care utilization savings due to faster and more complete healing.

Chronic wounds are most often found in elderly people and in people with immunological or chronic disease. They may lead to deficits in function or HRQOL, amputation, or even death. One systematic review reported that the prevalence of lower limb ulcers ranged from 0.12% to 0.32% in the general population, which translates to between 15,600 and 41,600 people in Ontario (in 2004). Among patients with diabetes, 15% are thought to have foot ulcers at some time during their lives, typically due to peripheral neuropathy and vascular disease, deformity, or infection. This equates to approximately 105,000 people in Ontario.

Negative pressure wound therapy is currently being used across many health sectors in Ontario, and is widely diffused. In 2004, there were about 380 NPWT units rented from the manufacturer in Ontario: 152 systems were rented by CCACs, 110 by LTC facilities and 103 by hospitals. NPWT is typically performed by nurses or enterostomal therapists. In 2006, it was estimated that home care agencies use 40% of NPWT systems in Ontario, followed by LTC facilities (29%) and hospitals (27%), and it is believed that estimates have not changed dramatically since that time. While an economic analysis was not conducted, reported cost savings ranged from $1,517 to $12,852 (US) per patient when NPWT was used compared to usual care.

Photoselective Vaporization for the Treatment of Benign Prostatic Hyperplasia

Background

Traditional treatment of benign prostatic hyperplasia (BPH) includes watchful waiting, pharmacotherapy, and surgical procedures. The gold standard for the surgical treatment and management of BPH is transurethral resection of the prostate (TURP), which is a slice-by-slice resection of prostatic tissue performed through the urethra. However, new options for the surgical treatment and management of BPH have become available in the last decade to reduce the morbidity associated with TURP. These options include monopolar and bipolar electrovaporization, transurethral microwave thermotherapy, transurethral needle ablation of prostate, and laser treatments such as YAG laser and potassium titanyl phosphate laser, also known as PVP.

The PVP procedure involves laser energy, which is strongly absorbed by hemoglobin and penetrates only 1 to 2 mm of tissue. Heat is thus concentrated into a small volume and prostatic tissue is ablated by rapid vaporization of cellular water instantaneously and with improved hemostasis, leaving only a 2 mm rim of coagulated tissue. One of the proposed benefits of PVP is the ability to successfully discharge patients on the day of surgery.

In 2006, OHTAC made the recommendation that a field evaluation be conducted on PVP given the uncertainty of the best technology and the likelihood of increasing diffusion of PVP. We present a summary of this field evaluation. (23)

Results

A field evaluation was conducted by research partners at PATH, McMaster University (Hamilton, Ontario, Canada), to examine the effectiveness of PVP for BPH versus the current gold standard treatment of TURP. (17)

The primary outcomes of the analysis were change from baseline on the international prostate symptom score, urinary flow rate, post-void residual, prostate-specific antigen, sexual health inventory for men score, and HRQOL at 6 months. Other outcomes of interest included the proportion of patient admissions after the procedure and number of hospitalization days (if admitted).

Overall, there was no significant difference in the change from baseline to 6-month follow-up for the disease-specific clinical measures evaluated, with only changes in post-void residual favouring PVP (P = 0.018). A summary of the results for hospital utilization and HRQOL at 6 months is presented in Table 20.

Table 20: PVP Versus TURP for the Treatment of BPH—Summary of Outcomes

Technology Reviewed		Population	Hospital Utilization		Health Quality
Intervention	Comparator		Admissions	Mean Length of Stay (SD) in days (If Admitted)	HRQOL at 6 Months
PVP	TURP	Patients with BPH requiring surgical treatment	PVP 7.1% TURP 100%	PVP 2.0 (0.5) TURP 2.5 (0.5) (P = 0.02)	No significant difference between groups (P = 0.13)

Abbreviations: BPH, benign prostatic hyperplasia; PVP, photoselective vaporization of the prostate; HRQOL, health-related quality of life; TURP, transurethral resection of the prostate.

Economic Analysis

An economic analysis was conducted to evaluate the 6-month expected costs and QALYs associated with PVP and TURP (Table 21). Total costs per case were based on hospital, physician/anaesthesiologist and device costs. (17)

A budget impact analysis was conducted from an Ontario Ministry of Health Perspective to assess the annual costs of TURP and PVP, and the difference in costs between procedures. It was assumed that 5,000 individuals underwent TURP per year, with costs associated with PVP based on a 100% substitution rate for TURP. The total number of hospital admissions and patient days were also evaluated.

Table 21: PVP Versus TURP for Treatment of BPH—Summary of Economic Evaluation[a]

Technology Reviewed		Population	Expected Direct Cost, 6 Months	Expected QALY, 6 Months	ICER: Cost/ QALY	Annual Budget Impact Analysis[b]	Annual Impact on Hospitalizations[b]
Intervention	Comparator						
PVP	TURP	Patients with BPH requiring surgical treatment	PVP $3,891 TURP $4,863 ($P$ < 0.001)	PVP 0.447 TURP 0.437 (P = 0.508)	PVP Dominates	PVP $16,876,259.85 TURP $22,808,250.00 Cost difference with PVP –$5,931,990.15	Hospital admissions 4,644 Total bed days 11,790 Bed days per patient 2.4

Abbreviations: BPH, benign prostatic hyperplasia; ICER, incremental cost effectiveness ratio; PVP: photoselective vaporization of the prostate; TURP, transurethral resection of the prostate; QALY, quality-adjusted life-year.

[a]All costs in Canadian dollars.

[b]Assuming 5,000 TURPs per year.

Conclusion: Impact on Chronic Disease Management

Based on evidence from a field evaluation, PVP has been shown to be both safe and effective over a 6-month follow-up period for the treatment of BPH. No significant differences were found in clinical or HRQOL outcomes between PVP and TURP.

BPH is 1 of the most common conditions for which male patients seek treatment, with 40% to 50% of men having the condition by age 50 to 59 years and 80% in those over age 80 years. Without treatment, complications of BPH can include upper tract dilatation and hydronephrosis, chronic renal failure, bladder wall hypertrophy, bladder stones, bladder diverticula, and urinary infection.

The use of PVP in place of TURP for the treatment of BPH has been shown to directly improve chronic disease management. PVP has been shown to be both safe and effective based on long-term follow-up data, and results in substantially fewer hospital admissions and lower costs. Conservative estimates of PVP predict a $6.5 million (Cdn) annual savings to the province of Ontario, with 4,600 avoided hospitalizations and 11,800 avoided hospital days each year. Additionally, given that PVP is an outpatient, noninvasive procedure it is likely to be preferred by patients; this was seen over the course of this field evaluation, which faced challenges with recruitment for the TURP arm of the trial, with patients opting for PVP as part of the informed-consent process.

Summary of Results

A number of individual health technologies have demonstrable effectiveness and cost-effectiveness related to the management of chronic disease in the community setting. The final technologies selected for review can be categorized into 3 groups: (1) technologies related to the cure of a chronic disease; (2) technologies related to the prevention of a chronic disease; and (3) technologies related to the management of chronic disease.

Potentially of greatest clinical benefit are technologies that have been shown to be curative or preventative in nature. Bariatric surgery among morbidly obese adults with diabetes was shown to result in significant reductions in HbA1c levels, as well as the resolution of the disease itself. Similarly, ablation procedures for atrial fibrillation resulted in significant freedom from arrhythmias and improved HRQOL.

Alternative foam mattresses had evidence supporting their effectiveness in the prevention of pressure ulcers. Additionally, alternative foam mattresses plus alternative turning/repositioning schedules in LTC facilities and specialized gel pads in operating rooms had demonstrated cost-effectiveness, and even cost savings under certain circumstances. By preventing or curing these diseases, it is possible to reduce the need for long-term management by the health care system and directly prevent downstream complications.

The third category of technologies either greatly supported the management of chronic disease in the community or were associated with a reduction of hospital utilization. Primary angioplasty, or PCI, as an alternative to thrombolytic treatments for patients presenting with STEMI reduced mortality, stroke, reinfarction and severe adverse events, including major bleeding rates. Influenza and pneumococcal vaccinations resulted in significant management of COPD, as they were associated with a decrease in influenza-related ARI and pneumococcal pneumonia among COPD patients, respectively. This would be expected to reduce hospitalizations related to these events, as well as the need for mechanical ventilation. Smoking cessation strategies for smokers with COPD (consisting of at least 1 of counselling, NRT or antidepressants) demonstrated significantly improved prolonged abstinence from smoking compared with usual care or placebo. Cessation from smoking among patients with COPD has been associated with decreased mortality and improved lung function. NPPV to manage acute exacerbations in COPD was associated with a significant decrease in mortality, hospital LOS, and complications in comparison to usual care. When NPPV was used to assist in weaning patients off the more invasive IMV it resulted in a decrease in mortality, hospital LOS, weaning failure, and nosocomial pneumonia rates. ICDs have shown significant evidence in reducing overall mortality for CAD and CHF patients. CIMT for the rehabilitation of arm dysfunction after stroke resulted in improved health outcomes, including improved arm motor function and reduced arm motor impairment. As well, CIMT demonstrated further improvement in both self-reported amount and quality of arm use. NPWT was shown to be an effective option in the management and treatment of certain chronic wounds. It decreased hospital LOS and may lead to other downstream health care utilization savings due to faster and more complete healing. Finally, PVP for BPH is a noninvasive procedure that results in a decrease in hospitalizations, hospital LOS, and significant cost savings in comparison to TURP.

Findings and corresponding results of the outcomes of interest for all technologies reviewed are summarized in Table 22.

Table 22: Summary of Results

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
Technologies for the *Cure* of Disease							
Diabetes	Bariatric surgery for people with diabetes and morbid obesity	—	—	—	—	Resolution of diabetes (76.8%; 95% CI 70.7–82.9) *GRADE: Moderate* Clinically significant reduction in HbA1c (–2.7%; range –5.0 to –0.70) *GRADE: Moderate*	ICER: $15,697/QALY *Complications avoided* Heart disease: 2,757 MI: 13,839 HF: 31,137 Stroke: 8,957 Amputation: 2,997 Blindness: 4,179 Renal failure: 17
Atrial Fibrillation	First-line treatment of ablation for AF of flutter (vs. drug therapy)	—	—	—	Significant improvement *GRADE: NR*	Significant freedom from arrhythmia (RR 0.24; 95% CI 0.09–0.59) *GRADE: Moderate*	Annual cost savings per patient starting from 4.5 years post-ablation forward
	Ablation for drug-refractory AF when no other heart surgery required (vs. drug therapy)	—	—	—	Significant improvement ($P < 0.05$) *GRADE: NR*	Significant freedom from arrhythmia (RR 0.32; 95% CI 0.21–0.43) *GRADE: Moderate*	—
	Ablation for drug-refractory AF when additional heart surgery required (vs. heart surgery alone)	—	—	—	No difference *GRADE: NR*	Significant freedom from arrhythmia (range RR 0.13–0.53) *GRADE: Moderate–High*	—
Technologies for the *Prevention* of Disease							
Chronic Wounds	Alternative foam mattresses (vs. standard mattresses)	—	—	—	—	Significant prevention of pressure ulcers (RR 0.31; 95% CI 0.21–0.46) *GRADE: Moderate*	ICER: $6,328/QALY (in LTC) Annual pressure ulcer–related cost savings: $17.3 million Pressure ulcer cases averted: 2,984
	Repositioning every 4 hours plus a alternative foam mattress (vs. 2–3 h)	—	—	—	—	Significant prevention of pressure ulcers (RR 0.70; 95% CI 0.52–0.93) *GRADE: Low*	ICER: $5,234/QALY (in LTC) (Dominant when also assuming a reduction in personal support worker time) Annual pressure ulcer–related cost savings: $19.7 million Pressure ulcer cases averted: 3,381 Projected 47% reduction in pressure ulcer–related deaths over 5 years

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
	Dry vesico-elastic polymer pad (gel pad) (vs. standard mattress)	—	—	—	—	Significant prevention of pressure ulcers for surgeries > 90 minutes (RR 0.53; 95% CI 0.33–0.85) *GRADE: Low*	ICER: Dominant (in operating room) Annual pressure ulcer–related cost savings: $26 million–$29 million Pressure ulcer cases avoided: 4,233-4,868 Projected no change in absolute life expectancy
Technologies for the *Management* of Disease							
Coronary Artery Disease	Primary PCI (vs. in-hospital thrombolysis)	No difference (OR 0.87; 95% CI 0.61–1.24) *GRADE: Moderate*	—	—	—	Significant reduction in composite outcome of mortality, reinfarction, and stroke (OR 0.56; 95% CI 0.42–0.75) *GRADE: Moderate*	Cost savings per capita: $2,820–$5,259
	Routine early PCI (vs. thrombolysis and rescue PCI as needed)	No difference (OR 0.73; 95% CI 0.47–1.14) *GRADE: Moderate*	—	—	—	Significant reduction in composite outcome of mortality, reinfarction, and stroke (OR 0.64; 95% CI 0.49–0.83) *GRADE: Moderate*	—
Chronic Obstructive Pulmonary Disease	Influenza vaccination[b] (vs. no vaccination)	—	—	No difference (RR 0.41; 95% CI 0.08–2.02) *GRADE: Low*	—	Significant reduction in ARI (RR 0.2; 95% CI 0.06–0.70) *GRADE: High* No difference in mechanical ventilation (RR 0.15; 95% CI 0.01–2.75) *GRADE: Low*	—
	Pneumococcal vaccination[b] (vs. no vaccination)	No difference *GRADE: NR*	No difference (P = 0.16) *GRADE: NR*	No difference (P = 0.59) *GRADE: Low*	—	Significant 1.7% reduction in pneumococcal pneumonia (P = 0.025) *GRADE: High* Significant reduction in CAP among < 65 years (RR 0.24; 95% CI 0.07–0.80) *GRADE: NR*	—
	Smoking cessation[b] strategies, including a combination of counselling, NRT, and antidepressants (vs. usual care or placebo)	—	—	—	—	Significant improvement in prolonged smoking abstinence (range RR 2.01–7.70, depending on intervention) *GRADE: Moderate*	ICER: Dominant for all cessation strategies modelled Budget impact for Ontario to fund NRT: $10.4 million

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
	NPPV + usual care (vs. usual care)	Significant reduction (RR 0.53; 95% CI 0.35–0.81) *GRADE: Moderate*	Significant reduction (WMD –2.68; 95% CI –4.41 to –0.94) *GRADE: Moderate*	—	No significant difference in quality of sleep and general well-being *GRADE: NR*	Significant reduction in endotracheal intubation (RR 0.38 (95% CI 0.28–0.50) *GRADE: Moderate* Fewer complications *GRADE: Low*	ICER: Dominant Cost savings to Ontario from hospital perspective: $42 million
	Weaning from IMV using NPPV (vs. IMV)	Significant reduction (RR 0.47; 95% CI 0.23–0.97) *GRADE: Moderate*	No difference (WMD –5.21; 95% CI –11.60 to 1.18) *GRADE: Low*	—	Poor sleep quality in NPPV group *GRADE: NR*	No difference in duration of mechanical ventilation (WMD –3.55; 95% CI –8.55 to 1.44) *GRADE: Low* Significant reduction in weaning failure *GRADE: Moderate* Signficant reduction in nosocomial pneumonia (RR 0.14; 95% CI 0.03–0.71) *GRADE: Moderate*	ICER: Dominant Cost savings to Ontario from hospital perspective: $12 million
Congestive Heart Failure	ICD (vs. conventional therapy)	Significant reduction (range HR 0.46–0.77) *GRADE: Low–Moderate*	—	—	—	—	ICER: $34,000/QALY–$70,200/QALY (US) Total cost: $156 million–$770 million
Stroke	CIMT (vs. usual care)	—	—	—	No difference in HRQOL *GRADE: Very low* No difference in functional status *GRADE: Low* Significantly improved perceived arm motor function, quality of use (MD 0.97; 95% CI 0.7–1.3) and amount of use (MD 1.1; 95% CI 0.6–1.7) *GRADE: Low*	Significant improvement in measured arm motor function (ARAT MD 13.6; 95% CI 8.7–18.6) and decreased impairment (FMA MD 6.5; 95% CI 2.3–10.7) *GRADE: Low–Moderate*	Average annual implementation cost: $0.46 million–$0.97 million
Chronic Wounds	NPWT (vs. usual care)	—	Significant reduction of 3.5 days among patients with a skin graft (P = 0.01) *GRADE: NR*	—	First week: lower (P = 0.031) End of study: no difference *GRADE: NR*	Significantly greater proportion of complete wound closure (P < 0.05) *GRADE: Moderate* Significantly greater graft survival (P = 0.01) and less graft loss (P < 0.001) *GRADE: NR*	Annual cost savings: $1,571 (US) —$12,852 (US), per patient

Disease	Health Technology	Mortality	Hospital Utilization		Health Quality	Disease-Specific Measures	Economic Evaluation[a]
			LOS	Hospitalizations			
Benign Prostatic Hyperplasia	PVP (vs. TURP)	—	Significant reduction (PVP 2 days, TURP 2.5 days)	Significant reduction (PVP 7.1%, TURP 100%)	No difference	No difference	ICER: dominant Annual cost savings: $6 million Hospitalizations avoided: 4,644 hospital admissions, 11,790 bed days

Abbreviations: AF, atrial fibrillation; ARAT, action research arm test; ARI, acute respiratory illness; CAP, community-acquired pneumonia; CI, confidence interval; CIMT, constraint-induced movement therapy; COPD, chronic obstructive pulmonary disease; EBA, evidence-based analysis; FMA, Fugl-Meyer motor assessment; HR, hazard ratio; HRQOL, health-related quality of life; ICD, implantable cardioverter defibrillator; ICER, incremental cost-effectiveness ratio; IMV, invasive mechanical ventilation; LOS, length of stay; LTC, long-term care; MD, mean difference; MI, myocardial infarction; NPPV, noninvasive positive pressure ventilation; NPWT, negative pressure wound therapy; NRT, nicotine replacement therapy; OR, odds ratio; PCI, percutaneous coronary intervention; PVP, photoselective vaporization of the prostate; QALY, quality-adjusted life-year; RR, relative risk; TURP, transurethral resection of the prostate; WMD, weighted mean difference.

[a]All costs in Canadian dollars unless otherwise stated.

[b]Manages COPD by preventing potentially complex adverse events.

Summary of Technologies Excluded Due to No Statistically or Clinically Significant Findings

The focus of this summary report was to identify technologies reviewed that could be leveraged to optimize chronic disease management in the community. Six EBAs related to the populations of interest were excluded from the summary due to no statistically and/or clinically significant findings or low GRADE quality of evidence for the outcomes of interest. This section summarizes these 6 technologies, as their implementation may result in unnecessary expenses absorbed by the health care system.

Continuous Subcutaneous Insulin Infusion Pumps for Adults With Type 2 Diabetes

There was low quality of evidence demonstrating that the efficacy of continuous subcutaneous insulin infusion (CSII) pumps was not superior to multiple daily injections (MDIs) among adults with type 2 diabetes. (24) Additionally, there were no differences in the number of mild and severe hypoglycemic episodes when comparing CSII pumps to MDI. There were conflicting findings with respect to improved HRQOL for patients with CSII pumps, and significant limitations of the literature exist. Limitations included the fact that all studies were sponsored by insulin pump manufacturers, prior treatment regimens varied, types of insulin used varied by study (NPH versus glargine), and the generalizability of studies may not reflect the eligible patient population in Ontario, as participants were not necessarily on MDI prior to study entrance.

OHTAC did not recommend that Ontario support expanding the CSII pump program to adults with type 2 diabetes.

Hospital-at-Home for Acute Exacerbations Among Individuals With COPD

There was low quality evidence showing no significant differences in hospital readmissions between individuals in the hospital-at-home and inpatient care groups. (25) However, the number of days to hospital readmission was increased in the hospital-at-home group compared with the inpatient care group. As well, there was very low quality of evidence that showed no significant difference in mortality, HRQOL, or patient caregiver satisfaction between the hospital-at-home and inpatient groups. There was also insufficient evidence to determine the impact on lung function and LOS of hospital-at-home compared with inpatient care.

There was insufficient evidence for OHTAC to make a recommendation for the strategy of hospital-at-home for the treatment of acute exacerbations.

Long-Term Oxygen Therapy for Individuals With COPD

Long-term oxygen therapy (LTOT) was examined in comparison to no oxygen therapy among individuals with COPD. (26) Results were stratified among patients with severe hypoxemia ($PaO_2 \leq 55$ mmHg) and mild to moderate hypoxemia ($55 < PaO_2 \leq 60$ mmHg). Among patients with severe hypoxemia, there was low quality evidence that LTOT decreased all-cause mortality, but this was based on borderline statistical significance. Based on very low quality evidence, LTOT resulted in a significant improvement in FEV_1, and based on low to very low quality evidence, LTOT showed a significant improvement in HRQOL. Low quality evidence showed an increase in hospitalizations in the LTOT group compared with the no-oxygen group, but no difference in hospital LOS between the 2 groups. Among patients with mild to moderate hypoxemia, there was low quality evidence that showed no difference in mortality in the LTOT group compared with the no-oxygen group at 3 and 7 years of follow-up. Very low quality evidence showed nonsignificant improvements in % predicted FEV_1, endurance time, and dyspnea in the LTOT group compared with the no-oxygen group.

Overall, based on societal values in the decision determinants, OHTAC recommended that LTOT should continue to be provided to COPD patients with severe resting hypoxemia (<55 mm Hg).

Noninvasive Positive Pressure Ventilation for Chronic Respiratory Failure in COPD

NPPV was evaluated in comparison to no ventilation plus usual care among stable persons with COPD. (12) There was moderate quality evidence showing a nonsignficant difference in mortality, lung function after 3 months, functional exercise capacity after 3 months, and hospitalizations. Additionally, there was low quality evidence supporting clinically and statistically significant improvements in functional exercise capacity for the first 3 months of treatment and a beneficial impact on dyspnea in the NPPV group compared with the usual care group. There was insufficient evidence to draw conclusions about the impact of NPPV on HRQOL.

Overall, OHTAC did not recommend the use of NPPV for chronic respiratory failure in stable COPD patients due to its lack of clinical effectiveness.

Enhanced External Counterpulsation

There was insufficient evidence to support the effectiveness and safety of enhanced external counterpulsation (EECP) for the treatment of patients with refractory stable Canadian cardiovascular society classification III-IV angina or HF. (27) The overall quality of evidence was low for patients with angina and HF, as there were uncertainties due to methodological limitations in study design (study quality and directness). As well, the corresponding risk/uncertainty increased due to a budget impact of approximately $26.6 million (Cdn) or $166 million (Cdn), respectively, while the cost-effectiveness of EECP was unknown and difficult to estimate considering that there were no high-quality studies of effectiveness.

Management of Chronic Pressure Ulcers

Numerous strategies were evaluated for the management of chronic pressure ulcers, but evidence was generally based on small RCTs with methodological flaws. (15) The type of nonsurgical debridement used did not appear to have a significant impact on the complete healing of ulcers. No significant difference in debridement abilities was detected among nonsurgical debridement agents, with 3 exceptions (papain urea was better than collagenase, calcium alginate was better than dextranomer, and addition of streptokinase/streptodornase improved the debridement ability of hydrogel). There were no significant differences among modern dressings in influencing complete healing of pressure ulcers, with 2 exceptions (hydrocolloid dressing was associated with more complete healing than saline gauze, as was hydrogel or hydropolymer when compared with hydrocolloid dressing). There was evidence that polyurethane foam dressing and hydrocellular dressing have better absorbency and less difficult removal than hydrocolloid dressings. Efficacy of tropical growth factors in the treatment of pressure ulcers has not been established, and the use of platelet-derived growth factor has been associated with higher mortality from cancers. Additionally, there were no significant differences in complete healing between specialized beds and mattresses, with 3 exceptions (alternative pressure mattresses with a heel guard were superior to ones without, profiling beds were superior to flat based beds, and air-fluidized beds were associated with more improved ulcers than other low pressure beds or mattresses). Supplementation of standard hospital diet with protein, ascorbic acid (500 mg twice daily), or multinutrient supplements was associated with a significantly greater or faster reduction in the size of pressure ulcers, but did not result in a significant increase in the proportion of health pressure ulcers. There was evidence to suggest that electrotherapy may improve healing of pressure ulcers, but no firm conclusion can be drawn. There was no evidence that other adjunctive physical therapies (electromagnetic therapy, ultrasound therapy, ultrasound therapy in conjunction with ultraviolet C light, LLL therapy, and NPWT) would improve the healing of pressure

ulcers. There was preliminary evidence that suggested multidisciplinary wound care teams may have an impact on the healing of pressure ulcers and length of hospitalization in the acute care setting, but no firm conclusion could be drawn.

OHTAC recommended that a field evaluation be undertaken to determine the effectiveness of a multidisciplinary wound care team for wound healing. It was also recommended that an expert panel review those therapies whose effectiveness is supported by low quality evidence to advise on which therapies would benefit from a field evaluation. Until better evidence is available, OHTAC recommended that all healthcare services should follow best clinical practice for the treatment of pressure ulcers.

Conclusions

This review highlights the important role of health technologies in improving community-based care for chronic disease. Eleven health technologies were identified with a meaningful reduction in health resource utilization. All technologies summarized in this report significantly improved patient-level outcomes and were often associated with decreased mortality and hospital utilization. Additionally, most of the technologies identified were highly cost-effective, with numerous technologies shown to be both more effective and less costly than their comparators.

Potentially of greatest clinical impact are those technologies with direct evidence for the cure or prevention of chronic disease. Technologies such as bariatric surgery for diabetes, ablation for AF, alternative mattresses for pressure wounds, and smoking cessation for COPD are associated with long-term freedom from disease, which would be expected to result in significant reductions in disease-related mortality, hospitalizations and hospital LOS.

Health technologies can provide an effective and cost-effective means to decrease burden of illness and improve patient outcomes, which would in turn reduce resource utilization intensity. As such, health technologies are a viable contributing factor to the management of chronic disease and should be considered as an integral component of community health care.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

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Appendices

Appendix 1: Search Strategies of Individual EBAs

A list of the databases and search dates utilized by the individual analyses that are included in this summary, further details can be accessed in each individual summary. (2)

Table A1: Search Strategies of Individual EBAs

Year; Volume (Number)	Title	Databases Searched	Search Dates
Type 2 Diabetes			
2009;9(22)	Bariatric Surgery for People with Diabetes and Morbid Obesity: An Evidence Based Analysis	OVID MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, EMBASE, CINAHL, the Cochrane Library, INAHTA	January 1996 to December 2004
Coronary Artery Disease			
2010;10(17)	Primary Angioplasty and Thrombolysis for the Treatment of Acute ST-Segment Elevated Myocardial Infarction (STEMI): An Evidence Update	Update of 2004 EBA; OVID MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, EMBASE, Wiley Cochrane, INAHTA	Original Search: 1966 to October 2003 Updated Search: 1996 to 2009
Atrial Fibrillation			
2006;6(7)	Ablation for Atrial Fibrillation: An Evidence-Based Analysis	The Cochrane Library, MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, EMBASE, Medscape and Current Controlled Trials	1966 to March 1, 2006
Chronic Obstructive Pulmonary Disease			
2012;12(3)	Influenza and Pneumococcal Vaccinations for Patients with Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Review	OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, CINAHL, the Cochrane Library, INAHTA	January 1, 2000, to July 5, 2010
2012;12(4)	Smoking Cessation for Patients With Chronic Obstructive Pulmonary Disease: An Evidence-Based Analysis	OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, CINAHL, the Cochrane Library, Centre for Reviews and Dissemination	1950 to June 2010

Year; Volume (Number)	Title	Databases Searched	Search Dates
2012;12(8)	Noninvasive Positive Pressure Ventilation for Acute Respiratory Failure Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, CINAHL, Wiley Cochrane, INAHTA	January 1, 2004 to December 3, 2010
Congestive Heart Failure			
2005;5(14)	Implantable Cardioverter Defibrillators—Prophylactic Use: An Evidence-Based Analysis	Update of 2004 EBA; updated search included: Cochrane Database of Systematic Reviews, ACP Journal Club, DARE, INAHTA, EMBASE, MEDLINE, reference sections from reviews and extracted articles	January 2003 to May 2005
Stroke			
2011;11(6)	Constrained-Induced Movement Therapy for Rehabilitation of Arm Dysfunction After Stroke in Adults: An Evidence-Based Analysis	OVID MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, OVID EMBASE, CINAHL, the Cochrane Library, Centre for Reviews and Dissemination	January 1, 2008, to January 21, 2011
Chronic Wounds			
2009;9(2)	Pressure Ulcer Prevention: An Evidence-Based Analysis	OVID MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, EMBASE, the Cochrane Library, CINAHL	January 1, 2006, to February 14, 2010
2010;10(22)	Negative Pressure Wound Therapy: An Evidence Update	OVID MEDLINE, MEDLINE In Process and Other Non-Indexed Citations, EMBASE, CINAHL, the Cochrane Library, INAHTA	January 1, 2006, to February 14, 2010
Other			
In Progress	PVP vs. TURP for the treatment of benign prostatic hyperplasia	This was a field evaluation; no literature search was conducted	NA

Abbreviations: EBA, evidence-based analysis; INAHTA, International Agency for Health Technology Assessment/Centre for Review and Dissemination; NA, not applicable; PVP, photoselective vaporization of the prostate; TURP, transurethral resection of the prostate.

Appendix 2: Inclusion/Exclusion Criteria and Statistical Analyses of Individual EBAs

Table A2: Inclusion/Exclusion Criteria and Statistical Analyses of Individual EBAs

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
Diabetes				
2009;9(22)	Bariatric Surgery for People with Diabetes and Morbid Obesity: An Evidence-Based Analysis	Data on the effectiveness or cost-effectiveness of bariatric surgery for the improvement of diabetes Systematic reviews, RCTs and observational controlled prospective studies that had > 100 patients Meta-analyses	Duplicate publications (superseded by another publication by the same investigator group, with the same objective and data) Non–English-language articles Non-systematic reviews, letters, and editorials Animal and in vitro studies Case reports, case series Studies that did not examine the outcomes of interest	No statistical analyses were conducted, as outcomes were based on a published meta-analysis of 134 studies and a single observational study
Coronary Artery Disease				
2010;10(17)	Primary Angioplasty and Thrombolysis for the Treatment of Acute ST-Segment Elevated Myocardial Infarction (STEMI): An Evidence Update	Systematic reviews of RCTs, meta-analyses of RCTs and RCTs Trial had to include, for the primary angioplasty arm, primary coronary stenting and option of using glycoprotein IIb/IIIa Thrombolysis group had to have received the accelerated regimen of alteplase in hospital and been offered rescue angioplasty Heparin and Aspirin had to have been offered to all patients and antiplatelet agents administered for at least 1 month after MI	Trials that are not consistent with practice standards in Ontario	No statistical analyses were conducted, as outcomes are summaries by RCT or systematic review

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
Atrial Fibrillation				
2006;6(7)	Ablation for Atrial Fibrillation: An Evidence-Based Analysis	Systematic reviews of RCTS, meta-analyses of RCTs, and RCTs > 20 patients included in the study Studies reported in English Studies with follow-up of at least a mean of 6 months Studies that reported baseline characteristics of patients in treatment groups (such as age, gender, duration of symptoms, left ventricular ejection fraction, etc.) Studies that reported at least 1 of the aforementioned outcomes of interest	Studies that included pacing therapy as a part of the treatment Studies including patients who had previous ablation procedures Studies including children (patients < 18 years) Nonhuman studies Studies in a language other than English Nonrandomized studies, prospective case series, case reports, retrospective studies, editorials, and letters	No statistical analyses were conducted as outcomes are summarized by RCT or systematic review
Chronic Obstructive Pulmonary Disease				
2012;12(3)	Influenza and Pneumococcal Vaccinations for Patients with Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Review	Studies comparing clinical efficacy of influenza vaccine or pneumococcal vaccine with no vaccine or placebo RCTs published between January 1, 2000, and January 31, 2011 Studies included patients with COPD only Studies investigating the efficacy of the types of vaccines approved by Health Canada English language studies	Non-RCTs Studies investigating vaccines for other diseases Studies comparing different variations of vaccines Studies in which patients received 2 or more types of vaccines Studies comparing different routes of administering vaccines Studies not reporting clinical effectiveness of the vaccine or studies reporting immune response only Studies investigating the efficacy of vaccines not approved by Health Canada	Results were pooled using Review Manager 5 Version 5.1. Continuous data were pooled to calculate RRs using the Mantel-Haenszel method and a random-effects model. When data could not be pooled, the results were summarized descriptively.

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
2012;12(4)	Smoking Cessation for Patients With Chronic Obstructive Pulmonary Disease: An Evidence-Based Analysis	English language, full reports from 1950 to week 3 of June 2010 RCTs, systematic reviews and meta-analyses, or non-RCTs with controls A proven diagnosis of COPD Adult patients (≥18 years) A smoking cessation intervention that comprised at least 1 of the treatment arms ≥ 6 months' abstinence as an outcome Patients followed for ≥ 6 months	Case reports Case series	Due to excessive clinical heterogeneity across interventions, studies were first grouped into categories of similar interventions and then statistically pooled as appropriate. When possible, pooled estimates (RR for abstinence with 95% CI) were calculated using a fixed-effects model. Remaining studies were reported separately.
2012;12(8)	Noninvasive Positive Pressure Ventilation for Acute Respiratory Failure Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	English language full reports HTAs, systematic reviews, meta-analyses, and RCTs Studies performed exclusively in patients with a diagnosis of COPD or studies performed with patients with a mix of conditions if results are reported for COPD patients separately Patient population: (Question 1) patients with acute hypercapnic respiratory failure due to an exacerbation of COPD; (Question 2a) COPD patients being weaned from IMV; (Questions 2b and 2c) COPD patients who have been extubated from IMV	< 18 years age Animal studies Duplicate publications Grey literature Studies examining noninvasive negative pressure ventilation Studies comparing modes of ventilation Studies comparing patient-ventilation interfaces Studies examining outcomes not listed below such as physiologic effects including heart rate, arterial blood gases, and blood pressure	When possible, results were pooled using Review Manager 5 Version 5.1; otherwise, the results were summarized descriptively. Dichotomous data were pooled into RRs using random-effects models and continuous data were pooled using weighted mean differences with a random-effects model. Analyses using data from RCTs were done using intention-to-treat protocols. *P* values < 0.05 were considered significant. Post hoc sample size calculations were performed using STATA 10.1. A priori subgroup analyses were planned for severity of respiratory failure, location of treatment (ICU or hospital ward), and mode of ventilation with additional subgroups as needed based on the identified literature. For the severity of respiratory failure subgroups, the mean pH level was used to classify a study as mild (pH ≥ 7.35), moderate (7.30 ≤ pH < 7.35), severe (7.25 ≤ pH < 7.30),

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
				and very severe (pH < 7.25) respiratory failure. For those studies that presented the mean pH for each study group separately, and the mean pH of the 2 arms fall into separate categories, the higher category was used.
Congestive Heart Failure				
2005;5(14)	Implantable Cardioverter Defibrillators—Prophylactic Use: An Evidence-Based Analysis	English-language articles (January 2003–May 2005). Journal articles that report primary data on the effectiveness or cost-effectiveness of prophylactic ICD, treatment obtained in a clinical setting, or analysis of primary data maintained in registries or databases Clearly described study design Systematic reviews, RCTs, non-RCTs, and/or cohort studies that have ≥ 20 patients, and studies on cost-effectiveness	Studies that are duplicate publications (superseded by another publication by the same investigator group, with the same objective and data) Non-English-language articles Nonsystematic reviews, letters, and editorials Animal and in vitro studies Case reports Studies that do not examine the outcomes of interest	No statistical analyses were conducted; outcomes are summarized by RCT or systematic review
Stroke				
2011;11(6)	Constrained-Induced Movement Therapy for Rehabilitation of Arm Dysfunction After Stroke in Adults: An Evidence-Based Analysis	Systematic reviews of RCTs with or without meta-analysis Study participants 18 years of age and older with arm dysfunction after stroke Studies comparing the use of CIMT with occupational therapy and/or physiotherapy rehabilitative care (usual care) to improve arm function Studies which described CIMT as having the following 3 components: i) restraining unimpaired arm and/or wrist with a sling, hand splint or cast; ii) intensive training with functional task practice of the affected arm; and iii) application of shaping methodology during training	Narrative reviews, case series, case reports, controlled clinical trials Letters to the editor Grey literature Non-English-language publications	Where appropriate, a meta-analysis was undertaken to determine the pooled-estimate of effect of CIMT compared with usual care for explicit outcomes using Review Manager 5 version 5.0.25. Mean difference was used as the pooled summary estimate for continuous data where the outcome among pooled studies was measured by the same scale. The degree of statistical heterogeneity among studies was assessed by the I^2-statistic for each outcome. A fixed or random effects model was used. An I^2 > 50% was considered as substantial

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
		No restriction was placed on intensity or duration of treatment otherwise Duration and intensity of therapy equal in treatment and control groups Therapy beginning a minimum of 1 month after stroke Published 2008 to 2011		heterogeneity, for which a subgroup analysis was undertaken
Chronic Wounds				
2009;9(2)	Pressure Ulcer Prevention: An Evidence-Based Analysis	English-language systematic reviews and RCTs that meet the following description: Patients: in any setting, with 1 or more pressure ulcers; Interventions: nondrug and nonsurgical treatments for pressure ulcers, including local wound therapy, adjunctive physical therapies, pressure relieving support surfaces, nutrition therapy, and multidisciplinary wound care teams; Comparison: an intervention versus a placebo, a sham treatment or another intervention; Outcome of interest: proportion of ulcers that healed completely (closed), percent change in surface area/volume, rate of change in surface area, mean time to achieve complete healing, change in the amount of exudate, granulation, PSST score, PUSH score, treatment-related adverse events, and absorbency and ease of removal Clinical controlled trials or other observational studies if RCTS are not available Sample ≥10 ulcers	Studies on acute wounds or chronic wounds other than pressure ulcers Studies with only subjective outcomes Nonsystematic reviews or case reports (except where indicated) Opinion articles or letters to the editor that provided no primary data Studies for which results have already been reported or for which a more current update is available Full text articles in a language other than English Studies on surgical reconstruction of pressure ulcers	The individual study results were not amenable to meta-analysis because of different study designs and outcome measures used

Year; Volume (Number)	Title	Inclusion Criteria	Exclusion Criteria	Statistical Analyses
2010;10(22)	Negative Pressure Wound Therapy: An Evidence Update	RCTs published between 2000 and 2010 Sample size ≥ 30 Inclusion of homogenous type of wounds Commercially marketed NPWT systems Human subjects English language	Non-RCTs Sample size <30 Studies included a variety of wound types Studies used home-made negative pressure systems Studies included patients with abdominal wall loss Studies on open fractures/high-energy trauma Studies on wounds at the donor site of the graft	No statistical analyses were conducted; outcomes were summarized by RCT or systematic review
Other				
In Progress	PVP versus TURP for benign prostatic hyperplasia	This was a field evaluation; no literature review was conducted	—	—

Abbreviations: CI, confidence interval; CIMT, constraint-induced movement therapy; COPD, chronic obstructive pulmonary disease; EBA, evidence-based analysis; HTA, health technology assessment; ICD, implantable cardioverter defibrillator; ICU, intensive care unit; IMV, invasive mechanical ventilation; MI, myocardial infarction; NPPV, noninvasive positive pressure ventilation; NPWT, negative pressure wound therapy; PVP, photoselective vaporization of the prostate; RCT, randomized controlled trial; RR, relative risk; STEMI, ST-segment elevation myocardial infarction; TURP, transurethral resection of the prostate.

Appendix 3: Excluded EBAs

Excluded EBAs conducted between 2006 and 2011 that were related to 1 of the disease areas of interest but did not meet other inclusion criteria.

Table A3: Excluded EBAs

Year; Volume (Number)	Title	Reason for Exclusion
Type 2 Diabetes		
2011;11(4)	Continuous Glucose Monitoring for Patients With Diabetes: An Evidence-Based Analysis *(type 1 diabetes)*	The patient population falls beyond the scope of the summary review
2009;9(13)	Optical Coherence Tomography For Age-Related Macular Degeneration And Diabetic Macular Edema: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2009;9(20)	Continuous Subcutaneous Insulin Infusion (CSII) Pumps For Type 1 And Type 2 Adult Diabetic Populations: An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest
2009;9(21)	Behavioural Interventions for Type 2 Diabetes: An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis
2009;9(23)	Community-Based Care for the Management of Type 2 Diabetes: An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis
2009;9(24)	Home Telemonitoring for Type 2 Diabetes: An Evidence-Based Analysis	The technology falls beyond the scope of the summary review
Coronary Artery Disease		
2010;10(7)	Non-Invasive Cardiac Imaging Technologies for the Diagnosis of Coronary Artery Disease: A Summary of Evidence-Based Analyses	Technologies for screening purposes are beyond the scope of the summary review
2010;10(8)	Single Photon Emission Computed Tomography for the Diagnosis of Coronary Artery Disease: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(9)	Stress Echocardiography for the Diagnosis of Coronary Artery Disease: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(10)	Stress Echocardiography With Contrast for the Diagnosis of Coronary Artery Disease: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(11)	64-Slice Computed Tomographic Angiography for the Diagnosis of Intermediate Risk Coronary Artery Disease: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(12)	Cardiac Magnetic Resonance Imaging for the Diagnosis of Coronary Artery Disease: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(13)	Use of Contrast Agents With Echocardiography in Patients With Suboptimal Echocardiography: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review

Year; Volume (Number)	Title	Reason for Exclusion
2006;6(12)	Intravascular Ultrasound to Guide Percutaneous Coronary Inteventions: An Evidence-Based Analysis	Technology not related to outcomes associated with larger mega-analysis
Atrial Fibrillation		
2006;6(8)	Advanced Electrophysiologic Mapping Systems: An Evidence-Based Analysis	Technology not related to outcomes associated with larger mega-analysis
Chronic Obstructive Pulmonary Disease		
2012;12(5)	Community-Based Multidisciplinary Care for Patients With Stable Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis
2012;12(6)	Pulmonary Rehabilitation for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis
2012;12(7)	Long-Term Oxygen Therapy for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest
2012;12(9)	Noninvasive Positive Pressure Ventilation for Chronic Respiratory Failure Patients With Stable Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest
2012;12(10)	Hospital-at-Home Programs for Patients With Acute Exacerbations of Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest
2012;12(11)	Home Telehealth for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis	The technology falls beyond the scope of the summary review
Congestive Heart Failure		
2010;10(15)	Magnetic Resonance Imaging (MRI) for the Assessment of Myocardial Viability: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2010;10(16)	Positron Emission Tomography for the Assessment of Myocardial Viability: An Evidence-Based Analysis	Technologies for screening purposes are beyond the scope of the summary review
2006;6(5)	Enhanced External Counterpulsation (EECP): An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest
Stroke		
No technologies related to stroke were excluded		
Chronic Wounds		
2009;9(3)	Management of Chronic Pressure Ulcers: An Evidence-Based Analysis	No statistical and/or clinically significant results supporting the technology were found for the population of interest

Year; Volume (Number)	Title	Reason for Exclusion
Other		
2009;9(12)	Point-of-Care International Normalized Ratio (INR) Monitoring Devices for Patients on Long-Term Oral Anticoagulation Therapy: An Evidence-Based Analysis	The technology falls beyond the scope of the summary review
2009;9(17)	Community-Based Care for the Specialized Management of Heart Failure: An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis
2009;9(17)	Community-Based Care for Chronic Wound Management: An Evidence-Based Analysis	The EBA falls under the scope of 1 of the major drivers of the larger mega-analysis

Abbreviations: EBA, evidence-based analysis.

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Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation

PATH-THETA Collaboration

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Conflict of Interest Statement

All reports in the *Ontario Health Technology Assessment Series* are impartial. There are no competing interests or conflicts of interest to declare.

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All reports in the *Ontario Health Technology Assessment Series* are subject to external expert peer review. Additionally, Health Quality Ontario posts draft reports and recommendations on its website for public comment prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

About Health Quality Ontario

Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publishresearch that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications:http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

As Ontario's population ages, chronic diseases are becoming increasingly common. There is growing interest in services and care models designed to optimize the management of chronic disease.

Objective

To evaluate the cost-effectiveness and expected budget impact of interventions in chronic disease cohorts evaluated as part of the Optimizing Chronic Disease Management mega-analysis.

Data Sources

Sector-specific costs, disease incidence, and mortality were calculated for each condition using administrative databases from the Institute for Clinical Evaluative Sciences. Intervention outcomes were based on literature identified in the evidence-based analyses. Quality-of-life and disease prevalence data were obtained from the literature.

Methods

Analyses were restricted to interventions that showed significant benefit for resource use or mortality from the evidence-based analyses. An Ontario cohort of patients with each chronic disease was constructed and followed over 5 years (2006–2011). A phase-based approach was used to estimate costs across all sectors of the health care system. Utility values identified in the literature and effect estimates for resource use and mortality obtained from the evidence-based analyses were applied to calculate incremental costs and quality-adjusted life-years (QALYs). Given uncertainty about how many patients would benefit from each intervention, a system-wide budget impact was not determined. Instead, the difference in lifetime cost between an individual-administered intervention and no intervention was presented.

Results

Of 70 potential cost-effectiveness analyses, 8 met our inclusion criteria. All were found to result in QALY gains and cost savings compared with usual care. The models were robust to the majority of sensitivity analyses undertaken, but due to structural limitations and time constraints, few sensitivity analyses were conducted. Incremental cost savings per patient who received intervention ranged between $15 per diabetic patient with specialized nursing to $10,665 per patient wth congestive heart failure receiving in-home care.

Limitations

Evidence used to inform estimates of effect was often limited to a single trial with limited generalizability across populations, interventions, and health care systems. Because of the low clinical fidelity of health administrative data sets, intermediate clinical outcomes could not be included. Cohort costs included an average of all health care costs and were not restricted to costs associated with the disease. Intervention costs were based on resource use specified in clinical trials.

Conclusions

Applying estimates of effect from the evidence-based analyses to real-world resource use resulted in cost savings for all interventions. On the basis of quality-of-life data identified in the literature, all interventions were found to result in a greater QALY gain than usual care would. Implementation of all interventions could offer significant cost reductions. However, this analysis was subject to important limitations.

Plain Language Summary

Chronic diseases are the leading cause of death and disability in Ontario. They account for a third of direct health care costs across the province. This study aims to evaluate the cost-effectiveness of health care interventions that might improve the management of chronic diseases. The evaluated interventions led to lower costs and better quality of life than usual care. Offering these options could reduce costs per patient. However, the studies used in this analysis were of medium to very low quality, and the methods had many limitations.

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List of Abbreviations

BP	Blood pressure
CAD	Coronary artery disease
CCAC	Community Care Access Centre
CHEPA	Centre for Health Economics and Policy Analysis
CHF	Congestive heart failure
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COC	Continuity of care
COCI	Continuity of Care Index
COPD	Chronic obstructive pulmonary disease
CPWC	Cost per weighted case
DAD	Discharge Abstract Database
EBA	Evidence-based analysis
ED	Emergency department
EDS	Evidence Development and Standards
EQ-5D	European Quality of Life 5 Domain
eTool	Electronic tool
FY	Fiscal year
GH	General health
GP	General practitioner
HEED	Health Economic Evaluation Data Base
HQO	Health Quality Ontario
ICD-9	International Classification of Diseases, 9th edition
ICER	Incremental cost-effectiveness ratio
ICES	Institute for Clinical Evaluative Sciences
MH	Mental health
NA	Not applicable
NACRS	National Ambulatory Care Reporting System
NR	Not reported
OHIP	Ontario Health Insurance Plan
OHTAC	Ontario Health Technology Advisory Committee
OSB	Ontario Schedule of Benefits for Physician Services
PATH	Programs for Assessment of Technology in Health
PF	Physical functioning
QALY	Quality-adjusted life-year
RD	Relative difference

RE	Role—emotional
RIW	Resource intensity weight
RP	Role—physical
RR	Relative risk
RUG	Resource utilization group
SF	Social functioning
SE	Standard error
SF-36	Short Form (36) Health Survey
THETA	Toronto Health Economics and Technology Assessment
UK PDS	United Kingdom Prospective Diabetes Study
VDIS	Vermont Diabetes Information System
VT	Vitality
WTP	Willingness to pay

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

The objective of this study was to evaluate the cost-effectiveness and expected budget impact of interventions in the chronic disease cohorts evaluated as part of the Optimizing Chronic Disease Management mega-analysis. This objective was initially addressed by conducting a systematic review of the published literature. Where the literature failed to address the objective, original cost-effectiveness analyses were conducted from the perspective of the Ontario Ministry of Health and Long-Term Care.

Clinical Need and Target Population

The rising prevalence of chronic disease is of global concern. Longer life expectancy, public health initiatives, social development, demographic changes, and shifts in working environment have meant that noncommunicable diseases are expected to contribute to 57% of the global burden of disease by 2020. (1)

In 2005, 29% of Ontarians over age 25 reported having 1 or more chronic diseases; the proportion increased to 62% among those aged 65 and older. (2) Chronic disease is the leading cause of death and disability in Canada, (3) imposes a substantial financial burden on the health care system, (4) and can severely affect individuals' quality of life.

The Ministry of Health and Long-Term Care has called for the integration of health system organizations, health care providers, community partners, and family supports to improve patient outcomes in chronic disease and ease the burden on the health care system. As noted by Iron et al, (5) this initiative is consistent with a World Health Organization report suggesting the need for a paradigm shift so that "decision makers can take actions that will reduce the threats chronic conditions pose to the health of their citizens, their health care systems, and their economies." (1)

The Ontario Health Technology Advisory Committee has proposed that hospitalization rates for chronic diseases be used as a surrogate marker of the quality of outpatient and community-based care. Assuming that appropriate care can lower costs and improve outcomes by reducing hospitalizations, the aim of this study was to evaluate the cost-effectiveness and budget impact of several interventions (discharge planning, in-home care, continuity of care, advanced [open] access scheduling, screening and management of depression, self-management support interventions, specialized nursing practice, electronic tools [eTools] for health information exchange, and health technologies) in the chronic disease populations included in the Optimizing Chronic Disease Management evidence-based analyses (EBAs) (diabetes, coronary artery disease [CAD], congestive heart failure [CHF], chronic obstructive pulmonary disease [COPD], stroke, atrial fibrillation, and chronic wounds).

Interventions Under Evaluation

Only interventions that led to statistically significant improvements in mortality or in health care use were evaluated in the economic analysis. These are defined below.

Discharge Planning

People with chronic diseases experience frequent changes in health status, accompanied by multiple transitions between care settings and care providers. During these transitions, mistakes frequently occur (e.g., information about medication that a patient was prescribed while in hospital might not be accurately communicated to the family physician). Transitions can also give rise to adverse clinical events and have been associated with increased rates of potentially avoidable hospitalizations. For the purpose of this analysis, *discharge planning* was defined as a care process or bundle of service designed to ensure

transition from inpatient to community (outpatient) care. This can include support services, follow-up activities, monitoring, or other interventions that span prehospital discharge and posthospital care. The discharge planning EBA aimed to determine whether discharge planning bundles are effective at reducing health resource use and improving patient outcomes compared with usual care alone.

In-Home Care

Much of the current focus on in-home care in Canada assumes that health costs can be lowered when care is provided in the community or in the home rather than in health care institutions. *In-home care* was defined as ongoing in-home assessment, case management, and coordination of a range of services provided in the home or in the community that are curative, preventive, or supportive in nature (including personal care, meal preparation, and homemaking) and that aim to enable patients to live at home, thus preventing or delaying the need for long-term care or acute care. Palliative care and rehabilitation were not included in this definition. The objective of the in-home care EBA was to determine the effectiveness of in-home care in optimizing chronic disease management in the community.

Continuity of Care

There are 3 defined areas of continuity of care: informational, management, and relational or interpersonal. The continuity of care EBA addressed management and relational continuity, but not informational continuity:

- *Management continuity* involves the use of standards and protocols to ensure that care is provided in an orderly, coherent, complementary, and timely way. Often this applies when care is being provided by multiple providers. This also includes accessibility (availability of appointments, medical tests), flexibility to adapt to care needs, and consistency of care and transitions of care (e.g., the coordination of home care by a family physician).
- *Relational continuity* (interpersonal) refers to the ongoing relationship between the care provider and the patient. It refers to the duration of the relationship as well as to the quality of the relationship, which is affected by the attentiveness, inspiration of confidence, and medical knowledge of the health professional.

Several indices have been developed to assess the 4 primary components of continuity of care: (6)

- duration—length of time with a particular provider,
- density—number of visits with the same provider over a defined period,
- dispersion—number of visits with distinct providers,
- sequence—order in which different providers are seen.

The Continuity of Care Index (COCI) is the most common index; it measures the number of providers seen and the number of visits with each primary care provider. The objective of the continuity of care EBA was to determine whether continuity of care was associated with health resource use and patient outcomes.

Specialized Nursing Practice

With increased demand for better chronic disease management and health care efficiency, there has been an expansion of nursing roles in primary health care in Ontario. The term *specialized nursing practice* was used to define nurses with enhanced training, experience, or scope of clinical practice or nurses with a primary clinical role in the care of patients with chronic disease. This can include registered nurses with specific knowledge and skills for chronic disease management or those providing disease-specific nurse-led interventions and nurse practitioners with advanced formal training for the care of patients in primary

health care. Specialized nurses can either substitute or supplement aspects of care provided by physicians in primary health care. For the purpose of this analysis, the former (specialized nurses providing the same services as physicians) was referred to as *Model 1*; the latter (specialized nurses providing services that extend or complement care provided by physicians) was referred to as *Model 2*. The specialized nursing practice EBA aimed to determine how effectively specialized nurses who have a clinical role in patient care optimize chronic disease management among adults in primary health care.

Electronic Tools for Health Information Exchange

Patients with chronic diseases experience many transitions in care (e.g., between primary care, specialists, and hospitalists), putting them at increased risk for adverse events as a result of errors in the transmission of information. Given the potential risks associated with poor care coordination, many institutions and health care systems are exploring methods of improving communication. Although there is currently a push toward electronic medical records and other electronic tools (eTools) to facilitate health information exchange, uncertainty remains about the effect of eTools as a form of communication. *eTools* were defined as tools and systems for electronic health information exchange that facilitate provider-provider communication about outpatients in the community setting (including but not limited to referrals, prescribing, computerized physician order entries, and intra-team communication). Excluded were patient health records and self-monitoring devices; database risk-assessment tools; eTools to facilitate communication between patient and provider; and eTools to facilitate improved management or care of patients within a single practice (e.g., decision support and data-management systems). The eTools EBA aimed to examine the effect of eTools on health information exchange in the context of care coordination for patients with chronic disease in the community.

Economic Literature Review

Economic Literature Review Methods

Literature Search

Search Strategy

To identify economic evaluations that included any of the interventions of interest, literature searches were performed between January 17, 2012, and August 15, 2012, using Ovid MEDLINE and EMBASE, Wiley's Cochrane Library and Health Economic Evaluation Database (HEED), the National Library of Medicine's PubMed (for non-MEDLINE records), and the Centre for Reviews and Dissemination database, for studies published from January 1, 2002, until the date each search was run. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- studies evaluating interventions that met the definitions applied in the EBAs;
- studies conducted in 1 of the 7 chronic disease cohorts explored in the EBAs (diabetes, CAD, CHF, COPD, stroke, atrial fibrillation, and chronic wounds);
- cost-utility analyses (studies comparing the costs and health consequences of alternative courses of action and reporting outcomes in terms of quality-adjusted life-years [QALYs]) were prioritized for inclusion; where cost-utility analyses were not available, cost-effectiveness, cost-benefit, and cost-consequence analyses were considered; costing studies were also considered.

Exclusion Criteria

- abstracts, posters, reviews, letters/editorials, non–English-language publications, and unpublished studies.

Economic Literature Review Results

Results of the economic literature review are summarized briefly below. Study characteristics are provided in Table 1.

Table 1: Studies Identified in the Economic Literature Review

Study	Population	Perspective	Cost per QALY
Discharge Planning			
Gohler et al, 2008 (7)	CHF	Germany, society	Discharge management programs cost €8,900 per QALY gained
In-Home Care			
No relevant economic studies were identified			
Continuity of Care			
Chen and Cheng, 2011 (8)	Diabetes	Korea, health care system	QALYs not reported; patients with a high level of continuity of care incurred lower annual expenses than those with medium and low levels of continuity of care
Specialized Nursing Practice (Model 1)[a]			
Arts et al, 2012 (9)	Diabetes	Netherlands, health care system	Specialized nursing cost €431 more and resulted in a loss of 0.02 QALYs compared with care by a physician alone (i.e., specialized nursing was dominated by usual care)
Specialized Nursing Practice (Model 2)[a]			
Raferty et al, 2005 (10)	CAD	United Kingdom, health care system	Specialized nursing cost £97 less and resulted in a gain of 0.124 QALYs compared with care by a physician alone, with an ICER of £782 per QALY gained (2003/2004 GBP)
Turner et al, 2008 (11)	CAD	United Kingdom, health care system, society	Specialized nursing cost £14,900 per QALY gained
eTools for Health Information Exchange			
Blanchfield et al, 2006 (12)	Diabetes	United States, health care system	Cost analysis; 1-time cost of $200 (US) per patient and ongoing cost of $90 (US) per patient

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; eTool, electronic tool; GBP, British pounds; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.

[a]Model 1 is specialized nursing practice alone; Model 2 is specialized nursing practice teamed with a physician.

Discharge Planning

A study by Gohler et al (7) evaluating a decision model populated with effectiveness data from a meta-analysis of 36 randomized controlled trials, cost data from the BEST trial, and utilities from the EPHESUS trial was included. The study found that "managed care programs" resulted in an increase in both costs and QALYs (2007 Euros) per QALY gained. The model was sensitive to age and sex; programs were more likely to be cost-effective when patients were younger and female.

In-Home Care

No relevant economic studies were identified.

Continuity of Care

A costing study by Chen and Cheng (8) met the inclusion criteria. The authors of this study developed a regression model to evaluate the cost associated with each COCI score in people with diabetes. The authors found that patients with high or medium COCI scores were less likely to be hospitalized or visit the emergency department (ED) for diabetes-related issues than those with a low COCI. However, a serious limitation of this analysis was that it was conducted in Taiwan, where patients do not have a primary health care provider; resource use might not be comparable to that in Ontario.

Specialized Nursing Practice

One cost-utility analysis by Arts et al (9) met the inclusion criteria for Model 1, and 2 cost-utility analyses by Raferty et al and by Turner et al (10;11) met the criteria for Model 2.

On the basis of results from a randomized controlled trial conducted in the Netherlands, Arts et al (9) found that, although nursing care itself was less costly, the intervention group incurred higher overall costs than the control group and had a lower quality of life at 2-year follow-up. As a result, specialized nursing was found to be both more expensive and less effective than usual care. However, this study did not control for baseline differences in health status (e.g., prevalence of diabetes-related complications and quality of life), which could account for much of the difference observed between groups.

Raferty et al (10) (evaluating a 1998 randomized controlled trial by Campbell and colleagues [13]) found that the cost of a nurse-led clinic was greater than that of general practitioners' (GPs') care. However, when primary care and hospital costs were combined, the nurse-led intervention was slightly less expensive than usual care, largely because of a decrease in hospitalizations in the nursing care group. Given that the nurse-led intervention also resulted in better quality of life, it was the dominant strategy. Turner et al (11) also found that the nurse-led intervention improved quality of life, but at a greater cost. The resulting incremental cost-effectiveness ratio (ICER) was cost-effective in 90% of simulations, at a threshold of £30,000 per QALY gained. Both analyses were conducted from the perspective of the United Kingdom's health system.

Electronic Tools for Health Information Exchange

One costing study that reported on an eTool similar to the intervention definition met the inclusion criteria. The eTool was a web-based program used to manage patients with type 2 diabetes in primary care. (12) The software (POPMAN) served as an electronic platform for organizing and continuously updating clinical information for a registry of 1,250 patients with type 2 diabetes, and the costs incurred to develop and implement the program were reported. The annual cost per patient to run POPMAN included both clinical and information technology support costs.

Economic Analysis

Economic Analysis Methods

Framework

The first step was to develop a framework to determine whether a model would add value to the evidence summarized in each EBA. When an intervention is less effective and more costly than an alternative, it is clearly not an efficient use of resources. In other cases—such as when an intervention produces greater benefit at a higher cost—further assessment is needed to determine whether the benefits are worth the cost.

In this analysis, only interventions that led to statistically significant improvements in mortality or health care use were evaluated (this does not mean that only statistically significant *outcomes* were included; as in the EBAs, the entire body of evidence must be represented in the cost-effectiveness analysis to avoid introducing bias). On the basis of these inclusion criteria, 5 interventions (discharge planning, in-home care, continuity of care, specialized nursing practice, and eTools for health information exchange) were assessed in 4 chronic disease populations (diabetes, CAD, CHF, and COPD). Atrial fibrillation, stroke, and chronic wounds were excluded, because the EBAs did not find interventions with a significant effect on health resource use or mortality in these populations.

Perspective

The analysis was conducted from the perspective of the Ontario Ministry of Health and Long-Term Care.

Discounting and Time Horizon

An annual discount rate of 5% was applied to both costs and QALYs. A 5-year time horizon was used in all analyses.

Populations

Chronic disease cohorts were constructed using administrative data. The diabetes, CHF, and COPD cohorts were identified using predefined Institute for Clinical Evaluative Sciences (ICES) algorithms (Appendix 2). The CAD cohort was identified using a validation study of International Classification of Diseases, 10th edition, coding algorithms in an acute myocardial infarction population (Appendix 2). (14)

- diabetes cohort: adults with 2 Ontario Health Insurance Plan (OHIP) Dx code 250 claims; 1 OHIP Fee code of a Q040, K029, or K030 claim; or 1 Discharge Abstract Database (DAD) admission within 2 years;
- CAD cohort: adults with a DAD admission Dx10 code of I09.9, I11.0, I13.0, I25.5, I42.0, I42.5–I42.9, I43.x, or I50.x;
- CHF cohort: adults with 1 hospital admission with a CHF diagnosis or an OHIP claim/National Ambulatory Care Reporting System (NACRS) ED record with a CHF diagnosis, followed within 2 years by either a second OHIP claim/NACRS record or a hospital admission with a CHF diagnosis;
- COPD cohort: adults with a COPD diagnosis in OHIP or DAD, or same-day surgery.

Patients were followed from their date of first hospitalization or physician visit (index event) after a diagnosis of 1 of the 4 chronic diseases between 2006 and 2011. The index event was hospitalization for the CAD, CHF, and COPD cohorts and a physician visit for the diabetes cohort. The observation window terminated at death or March 3, 2011—whichever occurred first. The index event was defined as all

people in the Registered Persons Database alive as of April 1, 2006, aged 19 or older (or ICES disease cohort algorithm specific age cutoff), with a new (incident) case of diabetes, CAD, CHF, or COPD between April 1, 2006, and March 31, 2011. (The Registered Persons Database houses information on all Ontarians alive at any time since 1990 who have ever received an Ontario health card number. [15])

Cohort Costs

For every individual in each cohort, resource use and mean 90-day total costs by sector were estimated. These included ED visits, acute inpatient and same-day surgery costs, other hospital costs (rehabilitation, complex continuing care), long-term care, home care, physician visits (general physician and specialist), laboratory costs, and drug costs. Costs were inflated to 2012 prices using the consumer price index for health care. All costs in the analysis are presented in 2012 Canadian dollars.

Ontario databases were used to identify data for the cohorts investigated. The number of inpatient hospitalizations was obtained from the DAD (2006–2010), and hospitalization costs were estimated using resource intensity weights (RIWs). The RIW associated with the case-mix group for each hospitalization was multiplied by the average provincial cost per weighted case (CPWC) for all Ontario hospitals. Using this method, a mean cost per hospitalization was obtained for cases assigned to a particular case mix group. (15)

A similar RIW method was applied to ED visits and inpatient rehabilitation. The number of visits was obtained from NACRS (2006–2010), and the RIW was again multiplied by the provincial CPWC. The length of stay in inpatient rehabilitation was obtained from the National Rehabilitation Reporting System (2006–2010), and a rehabilitation cost weight was calculated and multiplied by the provincial average CPWC. (15)

Hospitalizations in complex continuing care were obtained from the Continuing Care Reporting System (2006–2010). To determine cost, patients were classified into 44 resource utilization groups (RUG-IIIs) based on their treatment, clinical condition, and physical and cognitive functioning. Each RUG-III is associated with a case-mix index that provides an estimate of the costs for a patient in that group.

Home care visit costs were obtained from the Home Care Database (2006–2010). The number of home care visits was multiplied by the provincial average to obtain a cost. For some services, such as nursing and homemaking, the number of hours of service was multiplied by the provincial average cost per hour.

Drug costs were obtained from the Ontario Drug Beneficiary database (2006–2010), and physician costs were obtained from the OHIP claims database (2006–2010).

Survival

The ICES was asked to calculate Kaplan-Meier survival curves for each chronic disease cohort using information in the Registered Persons Database. Survival for each cohort over the 5-year observation window is reported in Table 2.

Table 2: 5-Year Survival in People With Diabetes, CAD, CHF, and COPD in Ontario

Disease	1 Year	2 Years	3 Years	4 Years	5 Years
Diabetes, %	97	95	94	92	90
COPD, %	92	89	86	83	80
CHF, %	76	68	61	55	49
CAD, %	65	55	47	41	35

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.
Source: Data provided by ICES, December 17, 2012.

The original intent was to extrapolate survival over the lifetime of each cohort by applying a Weibull distribution; this would have allowed lifetime costs per patient to be estimated. However, because survival at 5 years was approximately 50% or greater in 3 of the 4 populations, it was decided not to make assumptions about the shape of these functions, and the analysis was confined to a 5-year observation period.

Quality of Life

In cost-utility analyses, measures of health benefit are valued in terms of QALYs. The QALY is a measure of a person's length of life weighted by a valuation of quality of life over that period. The weighting comprises 2 elements: the description of changes in quality of life and an overall valuation of that description.

Utility values derived from generic preference-based utility measures such as the European Quality of Life 5 Domain (EQ-5D) were obtained from the EBAs. Studies using the Short Form (36) Health Survey (SF-36) were also included[1]; although this instrument does not contain preference weights, algorithms can be used to map generic descriptions of quality of life to preference-based utility indexes. All quality-of-life data and mapped EQ-5D data from studies in the EBAs are reported in Appendix 3.

In 2008, Ara and Brazier (16) published a method of predicting the mean EQ-5D preference-based utility index score using published mean cohort statistics from the 8 dimensions of the SF-36 health profile. To use these equations, values for all 8 dimensions of the questionnaire are required. Four studies of specialized nursing practice (9;17-19) included in the EBAs published mean scores for all 8 dimensions of the SF-36.

Studies from the economic literature search were also reviewed for applicable quality-of-life data. One study of patients with chronic disease and different levels of continuity of care (20) was identified in this way.

For the 3 remaining interventions (discharge planning, in-home care, and eTools), the Tufts Cost Effectiveness Analysis Registry was searched for published utility weights for people with diabetes and CHF. The objective of this search was to identify a "baseline" and a hospital-associated utility value for each population. Studies were evaluated for inclusion on the basis of their similarity to the populations in the studies included in the EBAs.

[1]Studies using disease-specific instruments were excluded. Although these questionnaires can be more responsive to changes associated with a certain condition, they cannot be used to compare quality of life across different illnesses. Although mapping techniques could theoretically be extended to disease-specific instruments, the use of mapping functions beyond the Short Form questionnaires is currently limited.

Sources and assumptions used to calculate utility values for each intervention and disease cohort are described below.

Discharge Planning and In-Home Care: Congestive Heart Failure

Significant outcomes for people undergoing discharge planning and in-home care interventions were observed only in the CHF population. By definition, all patients for these interventions were initially hospitalized. Gohler et al (7) reported mean EQ-5D utility scores collected as part of the EPHESUS trial; EQ-5D data were collected from a subsample of 1,628 patients at baseline and 3, 6, 12, and 18 months. Using these data, the utility at index hospitalization and the effect of rehospitalization on health-related quality of life were calculated (Table 3).

Table 3: Health-Related Utility Values, Discharge Planning, and In-Home Care

Hospitalization Status	EQ-5D Value
Index hospitalization	0.840
First rehospitalization	0.816
Second rehospitalization	0.799
Third or more rehospitalization	0.755

Abbreviation: EQ-5D, European Quality of Life 5 Domain.
Source: Gohler et al, 2008. (7)

In the absence of data regarding number of rehospitalization episodes, only the decrement between the index hospitalization and first rehospitalization was applied. Reductions in rehospitalization were applied by multiplying the observed risk ratio associated with the intervention to the proportion of people experiencing rehospitalization.

Continuity of Care: Diabetes and COPD

None of the studies in the continuity of care EBA included utility values, but 1 study identified in the economic literature review (20) included the SF-36 as a measure of health-related quality of life. This study calculated continuity of care based on the number of family physicians visited by each patient; a minimum of 2 regular encounters with a family physician during the 2-year study was used as a threshold for inclusion in the analysis. The population had a mean age of 69 years, and 56% had more than 1 chronic disease; the incidence of specific diseases was not reported. Results were reported in 2 groups: 1 with observed continuity (1 family physician) and 1 without continuity (more than 1 family physician). The utility observed in each group was applied to the relevant groups from the economic review; increasing the proportion of the population with high continuity was assumed to increase the baseline utility of this group (Table 4).

Table 4: Health-Related Utility Values, Continuity of Care

Population	Study	Measure	Domain[a]	Quality of Life	
Adults > 45 years old	De Maeseneer et al, 2003 (20)	SF-36		1 Family Physician N = 2,285 Mean (SE)	>1 Family Physician N = 1,849 Mean (SE)
			PF	65 (30)	60 (33)
			RP	67 (42)	62 (43)
			BP	68 (28)	62 (30)
			GH	58 (20)	54 (23)
			VT	58 (23)	53 (24)
			SF	80 (26)	75 (28)
			RE	79 (37)	74 (40)
			MH	69 (21)	64 (22)
		Mapped EQ-5D		0.73	0.68

Abbreviations: EQ-5D, European Quality of Life 5 Domain; SE, standard error; SF-36, Short Form (36) Health Survey.

[a]Domains are as follows: physical functioning (PF), role—physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role—emotional (RE), and mental health (MH).

Specialized Nursing Practice: Diabetes and Coronary Artery Disease

Model 1: Diabetes

One study (19) included in the EBA on specialized nursing practice reported full SF-36 results at baseline and 6-month follow-up for people with chronic disease treated by either a nurse or a GP (Table 5). Because no other estimates of quality of life were identified for diabetes-specific cohorts, these values were used to provide estimates of quality of life at baseline and at 6 months after introduction of specialized nursing.

One additional study (9) identified in the economic literature review elicited EQ-5D values from people with diabetes at baseline and 2 years (Table 5). The effect of using these values on the results of the economic model was explored in a sensitivity analysis.

Table 5: Health-Related Utility Values, Specialized Nursing Practice Model 1

Population	Study	Measure	Domain[a]	Quality of Life			
Chronic disease	Mundinger et al, 2000 (19)	SF-36		Control Physician Group N = 806		Intervention Nurse Practitioner Group N = 510	
				Mean		Mean	
				Baseline	6 Months	Baseline	6 Months
			PF	59.2	63.8	61.4	64.9
			RP	34.5	53.4	38.0	53.7
			BP	43.2	52.7	44.0	53.7
			GH	43.4	49.0	43.7	48.8
			VT	46.7	53.4	47.8	53.9
			SF	57.8	70.7	59.3	70.4
			RE	42.3	56.3	46.9	56.7
			MH	53.7	59.6	54.6	60.8
		Mapped EQ-5D		0.57	0.64	0.57	0.66
Diabetes	Arts et al, 2011 (9)	EQ-5D		Control General Practitioner N = 145		Intervention Specialized Nurse N = 149	
				Mean (SE)		Mean (SE)	
				Baseline	2 Years	Baseline	2 Years
				0.82 (0.22)	0.82 (NR)	0.86 (0.22)	0.80 (NR)

Abbreviations: EQ-5D, European Quality of Life 5 Domain; NR, not reported; SE, standard error; SF-36, Short Form (36) Health Survey.
[a]Domains are as follows: physical functioning (PF), role—physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role—emotional (RE), and mental health (MH).

Model 2: Diabetes

One study (17) included in the EBA on specialized nursing practice reported full SF-36 results at baseline and 14-month follow-up for patients with diabetes (Table 6). In the model, values were applied at baseline and 14 months for each arm (control and intervention), assuming a constant rate of change between time points (i.e., in the control group, the mapped EQ-5D value at 7 months was [0.78 + 0.75]/2 = 0.765).

Table 6: Health-Related Utility Values, Specialized Nursing Practice Model 2, Diabetes

Population	Study	Measure	Domain[a]	Quality of Life			
Diabetes	Houweling et al, 2011 (17)	SF-36		Control General Practitioner N = 93 Mean (SE)		Intervention Practice Nurse N = 85 Mean (SE)	
				Baseline	14 Months	Baseline	14 Months
			PF	69.0 (23.5)	65.2 (27.9)	71.8 (25.8)	64.9 (28.9)
			RP	64.0 (43.8)	64.7 (42.0)	69.3 (40.0)	56.8 (43.3)
			BP	74.5 (24.2)	72.1 (22.9)	72.9 (26.4)	71.6 (25.3)
			GH	62.7 (16.4)	63.5 (16.6)	61.7 (19.7)	60.2 (18.5)
			VT	67.9 (18.8)	64.8 (20.9)	67.6 (19.9)	62.8 (21.8)
			SF	80.1 (22.6)	77.6 (21.2)	81.6 (24.0)	81.8 (20.5)
			RE	77.7 (37.4)	73.3 (39.9)	78.9 (35.9)	72.1 (41.6)
			MH	77.6 (16.9)	75.6 (18.7)	79.3 (16.6)	77.7 (17.6)
		Mapped EQ-5D		0.78	0.75	0.79	0.76

Abbreviations: EQ-5D, European Quality of Life 5 Domain; SE, standard error; SF-36, Short Form (36) Health Survey.

[a]Domains are as follows: physical functioning (PF), role—physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role—emotional (RE), and mental health (MH).

Model 2: Coronary Artery Disease

One study (18) included in the specialized nursing practice EBA reported full SF-36 results at baseline and 1-year follow-up for patients with CAD (Table 7). In the model, values were applied at baseline and 1 year for each arm (control and intervention), assuming a constant rate of change between time points (i.e., in the control group, the mapped EQ-5D value at 6 months was [0.60 + 0.61]/2 = 0.605).

Table 7: Health-Related Utility Values, Specialized Nursing Practice Model 2, Coronary Artery Disease

Population	Study	Measure	Domain[a]	Quality of Life			
CAD	Khunti et al, 2007 (18)	SF-36		Control Group Mean (SE)		Intervention Group Mean (SE)	
				Baseline	1 Year[b]	Baseline	1 Year[b]
			PF	47.69 (30.04)	50.79	51.04 (29.09)	45.46
			RP	40.98 (44.90)	40.16	39.01 (42.89)	36.13
			BP	55.78 (29.25)	58.60	59.66 (28.44)	55.59
			GH	45.34 (24.09)	49.22	49.14 (23.76)	46.66
			VT	44.18 (23.50)	48.54	46.91 (21.99)	43.01
			SF	66.11 (30.89)	70.27	68.42 (29.91)	62.51
			RE	54.13 (45.47)	56.75	54.70 (44.51)	51.11
			MH	67.65 (20.77)	71.63	70.82 (20.48)	67.14
		Mapped EQ-5D		0.61	0.60	0.65	0.65

Abbreviations: CAD, coronary artery disease; EQ-5D, European Quality of Life 5 Domain; SE, standard error; SF-36, Short Form (36) Health Survey.
[a]Domains are as follows: physical functioning (PF), role—physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role—emotional (RE), and mental health (MH).
[b]SE not reported for 1-year follow-up.

Electronic Tools for Health Information Exchange: Diabetes

Baseline utility weights for people with diabetes were obtained from the Ontario Diabetes Economic Model, which used EQ-5D values elicited from 3,192 patients in the United Kingdom Prospective Diabetes Study (UKPDS). (21) The UKPDS population had a mean age of 62.3 years, similar to the diabetes population in the studies included in the eTools EBA, but the ratio of males to females was not reported. (21) The mean EQ-5D value reported in the UKPDS (0.77 [standard deviation = 0.27]) was applied to the proportion of people alive at each phase of the economic model.

Utility estimates for quality of life experienced by people hospitalized for diabetes were not identified. Severe hypoglycemia is an event during which the patient requires the assistance of others, and is a common cause of hospitalization in the diabetes population. A study by Davis et al (22) evaluated the effect of severe hypoglycemia on quality of life in United Kingdom patients with type 1 and 2 diabetes. The authors reported that during the most severe episode of hypoglycemia, patients reported a utility of 0.54 as measured by the EQ-5D. Those with only nocturnal episodes of hypoglycemia reported an average utility of 0.77. These categories were associated with the highest and lowest levels of resource use as reported by the UKPDS, and it was assumed that the nocturnal hypoglycemia utility was equivalent to a baseline utility in otherwise healthy individuals (Table 8).

In the absence of evidence to the contrary, it was assumed that the mean baseline utility remained constant over time, with the exception of decrements experienced by patients undergoing hospitalization. Therefore, a baseline utility of 0.77 was applied over the entirety of the model to patients who did not undergo hospitalization. For the proportion of patients who were hospitalized, a utility of 0.54 was applied over the average length of stay. The same method was applied to patients in the intervention group, except that the relative risk (RR) of hospitalization was also applied, thereby improving quality of life in this group by reducing the proportion of hospitalized patients.

Table 8: Health-Related Utility Values, Electronic Tools for Health Information Exchange

Health State of People With Diabetes	EQ-5D Value	Source
Baseline	0.77	Clarke et al, 2002, (21) and assumption based on Davis et al, 2005 (22)
Hospitalization	0.54	Assumption based on Davis et al, 2005 (22)

Abbreviation: EQ-5D, European Quality of Life 5 Domain.

Intervention Costs

The cost-effectiveness analyses paralleled the EBAs in that they evaluated specific interventions considered in the context of specific clinical studies. They differed in that not all clinical studies reported outcomes that could be included in the cost-effectiveness analysis. To maintain consistency within each cost-effectiveness analysis, estimates of resource use for each intervention were based on the study or studies from which the included estimate of clinical effect was derived. Unit costs were assigned to reported resource use according to publicly available reimbursement schedules, expert opinion from Community Care Access Centres (CCACs), and consultation with relevant stakeholders. All costs were inflated to 2012 Canadian dollars using the consumer price index for health care services.

Discharge Planning

Resource items for discharge planning were taken from studies in the discharge planning EBA (which included the cost of predischarge plus postdischarge planning) and are presented in Table 9. The base case cost per patient for predischarge plus postdischarge planning was $128.70. On the more conservative side, 1 study reported nurse counselling, an education booklet, and telephone outreach from a nurse within 24 hours (no physician visit); the per-patient cost for this approach was $80. (23) As part of the sensitivity analysis for each intervention, costs were varied between their estimated extremes.

Table 9: Intervention Costs per Patient: Discharge Planning

Resource	Unit Cost per Patient[a]	Assumptions	Source
Predischarge formal education by nurse	$56.00	1 hour of a nurse's time	CCACs[b]
Primary care physician visit	$33.70	Intermediate assessment (fee code A007)	OSB (24)
	$25.00	Postdischarge office assessment (fee code E080)	
24/7 telephone outreach line with nurse	$14.00	Call will take 15 minutes of a nurse's time ($56/4)	CCACs[b]
Education booklet	$10.00	—	Clinical expert[c]

Abbreviations: CCAC, Community Care Access Centre; OSB, Ontario Schedule of Benefits for Physician Services.
[a]All costs in 2012 Canadian dollars.
[b]Personal communication, CCACs, November 26, 2012.
[c]Personal communication, Clinical Expert, November 12, 2012.

In-Home Care

Resource use for in-home care was determined on the basis of the intervention described by Aguado et al (25) and in conversation with CCACs (November 26, 2012) (Table 10). In the study, (25) the intervention was described as follows:

> *A visit by a trained nurse to patients in their homes 1 week after discharge. In this visit, which lasted 2 hours, the nurse investigated patients' habits and their understanding of the pharmacologic treatment, with the purpose of detecting behaviours susceptible to modification. The nurse then used a guideline to deliver an educational session to instruct patients and caregivers in relevant aspects of the disease and self-management, centred on medication management, diet, fluid intake, smoking cessation, and physical activity.*

Although an exact replica of this model is not currently in practice in Ontario, contacts at CCACs confirmed that this type of care sometimes is performed during a nurse visit, which carries a charge of $91, regardless of the amount of time spent with each patient. These CCACs are currently recruiting nurses who would perform care similar to that described by Aguado and colleagues. (25) However, CCACs were unable to provide information on the expected salary and workload for such nurses. In the absence of such information, the cost of a nurse visit could be a reasonable estimate of the per-patient cost associated with these positions in future.

Table 10: Intervention Costs per Patient: In-Home Care

Resource	Unit Cost per Patient[a]	Assumptions	Source
Approximately 1 hour of nurse time, delivered in home	$91	Based on current reimbursement rates and expected nurse salaries associated with future models of care; cost was assumed to represent a reasonable estimate of the cost of delivering this type of care	CCACs[b]

Abbreviations: CCAC, Community Care Access Centre.
[a]All costs in 2012 Canadian dollars.
[b]Personal communication, CCACs, November 26, 2012.

Continuity of Care

The aim of the continuity of care EBA was to establish the relationship between continuity of care and patient outcomes. The EBA did not include studies that employed an intervention designed to improve continuity of care. Rather, the studies applied an algorithm to administrative databases to identify cohorts of patients belonging to high, medium, and low continuity of care indices. Because this EBA did not evaluate the effectiveness of an intervention, it represents an anomaly among our analyses. To estimate the potential cost-effectiveness of interventions designed to improve continuity of care, a sensitivity analysis was conducted in which the proportion of patients moving from low and medium continuity to high continuity was varied between 0% and 100%, while simultaneously increasing the hypothetical cost of the intervention. Given the range of other interventions evaluated in this analysis, the cost was varied from $0 to $1,000 in increments of $50.

Continuity of Care Indices were calculated for each cohort using the following equation developed by Brice and Boxerman: (26)

$$COCI = \frac{\sum_{j=1}^{M} n_j^2 - N}{N(N-1)}$$

where M is the number of primary care providers seen by the patient, j represents a given primary care provider, n_j represents the number of visits to the same primary care provider, and N is the total of primary care visits. Because the COCI is not applicable to patients with very few visits, we excluded patients with fewer than 3 primary care consultations in each of the years between 2006 and 2011. A primary care provider was defined as a family physician, a GP, a nurse practitioner, or a general internist. The number of patients in each of the following scoring groups was obtained: 0.00–0.47 (low continuity), 0.48–0.86 (medium continuity), 0.87–1.00 (high continuity).

The clinically significant effects obtained from the continuity of care EBA were applied to the outcomes and costs. The primary outcome measures were resource use, costs, and mortality. Where quality of life was reported in the clinical literature (preintervention and postintervention), incremental difference was used to estimate incremental cost per QALY gained. Where quality of life was not reported, incremental costs were estimated.

Variability and Uncertainty

One-way and 2-way sensitivity analyses were conducted to assess the robustness of the results to variations in clinical estimates and costs. Resource use and intervention costs were varied in 1-way sensitivity analyses. Clinical estimates were varied in 1-way or 2-way sensitivity analyses.

The net benefit of each intervention was also assessed over a 5-year time horizon. The net benefit approach combines the incremental cost and the incremental clinical benefit into a single measure and includes an estimate of the amount decision-makers are willing to pay per QALY gained. The net benefit (NB) can be defined as:

$$NB = (\lambda \times E)\text{-}C$$

where λ is the willingness to pay (WTP) threshold, E is the incremental clinical benefit, and C is the health care cost. The net benefit per patient was calculated for different values of λ, ranging from $25,000 to $100,000. The intervention with the highest net benefit was the most cost-effective strategy according to the WTP threshold.

Specialized Nursing Practice

Model 1

Studies that directly compared nurses providing autonomous patient care (intervention) to physicians performing the same tasks (usual care) were classified as Model 1. Nurses working in this model are generally nurse practitioners who have the legislative authority to perform tasks similar to those performed by physicians.

The study used to inform estimates of effect was also used to determine resource use. Lenz et al (27) reported that patients in both arms visited their care providers an average of 3.1 times (no statistical difference between groups). The unit cost of usual care was assumed to equal the cost of a physician visit ($33.70) as determined by the OSB. (24) Multiplying the cost of a visit by the average number of visits resulted in an average cost of $105 per patient for the usual care arm. Given that the hourly cost of a nurse practitioner is $36 (personal communication, CCAC, November 26, 2012), and assuming the nurse visit would last a an average of 21 minutes as reported in Model 2 (see below), the average per-patient cost of the intervention arm was $39. As a result, specialized nursing practice (Model 1) cost approximately $66 less than usual care (Table 11).

Model 2

Studies that compared nurses and physicians working in a partnership or the addition of a nursing intervention to a primary health care practice in comparison with physicians working alone (or usual care) were classified as Model 2. The cost of specialized nursing in Model 2 was calculated as the difference between care by a physician alone (usual care) and care by a physician and nurse practitioner team (intervention).

None of the studies included in the specialized nursing EBA reported outcomes of health care use or mortality. However, 1 study by Houweling et al (17) reported quality of life, which was used to inform the model. To maintain internal consistency, this study was also used to estimate resource use. The authors of this study reported that patients in the control arm had an average of 2.8 GP visits over a total of 0.48 hours. Given that the cost of an intermediate GP assessment is $33.70, (24) we estimated a total average per-patient cost of $94 for the usual-care arm. Patients in the intervention arm were in contact with the nurse-physician team for an average of 2.13 hours over a mean of 6.1 visits. As well, the protocol followed by the nurses in the trial indicated that in some cases, consultation with the GP would be necessary. The median number of consultations with a GP was 1.4 per patient, with a median time of 1.0 minutes. This cost was not included in the base-case analysis, but increased costs associated with the intervention were explored as part of the sensitivity analysis. Given that the hourly cost of a registered nurse is $35 (personal communication, CCAC, November 26, 2012), the average per-patient cost of the intervention arm was $75. As a result, specialized nursing practice (Model 2) cost approximately $20 less than usual care (Table 11).

Table 11: Intervention Costs per Patient: Specialized Nursing Practice

Resource	Unit Cost per Patient[a]	Assumptions	Source
Model 1			
GP consultation	$33.70/visit	As reported by the clinical study used to inform estimates of effect, it was assumed that patients in each strategy saw the practitioner an average of 3.1 times. Nurse consultations were assumed to last a mean of 21 minutes each (based on study by Houweling et al [17])	OSB (24)
Nurse practitioner	$36/hour		CCAC[b]
Total cost per patient receiving usual care = $105 Total cost per patient receiving intervention = $39			
Model 2			
GP consultation	$33.70/visit	Data regarding resource use was obtained from the study used to inform quality of life (Houweling et al [17]); health care use and mortality outcomes were not reported; the total number of reported visits to the GP was used to calculate the cost of usual care, while total average hours of patient contact was used to inform the cost of the intervention	OSB (24)
Registered nurse	$35/hour		CCAC[b]
Total cost per patient receiving usual care = $94 Total cost per patient receiving intervention = $75			

Abbreviations: CCAC, Community Care Access Centre; GP, general practitioner; OSB, Ontario Schedule of Benefits for Physician Services.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.
[b]Personal communication, Community Care Access Centre, November 26, 2012.

All intervention costs were based on fee-for-service models (OHIP). It is likely that the intervention costs represent an overestimate of the cost to the Ministry of Health and Long-Term Care, as some interventions would not trigger additional billings. If such costs were included, the marginal cost of the intervention would be reduced; the effect of these assumptions on the outcome of the model was explored in sensitivity analyses.

Electronic Tools for Health Information Exchange

Resource items for an eTool for diabetes care were identified from studies included in the eTools EBA and included the costs of software, maintenance, and sending results to physicians and patients. The eTool identified was the Vermont Diabetes Information System (VDIS). The VDIS is a laboratory-based registry and decision-support system that sends results and alerts to primary care providers and their patients with diabetes. (28) The primary function of the system is to collect clinical information on hemoglobin A1c, cholesterol, serum creatinine, and urine protein to generate 5 types of reports: flow sheets with laboratory results (to providers); reminders of overdue laboratory tests (to providers); overdue reminders (to patients); alerts with elevated test results (to patients); and summary population reports (to providers). The system requires no data entry, additional staff, office space, or capital investment by participating practices. (28) Reports are sent electronically or by fax to providers and mailed to patients.

The cost of the VDIS was obtained from the software manufacturer (personal communication, VDIS developer, November 15, 2012) (all costs in Canadian dollars). There is a 1-time software cost of $5,000 per laboratory and an annual maintenance cost of $2,500 per laboratory. The cost per physician to receive results and alerts is $6,000 per year. The cost to mail results to patients or send alerts is $48 a year.

Per-patient costs are presented in Table 12. Costs were calculated by obtaining an estimate of the number of patients with diabetes to be serviced by this eTool. There are 11,902 family physicians practising in Ontario. (29) Assuming an average physician roster size of 1,300 (personal communication, Clinical Expert, January 14, 2012) and a percentage of patients with diabetes in each roster of 6.5% (personal communication, Clinical Expert, November 5, 2012), there are approximately 85 patients with diabetes per roster and approximately 1,013,455 patients with diabetes being serviced in Ontario. There are also 211 central community laboratory and hospital sites in Ontario that would need the software.

Table 12: Intervention Costs per Patient: Electronic Tools for Health Information Exchange

Resource	Unit Cost per Patient[a]	Assumptions	Source
Software purchase (1-time cost)	$1.04	Cost per laboratory is $5,000, and there are 211 central laboratories in Ontario	Correspondence with the VDIS software developer[b]
Software maintenance (ongoing)	$0.52	Cost per laboratory is $2,500, and there are 211 central laboratories in Ontario	
Physician cost to receive results (ongoing)	$70.46	There are 11,902 family physicians in Ontario and 85 patients with diabetes per physician. Cost per physician to receive alerts and results is $6,000	
Patient cost to receive results (ongoing)	$48.00	—	

Abbreviation: VDIS, Vermont Diabetes Information System.
[a]All costs in 2012 Canadian dollars.
[b]Personal communication, VDIS developer, November 15, 2012.

Given that a family physician's roster varies from 1,200 to 1,400 patients, the roster size was varied to produce high and low estimates of cost. For a roster of 1,200, the 1-time cost per patient would be $0.39 and the ongoing cost per patient would be $74.37. For a roster of 1,400, the 1-time cost per patient would be $2.71 and the ongoing cost per patient would be $232.56.

Our data were based on the assumption that approximately 6% of patients on the average physician's roster currently have diabetes. If prevalence were to increase, the per-patient cost of the intervention

would decrease, resulting in greater cost savings than estimated by the model. Because this would not alter the conclusion of the analysis, it was not included as a sensitivity analysis.

Proportion to Benefit

The interventions included in the EBAs evaluated models of care specific to certain health care settings, but the cohorts used to calculate costs and mortality for each chronic disease included all patients in the province. As a result, it was necessary to estimate the proportion of the cohort eligible to benefit from each intervention. Where available, these estimates were informed by data provided by ICES; otherwise, estimates were inferred on the basis of published literature.

Only patients who are hospitalized for their index event are eligible to receive discharge planning and in-home care. Data from ICES were used to determine that 62% of the CHF cohort had an index event that took place in hospital; this proportion of patients was assumed to be able to benefit from discharge planning and in-home care.

In terms of continuity of care in the Ontario population, data from ICES (data provided by ICES, December 17, 2012) using COCI (26) showed that in 2010, 90% of patients with diabetes had low continuity of care and 8% had medium continuity of care. For individuals with COPD, 91% had low continuity of care and 7% had medium continuity of care.

Specialized nursing practice (Model 1) is intended to provide an alternative method of care for people with chronic diseases who do not currently have a primary care physician. Using ICES data, Glazier et al (30) reported that 5% of patients with chronic diseases in Ontario do not have a primary care physician. In contrast, specialized nursing practice (Model 2) applies to patients who do have a primary care provider; the inverse proportion (i.e., 95%) was applied to patients with diabetes and CAD in this model.

It was assumed that because eTools are currently not used to manage people with diabetes in Ontario, all patients in the diabetes cohort would be eligible to benefit from this intervention.

Estimates Used in the Economic Models: Summary

Table 13 summarizes the clinical estimates and costs used in the economic model for each intervention and disease cohort. Clinical estimates and duration of benefit came from the EBAs. Utility values were also obtained from the EBAs; if utilities were not reported, other published sources were consulted to obtain a utility value. Intervention costs were informed by the EBAs, and Ontario costs were applied. The proportion of patients to benefit from the intervention were informed by ICES data or published literature.

Table 13: Estimates Used in the Economic Models

Intervention and Disease Cohort	Point Estimate[a]	Range	Source
Discharge Planning (Predischarge and Postdischarge) in CHF			
RR of rehospitalization	Control: 1.00 Intervention: 0.74	NA 0.67–0.81	Phillips et al, 2004 (31)
RR of ED visits	NR	NA	NA
RR of mortality	0.87	0.73–1.04	Phillips et al, 2004 (31)
Baseline utility in CHF	0.84	0.80–0.88	Gohler et al, 2008 (7)
Utility for hospitalization	0.82	0.77–0.92	Gohler et al, 2008 (7)
Intervention cost	$128.70	$80.00–$75.007	CCAC[b] and OSB (24)
Duration of benefit	12 months	NA	Phillips et al, 2004 (31)
Proportion to benefit	62%	52%–72%	ICES[c]
In-Home Care in CHF			
RD in hospitalization	Control: 1.00 Intervention: 0.40	NA 0.38–0.42	Based on a mean difference of −1.03 (−1.53 to −0.53) reported by Aguado et al, 2010 (25)
RD in ED visits	Control: 1.00 Intervention: 0.34	NA 0.23–0.45	Based on a mean difference of −1.32 (−1.87 to −0.77) reported by Aguado et al, 2010 (25)
RR of mortality	Control: 1.00 Intervention: 0.92	NA 0.81–1.04	Brotons et al, 2009 (32); Aldamiz-Echevarría Iraurgui et al, 2007 (33)
Baseline utility in CHF	0.84	0.80–0.88	Gohler et al, 2008 (7)
Utility for hospitalization	0.82	0.77–0.92	Gohler et al, 2008 (7)
Intervention cost	$91.00	$82.00–$100.00	CCAC[b]
Duration of benefit	24 months	NA	Aguado et al, 2010 (25)
Proportion to benefit	62%	NA	ICES[c]
Continuity of Care in Diabetes			
RR of hospitalization	Low COC: 1.00 Medium COC: 0.75 High COC: 0.82	NA 0.61–0.91 0.68–0.98	Knight et al, 2009 (34)
RR of ED visits	Low COC: 1.00 High COC: 0.87	NA 0.83–0.92	Lin et al, 2010 (35)
RR of mortality	NR	NA	NA
Utility for people with high COC	0.73	0.68–0.76	De Maeseneer et al, 2003 (20)
Utility for people with medium COC	0.71	0.68–0.74	Assumption based on De Maeseneer et al, 2003 (20)
Utility for people with low COC	0.68	0.65–0.71	De Maeseneer et al, 2003 (20)
Intervention cost	NA	NA	Hypothetical intervention costs explored in sensitivity analysis

Duration of benefit	Ongoing	NA	Effect assumed to apply over a lifetime
Proportion to benefit	Medium COC: 8% Low COC: 90%	NA	ICES[c]
Continuity of Care in COPD			
RR of hospitalization	Low COC: 1.00 Medium COC: 0.67 High COC: 0.50	NA 0.62–0.71 0.47–0.69	Hong et al, 2010 (36)
RR of ED visits	Low COC: 1.00 Medium COC: 0.77 High COC: 0.56	NA 0.63–0.94 0.46–0.69	Hong et al, 2010 (36)
RR of mortality	NR	NA	NA
Utility for people with high COC	0.73	0.68–0.76	De Maeseneer, et al 2003 (20)
Utility for people with medium COC	0.71	0.68–0.74	Assumption based on De Maeseneer et al, 2003 (20)
Utility for people with low COC	0.68	0.65–0.71	De Maeseneer et al, 2003 (20)
Intervention cost	NA	NA	Hypothetical intervention costs explored in sensitivity analysis
Duration of benefit	Ongoing	NA	Effect assumed to apply over a lifetime
Proportion to benefit	Medium COC: 7% Low COC: 91%	NA	ICES[c]
Specialized Nursing Practice (Model 1) in Diabetes			
RR of hospitalization	Control: 1.00 Intervention: 0.80	NA 0.28–2.26	Lenz et al, 2002 (27)
RR of ED visits	Control: 1.00 Intervention 0.84	NA 0.49–1.46	Lenz et al, 2002 (27)
RR of mortality	NR	NA	NA
Control baseline utility	0.57	0.54–0.60	Mundinger et al, 2000 (19)
Control 6-month utility	0.64	0.61–0.67	Mundinger et al, 2000 (19)
Intervention baseline utility	0.57	0.54–0.60	Mundinger et al, 2000 (19)
Intervention 6-month utility	0.66	0.63–0.69	Mundinger et al, 2000 (19)
Intervention cost (incremental)	−$66.00	−$72.00 to −$59.00	CCAC[b] and Lenz et al, 2002 (27)
Duration of benefit	12 months	NA	Mundinger et al, 2000 (19)
Proportion to benefit	5%	3%–7%	Glazier et al, 2008 (30)
Specialized Nursing Practice (Model 2) in Diabetes			
RR of hospitalization	NR	NA	NA
RR of ED visits	NR	NA	NA
RR of mortality	NR	NA	NA
Control baseline utility	0.78	0.75–0.81	Houweling et al, 2011 (17)
Control 6-month utility	0.75	0.72–0.81	Houweling et al, 2011 (17)
Intervention baseline utility	0.79	0.76–0.82	Houweling et al, 2011 (17)
Intervention 6-month utility	0.76	0.73–0.79	Houweling et al, 2011 (17)
Intervention cost (incremental)	−$20.00	−$22.00 to −$18.00	CCAC[b] and OSB (24)
Duration of benefit	12 months	NA	Houweling et al, 2011 (17)
Proportion to benefit	95%	NA	Glazier et al, 2008 (30)

Specialized Nursing Practice (Model 2) in CAD			
RR of hospitalization	Control: 1.00 Intervention: 0.64	NA 0.48–0.86	Campbell et al, 1998 (37)
RR of ED visits	NR	NA	NA
RR of mortality	NR	NA	NA
Control baseline utility	0.61	0.58–0.64	Khunti et al, 2007 (18)
Control 1-year utility	0.60	0.57–0.63	Khunti et al, 2007 (18)
Intervention baseline utility	0.65	0.62–0.68	Khunti et al, 2007 (18)
Intervention 1-year utility	0.65	0.62–0.68	Khunti et al, 2007 (18)
Intervention cost (incremental)	−$19.00	−$24.00 to −$19.00	CCAC[b] and OSB (24)
Duration of benefit	12 months	NA	Campbell et al, 1998 (37)
Proportion to benefit	95%	NA	Glazier et al, 2008 (30)
eTools in Diabetes			
RD in hospitalization	Control: 1.00 Intervention: 0.85	NA 0.75–0.95	Based on a mean difference of –0.03 (–0.05 to –0.01) reported by Kahn et al, 2010 (38)
RD in ED visits	Control: 1.00 Intervention: 0.75	NA 0.61–0.89	Based on a mean difference of –0.09 (–0.14 to –0.04) reported by Kahn et al, 2010 (38)
RR of mortality	NR	NA	NA
Baseline utility in diabetes	0.77	0.74–0.80	Clarke et al, 2002 (21)
Utility for hospitalization	0.54	0.51–0.57	Assumption based on Davis et al, 2005 (22)
Intervention cost 1-time cost Ongoing cost	 $1.04 $119.00	 $0.39–$2.71 $74.00–$233.00	 VDIS software developer[d]
Duration of benefit	32 months	NA	Kahn et al, 2010 (38)
Proportion to benefit	100%	NA	Assumption

Abbreviations: CAD, coronary artery disease; CCAC, Community Care Access Centre; CHF, congestive heart failure; COC, continuity of care; COPD, chronic obstructive pulmonary disease; ED, emergency department; eTool, electronic tool; ICES, Institute for Clinical Evaluative Sciences; NA, not applicable; NR, not reported; OSB, Ontario Schedule of Benefits for Physician Services; RD, relative difference; RR, relative risk; VDIS, Vermont Diabetes Information System.

[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

[b]Personal communication, CCACs, November 26, 2012.

[c]Data provided by ICES, December 17, 2012.

[d]Personal communication from VDIS developer, November 15, 2012.

Individual estimates were compared with different control groups—assumed to be usual care—depending on the inclusion criteria of each EBA. For further details and full descriptions of comparisons, please see the individual EBAs.

Cost Curves and Phase Costs

A phase-based costing approach was used to estimate cumulative costs associated with each condition. Cohorts were subgrouped according to patient survival post–index event (355–360, 715–720, 1,075–1,080, 1,435–1,440, and 1,795–1,800 days). A 5-day window was used to allow for an increase in sample size. All health-related resources and costs incurred in the study period from the perspective of the Ministry of Health and Long-Term Care were identified and described by 90-day interval. These cost curves represent average costs for patients with varying lengths of lifespan after diagnosis. The intent was to employ a phase-based costing method as described by Wijeysundera et al. (39)

The aim was to examine cost curves for inflection points separating post-index (high costs), maintenance (stable costs), and pre-death (high costs) phases. However, because of delays in data acquisition, we chose to define the length of each phase a priori on the basis of experience. For the diabetes cohort, inflection points were 90 days post-index and 270 days pre-death. For the CAD, CHF, and COPD cohorts, inflection points were 90 days post-index and 180 days pre-death.

Individual patient costs were then assigned to each 90-day costing block in the 3 phases. A hierarchical design was used: costs were assigned beginning with the post-index phase, then pre-death, then maintenance. For example, if a CAD patient survived to 12 months post-discharge, the mean costs for the first 3 months were assigned to the corresponding 90-day post-index phase; the mean costs for the last 6 months were assigned to the corresponding 2 cost blocks in the pre-death phase; and mean costs for the remaining 3 months were assigned to the maintenance phase.

Using a survival curve for each disease cohort, the proportion of patients in each phase was determined for every 90-day interval. The average total cost for each 90-day interval was then calculated by multiplying the mean cost per phase by the proportion of patients in each phase. These costs were reported by consecutive 90-day intervals according to the health care sector in which they were accrued: hospital, emergency, same-day surgery, inpatient rehabilitation, home care, long-term care, complex care, drugs, and physician visits. The cumulative cost over the 5-year period was calculated for each cohort by summing costs across all 90-day intervals.

The clinical benefit of each intervention was incorporated into phase costs by reducing the costs in specific health care sectors according to the reductions in health care use observed in the EBAs. The result was the average phase cost for patients for each intervention.

Diabetes

Figure 1 shows mean cost as a function of time from the index date for each of the 5 diabetes survival subgroups. The cost curve for those surviving 1,795 to 1,800 days did not follow the expected trend, because this subgroup comprised only 2 individuals. Inflection points were 3 months post-index and 9 months pre-death. The post-index, maintenance, and pre-death costs for hospital, emergency, and medical visits per patient per 90 days are reported in Table 14.

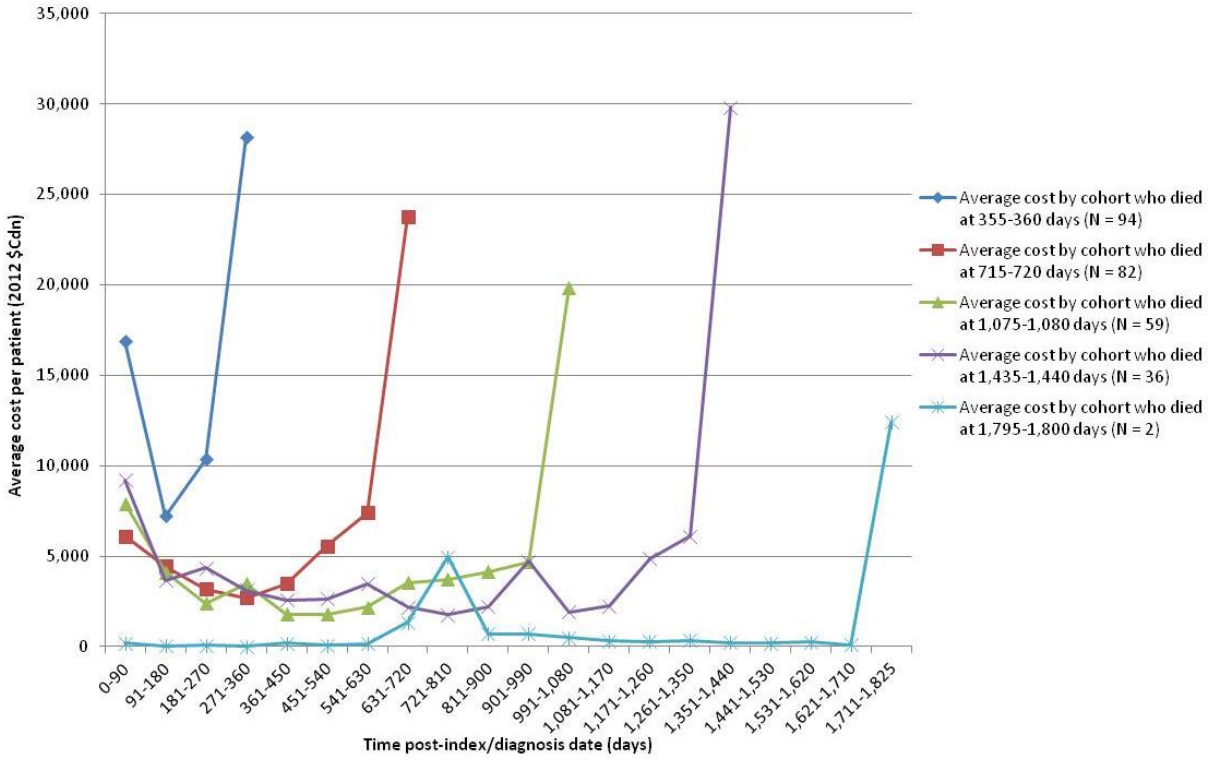

Figure 1: Diabetes Cost Curves for 5 Patient Subgroups (FY 2006–2010)[a]

Abbreviation: FY, fiscal year.

[a]Average cost per patient during each 90-day period from index date to maximum follow-up. All costs in 2012 Canadian dollars.

Table 14: Sector-Specific 90-Day Phase Costs per Person With Diabetes

	Mean Cost per 90 Days per Patient, $[a]	95% Upper Confidence Limit, $[a]	95% Lower Confidence Limit, $[a]
Post-Index Phase (90 days)			
Hospital	1,638	1,662	1,615
Emergency	91	93	90
Inpatient rehabilitation	111	115	107
Home care	127	129	125
Long-term care	33	34	32
Complex care	36	38	35
Drugs	202	204	201
Physician visits	647	653	642
Maintenance Phase (1,440 Days Over 5 Years)			
Hospital	338	344	331
Emergency	42	42	42
Inpatient rehabilitation	25	27	24
Home care	89	91	88
Long-term care	83	84	81
Complex care	47	50	44
Drugs	196	198	194
Physician visits	286	288	285
Pre-Death Phase (270 Days)			
Hospital	38,464	39,479	37,448
Emergency	1,934	2,029	1,838
Inpatient rehabilitation	430	480	379
Home care	1,208	1,240	1,176
Long-term care	720	735	704
Complex care	1,394	1,447	1,340
Drugs	612	627	596
Physician visits	6,351	6,632	6,069

[a]All costs in 2012 Canadian dollars.

Coronary Artery Disease

Figure 2 shows mean cost as a function of time from the index date for each of the 5 CAD survival subgroups. The cost curve for those surviving 1,795 to 1,800 days did not follow the expected trend, because this subgroup comprised only 3 persons. Inflection points were 3 months post-index and 6 months pre-death. The post-index, maintenance, and pre-death costs for hospital, emergency, and medical visits per patient per 90 days are reported in Table 15.

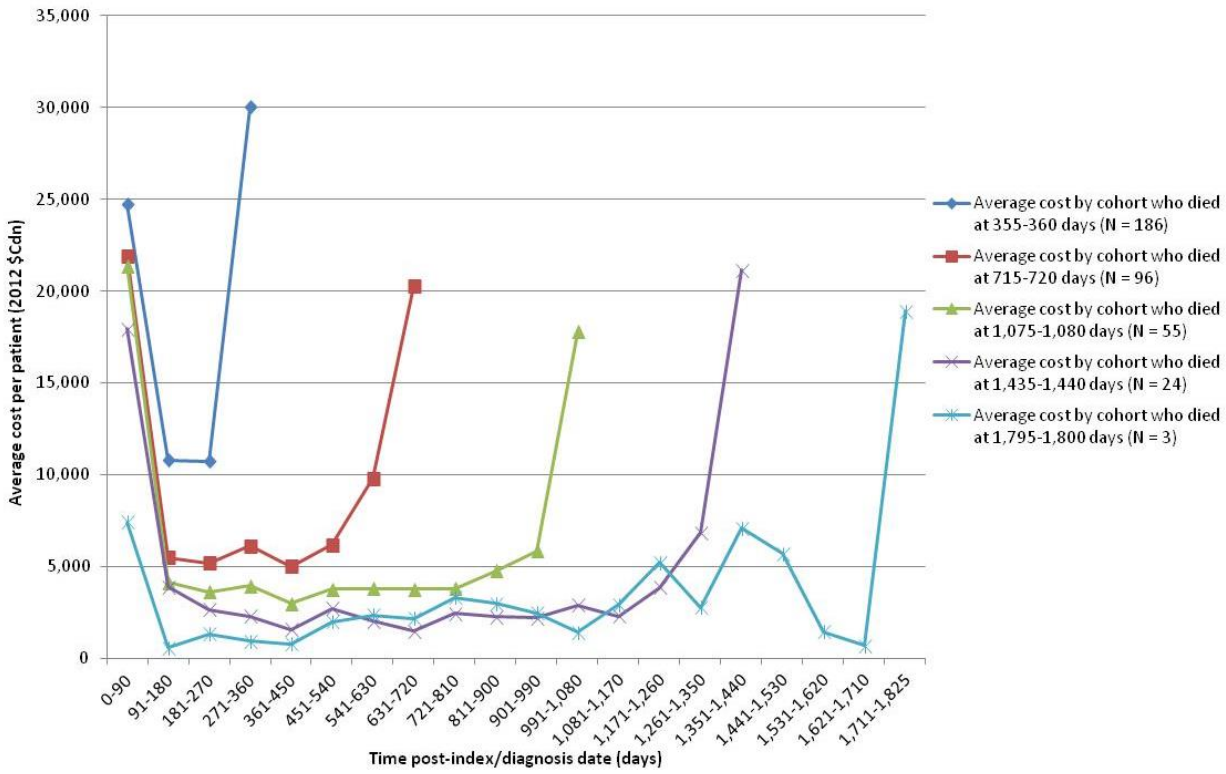

Figure 2: Coronary Artery Disease Cost Curves for 5 Patient Subgroups (FY 2006–2010)[a]

Abbreviation: FY, fiscal year.

[a]Average cost per patient during each 90-day period from index date to maximum follow-up. All costs in 2012 Canadian dollars.

Table 15: Sector-Specific 90-Day Phase Costs per Person With Coronary Artery Disease

Sector	Mean Cost per 90 Days per Patient, $[a]	95% Upper Confidence Limit, $[a]	95% Lower Confidence Limit, $[a]
Post-Index Phase (90 Days)			
Hospital	20,397	20,599	20,194
Emergency	940	953	927
Same-day surgery	450	465	435
Inpatient rehabilitation	669	693	645
Home care	968	978	958
Long-term care	232	237	228
Complex care	387	398	375
Drugs	560	566	554
Physician visits	3,357	3,391	3,323
Maintenance Phase (1,530 Days over 5 Years)			
Hospital	2,428	2,485	2,371
Emergency	184	187	181
Same-day surgery	128	134	122
Inpatient rehabilitation	141	151	131
Home care	645	657	634
Long-term care	594	603	585
Complex care	366	385	348
Drugs	533	539	527
Physician visits	761	773	749
Pre-Death Phase (180 Days)			
Hospital	64,635	65,449	63,821
Emergency	4,076	4,174	3,978
Same-day surgery	265	303	228
Inpatient rehabilitation	452	483	421
Home care	1,333	1,360	1,306
Long-term care	732	743	721
Complex care	1,318	1,352	1,284
Drugs	505	519	491
Physician visits	9,327	9,526	9,129

[a]All costs in 2012 Canadian dollars.

Congestive Heart Failure

Figure 3 shows mean cost as a function of time from the index date for each of the 5 CHF survival subgroups. Inflection points were 3 months post-index and 6 months pre-death. The post-index, maintenance, and pre-death costs for hospital, emergency, and medical visits per patient per 90 days are reported in Table 16.

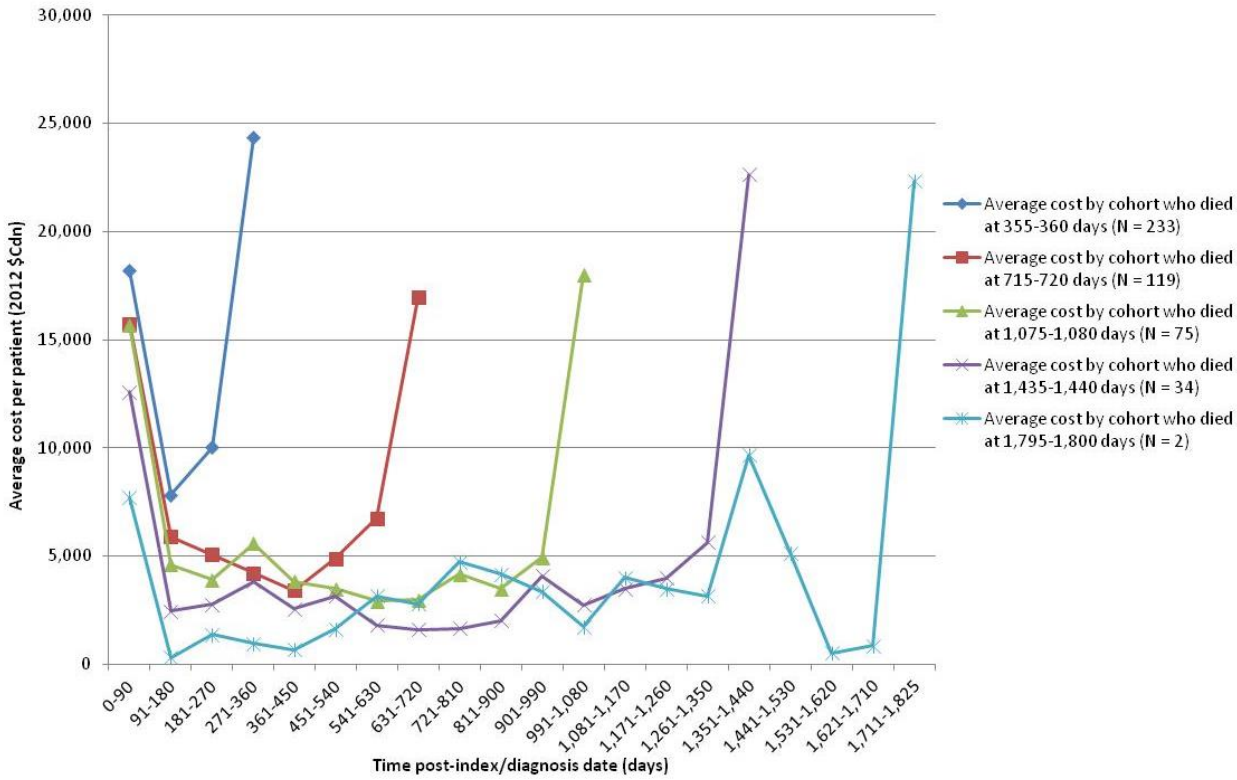

Figure 3: Congestive Heart Failure Cost Curves for 5 Patient Subgroups (FY 2006–2010)[a]

Abbreviation: FY, fiscal year.

[a]Average cost per patient during each 90-day period from index date to maximum follow-up. All costs in 2012 Canadian dollars.

Table 16: Sector-Specific 90-Day Phase Costs per Person With Congestive Heart Failure

Sector	Mean Cost per 90 Days per Patient, $[a]	95% Upper Confidence Limit, $[a]	95% Lower Confidence Limit, $[a]
Post-Index Phase (90 Days)			
Hospital	12,735	12,853	12,618
Emergency	597	605	589
Inpatient rehabilitation	594	613	576
Home care	696	703	690
Long-term care	181	184	178
Complex care	296	304	288
Drugs	505	510	499
Physician visits	2,648	2,675	2,621
Maintenance Phase (1,530 Days Over 5 Years)			
Hospital	1,827	1,865	1,790
Emergency	139	141	137
Inpatient rehabilitation	129	136	122
Home care	474	481	466
Long-term care	483	489	477
Complex care	304	316	291
Drugs	485	490	479
Physician visits	668	676	660
Pre-Death Phase (180 Days)			
Hospital	58,997	59,779	58,214
Emergency	3,273	3,353	3,192
Inpatient rehabilitation	463	497	430
Home care	1,258	1,283	1,234
Long-term care	811	822	801
Complex care	1,384	1,417	1,350
Drugs	517	526	507
Physician visits	9,155	9,382	8,929

[a]All costs in 2012 Canadian dollars.

Chronic Obstructive Pulmonary Disease

Figure 4 shows mean cost as a function of time from the index date for each of the 5 COPD survival subgroups. The cost curve for those surviving 1,795 to 1,800 days did not follow the expected trend, because this subgroup comprised only 4 persons. Inflection points were 3 months post-index and 6 months pre-death. The post-index, maintenance, and pre-death costs for hospital, emergency, and medical visits per patient per 90 days are reported in Table 17.

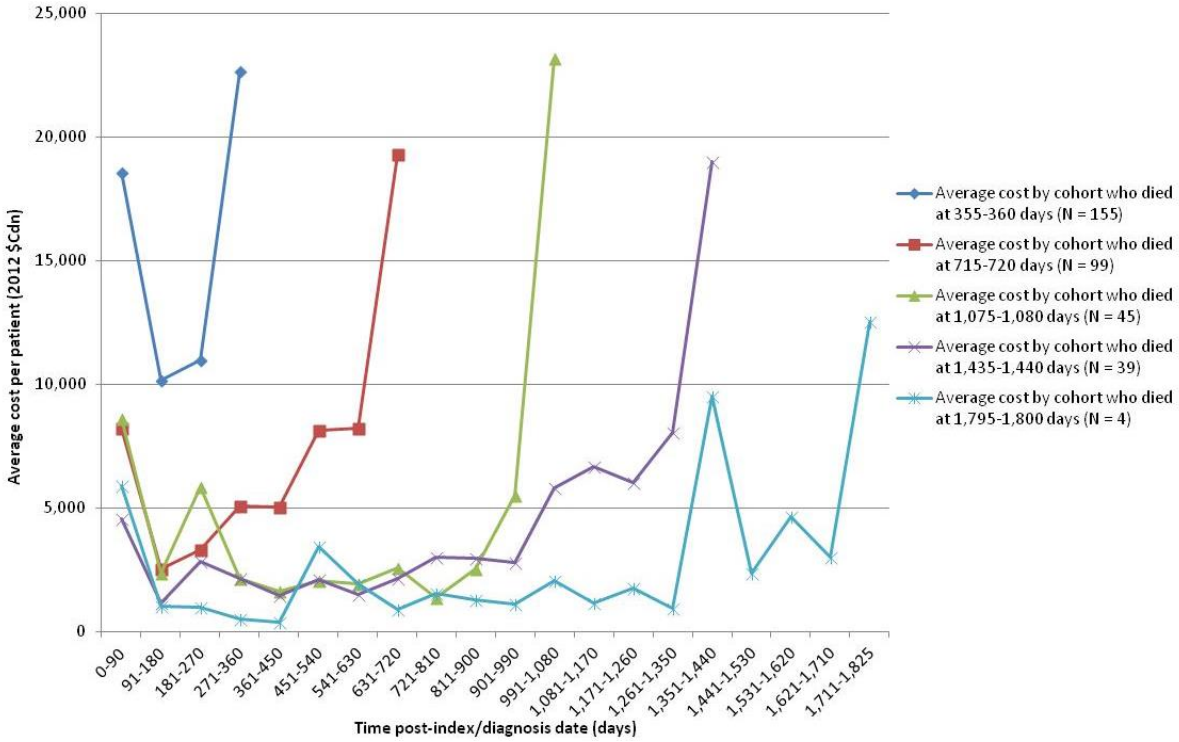

Figure 4: Chronic Obstructive Pulmonary Disease Cost Curves for 5 Patient Subgroups (FY 2006–2010)[a]

Abbreviation: FY, fiscal year.

[a]Average cost per patient during each 90-day period from index date to maximum follow-up. All costs in 2012 Canadian dollars.

Table 17: Sector-Specific 90-Day Phase Costs per Person With Chronic Obstructive Pulmonary Disease

Sector	Mean Cost per 90 Days per Patient, $[a]	95% Upper Confidence Limit, $[a]	95% Lower Confidence Limit, $[a]
Post-Index Phase (90 Days)			
Hospital	2,879	2,920	2,839
Emergency	180	182	177
Inpatient rehabilitation	161	168	153
Home care	216	219	213
Long-term care	67	68	65
Complex care	71	74	68
Drugs	272	274	270
Physician visits	883	892	874
Maintenance Phase (1,530 Days Over 5 Years)			
Hospital	607	622	592
Emergency	67	68	67
Inpatient rehabilitation	45	48	42
Home care	157	160	154
Long-term care	155	158	153
Complex care	99	104	94
Drugs	261	264	259
Physician visits	355	358	352
Pre-Death Phase (180 Days)			
Hospital	40,206	40,990	39,421
Emergency	2,105	2,182	2,028
Inpatient rehabilitation	380	418	341
Home care	1,345	1,376	1,314
Long-term care	751	764	738
Complex care	1,420	1,465	1,374
Drugs	627	653	601
Physician visits	5,982	6,173	5,791

[a]All costs in 2012 Canadian dollars.

Economic Analysis Results

Diabetes

Continuity of Care

Table 18 presents the incremental cost per QALY gained for various hypothetical intervention costs and levels of intervention effectiveness (i.e., percent increase of patients to the high continuity of care cohort). The results suggested that the intervention was dominant across all variations of intervention costs when the level of effectiveness increased to 90% or 100%. The intervention was largely dominant for different variations of intervention effectiveness and intervention costs.

A sensitivity analysis was undertaken to explore the effect of various baseline levels of continuity of care. According to an ICES report published in 2008, (30) most (56.5%) people in Ontario with at least 1 chronic disease had high continuity of care (28.2% had medium continuity of care, and 10.5% had low continuity of care). When these values were used to inform the baseline distribution for patients with diabetes, interventions were not likely to be cost-saving. However, they were likely to lead to greater quality of life, and were associated with varying costs per QALY on the basis of the intervention cost and the effectiveness of achieving high continuity of care (Table 19).

Table 18: Continuity of Care for People With Diabetes: Exploratory Analysis

	Intervention Effectiveness (% Increase of Patients in High-Continuity Cohort)[a]										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
$ 0	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$50	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$100	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$150	Dominated	$1,732	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$200	Dominated	$4,305	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$250	Dominated	$6,877	$446	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$300	Dominated	$9,450	$1,732	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$350	Dominated	$12,023	$3,018	$17	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$400	Dominated	$14,595	$4,305	$874	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$450	Dominated	$17,168	$5,591	$1,732	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$500	Dominated	$19,741	$6,877	$2,590	$446	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$550	Dominated	$22,313	$8,164	$3,447	$1,089	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$600	Dominated	$24,886	$9,450	$4,305	$1,732	$188	Dominant	Dominant	Dominant	Dominant	Dominant
$650	Dominated	$27,459	$10,736	$5,162	$2,375	$703	Dominant	Dominant	Dominant	Dominant	Dominant
$700	Dominated	$30,031	$12,023	$6,020	$3,018	$1,218	$17	Dominant	Dominant	Dominant	Dominant
$750	Dominated	$32,604	$13,309	$6,877	$3,662	$1,732	$446	Dominant	Dominant	Dominant	Dominant
$800	Dominated	$35,177	$14,595	$7,735	$4,305	$2,247	$874	Dominant	Dominant	Dominant	Dominant
$850	Dominated	$37,749	$15,882	$8,593	$4,948	$2,761	$1,303	$262	Dominant	Dominant	Dominant
$900	Dominated	$40,322	$17,168	$9,450	$5,591	$3,276	$1,732	$629	Dominant	Dominant	Dominant
$950	Dominated	$42,895	$18,454	$10,308	$6,234	$3,790	$2,161	$997	$124	Dominant	Dominant
$1,000	Dominated	$45,468	$19,741	$11,165	$6,877	$4,305	$2,590	$1,365	$446	Dominant	Dominant

[a]All costs in 2012 Canadian dollars.

Table 19: Continuity of Care for People With Diabetes: Sensitivity Analysis

	Intervention Effectiveness (% Increase of Patients in High-Continuity Cohort)[a]										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
$0	Dominated	$8,800	$8,800	$8,800	$8,800	$8,800	$8,800	$8,800	$8,800	$8,800	$8,800
$50	Dominated	$12,686	$10,743	$10,095	$9,771	$9,577	$9,447	$9,355	$9,285	$9,231	$9,188
$100	Dominated	$16,572	$12,686	$11,390	$10,743	$10,354	$10,095	$9,910	$9,771	$9,663	$9,577
$150	Dominated	$20,458	$14,629	$12,686	$11,714	$11,131	$10,743	$10,465	$10,257	$10,095	$9,965
$200	Dominated	$24,344	$16,572	$13,981	$12,686	$11,909	$11,390	$11,020	$10,743	$10,527	$10,354
$250	Dominated	$28,231	$18,515	$15,277	$13,657	$12,686	$12,038	$11,575	$11,228	$10,959	$10,743
$300	Dominated	$32,117	$20,458	$16,572	$14,629	$13,463	$12,686	$12,131	$11,714	$11,390	$11,131
$350	Dominated	$36,003	$22,401	$17,867	$15,600	$14,240	$13,333	$12,686	$12,200	$11,822	$11,520
$400	Dominated	$39,889	$24,344	$19,163	$16,572	$15,017	$13,981	$13,241	$12,686	$12,254	$11,909
$450	Dominated	$43,775	$26,287	$20,458	$17,544	$15,795	$14,629	$13,796	$13,172	$12,686	$12,297
$500	Dominated	$47,661	$28,231	$21,754	$18,515	$16,572	$15,277	$14,351	$13,657	$13,118	$12,686
$550	Dominated	$51,548	$30,174	$23,049	$19,487	$17,349	$15,924	$14,906	$14,143	$13,549	$13,074
$600	Dominated	$55,434	$32,117	$24,344	$20,458	$18,126	$16,572	$15,462	$14,629	$13,981	$13,463
$650	Dominated	$59,320	$34,060	$25,640	$21,430	$18,904	$17,220	$16,017	$15,115	$14,413	$13,852
$700	Dominated	$63,206	$36,003	$26,935	$22,401	$19,681	$17,867	$16,572	$15,600	$14,845	$14,240
$750	Dominated	$67,092	$37,946	$28,231	$23,373	$20,458	$18,515	$17,127	$16,086	$15,277	$14,629
$800	Dominated	$70,979	$39,889	$29,526	$24,344	$21,235	$19,163	$17,682	$16,572	$15,708	$15,017
$850	Dominated	$74,865	$41,832	$30,821	$25,316	$22,013	$19,810	$18,237	$17,058	$16,140	$15,406
$900	Dominated	$78,751	$43,775	$32,117	$26,287	$22,790	$20,458	$18,793	$17,544	$16,572	$15,795
$950	Dominated	$82,637	$45,718	$33,412	$27,259	$23,567	$21,106	$19,348	$18,029	$17,004	$16,183
$1,000	Dominated	$86,523	$47,661	$34,708	$28,231	$24,344	$21,754	$19,903	$18,515	$17,436	$16,572

[a]All costs in 2012 Canadian dollars.

Specialized Nursing Practice (Model 1)

Table 20 presents costs, QALYs, and ICERs for specialized nursing practice (patients treated by a nurse practitioner) and usual care (patients treated by a GP). Specialized nursing practice (Model 1) was dominant (i.e., less costly and more effective) compared with usual care.

Table 20: Specialized Nursing Practice (Model 1) for People With Diabetes: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$30,226	2.584	—
Intervention	$30,142	2.588	—
Incremental	−$84	0.003	Dominant

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to test the robustness of the results to variations in model parameters. Table 21 shows that the intervention remained dominant, except when specialized nursing practice resulted in an increase in hospitalizations and ED visits. It is expected that this scenario would be associated with a decrease in QALYs, but the nature of administrative databases and the structure of the model did not allow us to reflect associated changes in health status.

Table 21: Specialized Nursing Practice (Model 1) for People With Diabetes: Sensitivity Analysis

Intervention Measures	Incremental Cost[a]	Incremental QALYs	ICER[a]
Effect of Intervention on Hospitalization and ED Visits (2-Way Sensitivity Analysis)			
RR of hospitalization = 0.28 RR of ED visit = 0.49	−$172	0.003	Dominant
RR of hospitalization = 2.26 RR of ED visit = 1.46	$155	0.003	$46,018/QALY
Marginal Cost of Intervention (1-Way Sensitivity Analysis)			
−10% = −$72	−$90	0.003	Dominant
+10% = −$59	−$80	0.003	Dominant

Abbreviations: ED, emergency department; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; RR, relative risk.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Specialized Nursing Practice (Model 2)

Table 22 presents costs, QALYs, and ICERs for specialized nursing practice (patients treated by a nurse practitioner plus a GP) and usual care (patients treated solely by a GP). Specialized nursing practice (Model 2) was dominant (i.e., less costly and more effective) compared with usual care.

Table 22: Specialized Nursing Practice (Model 2) for People With Diabetes: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$30,226	3.068	—
Intervention	$30,210	3.108	—
Incremental	−$15	0.040	Dominant

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to test the robustness of the results to variations in select model parameters. Table 23 shows that the results were not sensitive to changes in intervention cost.

Table 23: Specialized Nursing Practice (Model 2) for People With Diabetes: Sensitivity Analysis

Marginal Cost of Intervention (1-Way Sensitivity Analysis)[a]	Incremental Cost[a]	Incremental QALYs	ICER
−10% = −$22	−$1,714	0.04	Dominant
+10% = −$18	−$1,417	0.04	Dominant

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Electronic Tools for Health Information Exchange

Table 24 presents costs, QALYs, and ICERs for centres with eTools and centres with usual care. Electronic tools were dominant (i.e., less costly and more effective) compared with usual care.

Table 24: Electronic Tools for People With Diabetes: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$30,226	2.789	—
Intervention	$29,889	2.795	—
Incremental	−$337	0.006	Dominant

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to test the robustness of the results to variations in model parameters. Table 25 shows that the model was sensitive to changes in resource use and intervention cost.

Table 25: Electronic Tools for People With Diabetes: Sensitivity Analysis

Intervention Measures	Incremental Cost[a]	Incremental QALYs	ICER
Effect of Intervention on Hospitalization and ED Visits (2-Way Sensitivity Analysis)			
RD of hospitalization = 0.75 RD of ED visit = 0.61	−$1,228	0.011	Dominant
RD of hospitalization = 0.95 RD of ED visit = 0.89	$554	0.002	$257,074
Marginal Cost of Intervention (1-Way Sensitivity Analysis)			
Ongoing cost = $74	−$724	0.006	Dominant
Ongoing cost = $233	$639	0.006	$38,869

Abbreviations: ED, emergency department; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; RD, relative difference.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Incremental Net Benefit: Diabetes

The incremental net benefit for each diabetes intervention was calculated given a WTP of $25,000, $50,000, $75,000, and $100,000 (Table 26). (Because no intervention costs were associated with continuity of care, sensitivity analyses were not conducted.) Of the interventions evaluated in a population with diabetes, specialized nursing practice (Model 2) was associated with the greatest incremental net benefit.

Table 26: Incremental Net Benefit of Diabetes Interventions

Intervention	Incremental Net Benefit[a]			
	$25,000	$50,000	$75,000	$100,000
Specialized nursing practice (Model 2) vs. usual care	$1,028	$2,040	$3,052	$4,064
Electronic tools vs. usual care	$499	$660	$822	$984
Specialized nursing practice (Model 1) vs. usual care	$169	$254	$338	$422

[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Coronary Artery Disease

Specialized Nursing Practice (Model 2)

Table 27 presents costs, QALYs, and ICERs for specialized nursing practice (patients treated by a nurse practitioner plus a GP) and usual care (patients treated solely by a GP). Specialized nursing practice (Model 2) was dominant (i.e., less costly and more effective) compared with usual care.

Table 27: Specialized Nursing Practice (Model 2) for People With Coronary Artery Disease: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$111,611	1.406	—
Intervention	$101,855	1.424	—
Incremental	−$9,757	0.018	Dominant

Abbreviation: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to test the robustness of the results to variations in select model parameters. Table 28 shows that the model was not sensitive to variations in resource use or intervention cost.

Table 28: Specialized Nursing Practice (Model 2) for People With Coronary Artery Disease: Sensitivity Analysis

Intervention Measure	Incremental Cost[a]	Incremental QALYs	ICER
Effect of Intervention on Hospitalization (1-Way Sensitivity Analysis)			
RR of hospitalization = 0.48	−$14,086	0.018	Dominant
RR of hospitalization = 0.86	−$3,804	0.018	Dominant
Marginal Cost of Intervention (1-Way Sensitivity Analysis)			
−10% = −$24	−$9,758	0.018	Dominant
+10% = −$19	−$9,755	0.018	Dominant

Abbreviations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; RR, relative risk.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Incremental Net Benefit: Coronary Artery Disease

The incremental net benefit for the CAD intervention was calculated given a WTP of $25,000, $50,000, $75,000, and $100,000 (Table 29). The intervention was cost-effective across all 4 WTP values.

Table 29: Incremental Net Benefit of Coronary Artery Disease Intervention

Intervention	Incremental Net Benefit[a]			
	$25,000	$50,000	$75,000	$100,000
Specialized nursing practice (Model 2) vs. usual care	$10,218	$10,678	$11,139	$11,600

[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Congestive Heart Failure

Discharge Planning

Table 30 presents costs, QALYs, and ICERs for discharge planning (predischarge and postdischarge) and usual care. Discharge planning was dominant (i.e., less costly and more effective) compared with usual care.

Table 30: Discharge Planning for People With Congestive Heart Failure: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$101,080	1.818	—
Intervention	$100,352	1.890	—
Incremental	−$728	0.072	Dominant

Abbreviation: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to take into consideration possible differences in resource use associated with this program. Table 31 shows that in all scenarios, the cost savings associated with reduced hospital admissions and ER visits outweighed the cost of the intervention.

Table 31: Discharge Planning for People With Congestive Heart Failure: Sensitivity Analysis

Intervention Measure	Incremental Cost[a]	Incremental QALYs	ICER
Estimate of Intervention on Hospitalization (1-Way Sensitivity Analysis)			
RR for hospitalization = 0.67	−$1,734	0.074	Dominant
RR for hospitalization = 0.81	$278	0.069	$4,039
Effect of Intervention on Mortality (1-Way Sensitivity Analysis)			
RR for mortality = 0.73	$2,824	0.164	$17,226
RR for mortality = 1.04	−$3,606	−0.004	Dominated
Marginal Cost of Intervention (1-Way Sensitivity Analysis)			
Marginal cost = $80	−$780	0.071	Dominant
Marginal cost = $757	−$256	0.071	Dominant

Abbreviations: ICER, incremental cost-effectiveness; QALY, quality-adjusted life-year; RR, relative risk.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

In-Home Care

Table 32 presents costs, QALYs, and ICERs for in-home care and usual care. In-home care was dominant (i.e., less costly and more effective) compared with usual care.

Table 32: In-Home Care for People With Congestive Heart Failure: Results

Care	Cost/Patient[a]	QALYs/Patient	ICER
Usual care	$101,080	1.818	—
Intervention	$90,415	1.929	—
Incremental	−$10,665	0.111	Dominant

Abbreviation: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

A sensitivity analysis was performed to test the robustness of the results to variations in model parameters. Table 33 shows that the model was not sensitive to changes in resource use or intervention cost.

Table 33: In-Home Care for People With Congestive Heart Failure: Sensitivity Analysis

Intervention Measure	Incremental Cost[a]	Incremental QALYs	ICER
Effect of Intervention on Hospitalization and ED Visits (2-Way Sensitivity Analysis)			
RR for hospitalization = 0.38 RR for ED visits = 0.23	−$11,222	0.112	Dominant
RR for hospitalization = 0.42 RR for ED visits = 0.45	−$10,109	0.109	Dominant
Effect of Intervention on Mortality (1-Way Sensitivity Analysis)			
RR for mortality = 0.81	−$7,869	0.233	Dominant
RR for mortality = 1.04	−$13, 042	0.006	Dominant
Marginal Cost of Intervention (1-Way Sensitivity Analysis)			
$82	−$10,672	0.111	Dominant
$100	−$10,658	0.111	Dominant

Abbreviations:; ED, emergency department; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; RR, relative risk.
[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Incremental Net Benefit: Congestive Heart Failure

The incremental net benefit for each CHF intervention was calculated given a WTP of $25,000, $50,000, $75,000, and $100,000 (Table 34). Of the interventions evaluated in a population with CHF, in-home care was associated with the greatest incremental net benefit.

Table 34: Incremental Net Benefit of Congestive Heart Failure Interventions

Intervention	Incremental Net Benefit[a]			
	$25,000	**$50,000**	**$75,000**	**$100,000**
In-home care	$13,432	$16,198	$18,965	$21,731
Discharge planning (predischarge and postdischarge)	$2,513	$4,298	$6,082	$7,867

[a]All costs in 2012 Canadian dollars. Any minor mathematical differences are due to rounding.

Chronic Obstructive Pulmonary Disease

Continuity of Care

Table 35 presents the incremental cost per QALY gained for different hypothetical intervention costs and levels of intervention effectiveness (i.e., percent increase of patients to the high continuity of care cohort). The results suggested that the intervention was dominant across almost all variations of intervention cost and level of effectiveness.

Table 35: Continuity of Care for People With Chonic Obstructive Pulmonary Disease: Exploratory Analysis

	Intervention Effectiveness (% Increase of Patients in High Continuity Cohort)[a]										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
$0	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$50	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$100	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$150	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$200	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$250	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$300	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$350	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$400	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$450	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$500	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$550	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$600	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$650	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$700	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$750	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$800	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$850	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$900	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$950	Dominant	$808	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$1,000	Dominant	$3,587	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant

[a]All costs in 2012 Canadian dollars.

As with the diabetes cohort, a sensitivity analysis was undertaken to explore the effect of different baseline levels of continuity of care. When base-case values were equal to that reported by ICES in 2008 (30) for people with chronic diseases (high 56.5%, medium 28.2%, low 10.5%), the results were largely unchanged (Table 36).

Table 36: Continuity of Care for People With Chronic Obstructive Pulmonary Disease: Sensitivity Analysis

	Intervention Effectiveness (% Increase of Patients in High-Continuity Cohort)[a]										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
$0	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$50	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$100	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$150	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$200	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$250	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$300	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$350	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$400	Dominated	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$450	Dominated	$944	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$500	Dominated	$5,182	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$550	Dominated	$9,420	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$600	Dominated	$13,658	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$650	Dominated	$17,896	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$700	Dominated	$22,135	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$750	Dominated	$26,373	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$800	Dominated	$30,611	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$850	Dominated	$34,849	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$900	Dominated	$39,087	$944	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$950	Dominated	$43,325	$3,063	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant
$1,000	Dominated	$47,563	$5,182	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant

[a]All costs in 2012 Canadian dollars.

Budget Impact Analysis—Ontario Perspective

A budget impact analysis was conducted from the perspective of the Ontario Ministry of Health and Long-Term Care. Originally, we had planned to determine the estimated cost burden over the next 5 years for each intervention; however, this was not possible given the lack of data regarding the proportion of patients currently receiving the interventions in hospitals throughout Ontario. Were the different interventions not previously introduced to Ontario, the maximum target population would be the current prevalent population as well as the future incident population for CHF, diabetes, and CAD (Table 37). Continuity of care was excluded because there were no intervention costs.

Table 37: Incident and Prevalent Populations

Population	Estimate	Source
Congestive heart failure		
Incident population, n	33,552	ICES[a]
Prevalent population, n	99,490	Canadian Community Health Survey (2), Statistics Canada (40), Chow et al. 2005 (41)
Diabetes		
Incident population, n	91,908	ICES[a]
Prevalent population, n	1,164,492	Booth et al, 2012 (42)
Coronary artery disease		
Incident population, n	22,076	ICES[a]
Prevalent population, n	565,285	Canadian Community Health Survey (2), Statistics Canada (40)

[a]Data provided by ICES, December 17, 2012.

As mentioned previously, interventions analyzed in this study are currently being implemented in various ways in hospitals throughout Ontario. As a result, the incident and prevalent target populations presented in Table 37 overestimate the number of NEW patients who will be targeted for the interventions. Because the number of patients currently receiving any of the interventions is unknown, a total budget impact cannot be calculated. The costs are thus presented at a per-patient level (as the cost difference between the total lifetime health care cost per patient receiving the intervention, and the total lifetime health care cost per patient without the intervention). This cost difference was already calculated in the economic evaluation, and the base case results are summarized in Table 38. The resulting incremental cost per patient is represented as the cost savings estimated.

Table 38: Summary of the Incremental Cost per Patient for Various Interventions for Optimizing Chronic Disease Management

Intervention and Chronic Disease	Cost per Patient With Usual Care	Cost per Patient With Intervention	Incremental Cost per Patient	Source
Discharge planning (predischarge and postdischarge) in people with CHF	$101,080	$100,352	−$728	Table 30
In-home care in people with CHF	$101,080	$90,415	−$10,665	Table 32
Specialized nursing (model 1) in people with diabetes	$30,226	$30,142	−$84	Table 20
Specialized nursing (model 2) in people with diabetes	$30,226	$30,210	−$15	Table 22
Specialized Nursing (Model 2) in people with CAD	$111,611	$101,855	−$9,757	Table 27
eTools in people with diabetes	$30,226	$29,889	−$337	Table 24

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; eTools, electronic tools.

Limitations

This analysis was subject to many limitations, summarized below.

The cost-effectiveness analyses paralleled the EBAs in that they evaluated specific interventions considered in the context of specific clinical studies. They differed in that not all clinical studies included in the EBAs reported outcomes that could be included in the cost-effectiveness analyses. To maintain consistency within each cost-effectiveness analysis, estimates of resource use for each intervention were based on the study or studies on which the clinical effect was based. The costs included in each analysis were no less generalizable than the effects, and the generalizability of these studies across interventions varied according to the intervention and the disease, at both the clinical and economic levels.

Because of time constraints, intervention costs were based on fee-for-service models (OHIP). As a result, it is likely that the intervention costs overestimate the costs to the Ministry, as some of these services would not trigger additional billings. If additional billings were excluded, the marginal cost of the intervention would be reduced, resulting in further cost savings.

Effect estimates for each intervention were based on point estimates obtained from the EBAs. Uncertainty surrounding effect size was explored using 1- and 2-way sensitivity analyses. These analyses provided more limited means of exploring uncertainty than probabilistic sensitivity analysis, which could not be constructed within our time constraints. An additional limitation associated with the effect estimates was that the evidence used to inform parameters was often limited to a single clinical trial with moderate- to very low–quality evidence.

Only effect estimates relating to resource use and mortality were included in the analysis. The model was not designed to allow for the inclusion of clinical outcomes, such as lipid levels or hemoglobin A_{1c}. Although these intermediate outcomes could indicate that an intervention has achieved a certain level of effectiveness compared with usual care, they require the use of a clinical disease model to forecast the long-term consequences.

Resource use associated with each intervention was largely based on the programs described in the clinical trials. Resource use estimates were then applied to Ontario-specific unit costs to calculate the cost of each intervention. This represented the best use of available data, but the intervention cost might not be directly applicable to an Ontario context. For example, data used to calculate per-patient costs for eTools in people with diabetes was based on the resources described in the study from the EBA, which took place in Vermont using a specific software tool and study protocol. Currently, similar software does not exist in Ontario; if it is developed and implemented in future, it could come at a different cost.

As a criterion for evaluation, this economic analysis considered only interventions that were conducted in 1 of several predefined chronic disease cohorts. Costs were calculated for each disease cohort, and clinical estimates of effect (which were derived from trials with homogeneous populations and often strict enrollment criteria) were applied. Therefore, the final cost associated with each intervention was population-specific and cannot be extrapolated to the general population.

Of the studies from the EBAs that reported generic quality-of-life measures, all found very little difference in health-related quality of life between baseline and follow-up. Given that there was also no difference in mortality associated with the interventions (except in the CHF cohort), there was little to no difference in QALYs.

Some of the included studies reported increases in patient satisfaction. However, because there is no standard method of measuring satisfaction and few reports on the reliability of satisfaction surveys, it is not accepted practice to capture this outcome in economic analyses. This difference highlights an important point: measures of satisfaction reflect items that refer to an aspect of treatment (usually defined by the researchers), whereas measures of health-related quality of life include a range of predefined emotional and physical parameters and do not refer to the treatment received. Patients tend to answer satisfaction surveys according to a perception of need, and quality-of-life measures are designed to incorporate value judgments. Because resource-allocation decisions are also based on value judgments, it is important to be sensitive to quality-of-life outcomes. However, quality of life and patient satisfaction are not mutually exclusive, and balance is needed when considering these related outcomes.

Another limitation in the use of utility measures was the lack of available quality-of-life data in 3 of the models. To calculate quality of life for eTools (diabetes) and in-home care (CHF), an average quality of life was applied to the cohort, and disease-specific reductions in quality of life were applied to episodes of hospitalization. Therefore, when the effect of each intervention on hospitalization rates was varied in each analysis, quality of life changed accordingly (in contrast to quality of life in studies that reported pre- and post-utility measures). Estimates of utility for patients with varying levels of continuity of care were obtained from the published economic literature rather than from the EBA.

When evaluating interventions in which there is a survival difference, the horizon of the analysis has implications for estimates of effectiveness. If an intervention is found to reduce mortality, any horizon that is less than the lifetime of the patient will underestimate total QALYs gained. Because of limitations in the data, we chose not to extrapolate our survival estimates beyond 5 years. Of our interventions, only those in the CHF populations included an estimate of mortality. Therefore, benefit is underestimated in this group.

As in the clinical trials, continuity of care was calculated as the ratio of visits to the same primary care provider over the total number of primary care consultations. This meant that, for physicians practising in a group, return visits were not captured in the index.

The findings indicate that most patients with diabetes and COPD had low continuity of care. However, a 2008 ICES paper reported that 90% to 95% of people with chronic disease had high continuity of care. (30;32) The reason for this discrepancy is unclear. It could be due to the fact that our cohort involved a group of patients with established chronic disease, whereas the ICES report included a random sample of the population with unnamed “high impact/high prevalence conditions.” Nevertheless, sensitivity analyses using the baseline distribution from the ICES report did not influence the results.

Conclusions

Of 70 potential cost-effectiveness analyses, 8 met our inclusion criteria. After calculating the total cost associated with each chronic disease cohort and applying the estimates of clinical effect identified in the evidence-based analyses (EBAs), all interventions were found to be cost-saving. On the basis of quality-of-life data identified in the EBAs and published literature, all were also found to result in a greater gain in quality-adjusted life years than usual care.

The incremental lifetime health care cost per patient receving the intervention versus no intervention resulted in cost savings per patient in the base case. These savings were mainly attributable to a reduction in hospitalizations or emergency department visits as a result of the intervention.

However, this analysis was subject to many important limitations, the most important of which was the clinical evidence base. Most of these analyses were based on studies of moderate to very low quality with indirect applicability to Ontario. The nature of the method and sources make it difficult to generalize the results of this study beyond the populations included in each analysis. Thus the results should be viewed with caution.

Acknowledgements

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
Onil Bhattacharrya	Clinician Scientist	Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

HEED was not available, and so was not searched for any of the topics.

Advanced Access – Economic Search
2012Jan19

Search date: January 17th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present; English; NOT comments, editorials, letters (conference abstracts in EMBASE)

Database: Ovid MEDLINE(R) <1946 to present>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 16, 2012>, EMBASE <1980 to 2012 Week 02>
Search Strategy:

Search run 2012Jan17

#	Searches	Results
1	exp Coronary Artery Disease/	211661
2	exp Myocardial Infarction/ use prmz	133323
3	exp heart infarction/ use emez	216531
4	(coronary artery disease or cad or heart attack*).ti.	45038
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149431
6	or/1-5	539191
7	exp Atrial Fibrillation/ use prmz	27983
8	exp heart atrium fibrillation/ use emez	55357
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73312
10	or/7-9	99156
11	exp heart failure/	300198
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234158
13	or/11-12	381094
14	exp Stroke/	177630
15	exp Ischemic Attack, Transient/ use prmz	16352
16	exp transient ischemic attack/ use emez	19630
17	exp stroke patient/ use emez	5626
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	100861
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	280544
20	or/14-19	390765
21	exp Diabetes Mellitus, Type 2/ use prmz	67951
22	exp non insulin dependent diabetes mellitus/ use emez	101327
23	exp diabetic patient/ use emez	12828
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	763708
25	or/21-24	788575
26	exp Skin Ulcer/	71941

27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28642
28	(decubitus or bedsore*).ti,ab.	8514
29	or/26-28	90619
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	16974
31	exp chronic obstructive lung disease/ use emez	54556
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54291
33	(copd or coad).ti,ab.	45422
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37370
36	exp chronic bronchitis/ use emez	6962
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50776
38	or/30-37	158905
39	exp Chronic Disease/	340391
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	219542
41	or/39-40	505687
42	exp Comorbidity/	143130
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	202862
44	or/42-43	283382
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2817928
46	"Appointments and Schedules"/ use prmz	6211
47	Health Services Accessibility/ use prmz	41879
48	Patient-Centered Care/ use prmz	7809
49	((patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) adj2 (access* or appointment* or booking? or schedul*)).ti,ab.	216
50	((advanced adj2 access*) or (enhanc* adj access*) or ((advanc* access or open access) adj (appointment* or schedul*))).ti,ab.	1612
51	*Health Care Access/ use emez	4285
52	Patient Scheduling/ use emez	734
53	or/46-49,51-52	60274
54	(45 and 53) or 50	6184
55	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2921591
56	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5791752
57	or/55-56	5896259
58	54 not 57	5622
59	*Economics/ use prmz	10087
60	*Economics, Medical/ use prmz	5122
61	*Economics, Pharmaceutical/ use prmz	1203
62	exp "Costs and Cost Analysis"/ use prmz	160072
63	exp Models, Economic/ use prmz	8268
64	Markov Chains/ use prmz	7501
65	Monte Carlo Method/ use prmz	16039
66	Quality-Adjusted Life Years/ use prmz	5264

67	"Value of Life"/ use prmz	5190
68	Decision Trees/ use prmz	7745
69	exp "Health Care Cost"/ use emez	168886
70	exp *Health Economics/ use emez	166475
71	exp Economic Evaluation/ use emez	176160
72	Quality Adjusted Life Year/ use emez	8255
73	*Statistical Model/ use emez	11107
74	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	204987
75	(decision adj1 (tree* or analy* or model*)).ti,ab.	18027
76	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7799
77	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	35632
78	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42568
79	(economic evaluation* or economic review*).ti,ab.	12039
80	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114063
81	(markov* or monte carlo).ti,ab.	61885
82	or/59-81	800342
83	58 and 82	714
84	limit 83 to english language	703
85	remove duplicates from 84	642
86	limit 85 to yr="2002 -Current"	489

PubMed

Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
OR/
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
OR/
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
OR/
Stroke[mh]
Ischemic Attack, Transient[mh]
stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
OR/
Diabetes Mellitus, Type 2[mh]
diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
OR/
Skin Ulcer[mh]
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decubitus[tiab] OR bedsore*[tiab]
OR/
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]

chronic airflow obstruction[tiab]
Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
OR/
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
OR/
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/
OR/
"Appointments and Schedules"[mh]
Health Services Accessibility[mh]
Patient-Centered Care[mh]
((patient-driven[tiab] OR patientdriven[tiab] OR patient-centered[tiab] OR patientcentered[tiab] OR patient-centred[tiab] OR patientcentred[tiab] OR same-day[tiab] OR sameday[tiab]) AND (access*[tiab] OR appointment*[tiab] OR booking*[tiab] OR schedul*[tiab]))
OR/
advanced access*[tiab] OR enhanc* access*[tiab] OR ((advanc* access[tiab] OR open access[tiab]) AND (appointment*[tiab] OR schedul*[tiab]))

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] ORcost* effectiveness[tiab] OR cost* efficac*[tiab] ORcost* benefit*[tiab] ORcost* consequence*[tiab] ORcost* analy*[tiab] ORcost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to 2002-present & English

Search run 2012Jan18

Search	Query	Items found
#64	Search **(#36 AND #55 AND #60 AND #62) OR (#55 AND #61 AND #62)** Limits: **English, Publication Date from 2002 to 2012**	40
#63	Search **(#36 AND #55 AND #60 AND #62) OR (#55 AND #61 AND #62)**	42
#62	Search **publisher[sb] OR in process[sb] OR pubmednotmedline[sb]**	1680294
#61	Search **advanced access*[tiab] OR enhanc* access*[tiab] OR ((advanc* access[tiab] OR open access[tiab]) AND (appointment*[tiab] OR schedul*[tiab]))**	15809
#60	Search **#56 OR #57 OR #58 OR #59**	91453

Search	Query	Items found
#59	Search **((patient-driven[tiab] OR patientdriven[tiab] OR patient-centered[tiab] OR patientcentered[tiab] OR patient-centred[tiab] OR patientcentred[tiab] OR same-day[tiab] OR sameday[tiab]) AND (access*[tiab] OR appointment*[tiab] OR booking*[tiab] OR schedul*[tiab]))**	1088
#58	Search **Patient-Centered Care[mh]**	7814
#57	Search **Health Services Accessibility[mh]**	72428
#56	Search **"Appointments and Schedules"[mh]**	12797
#55	Search **#37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54**	288827
#54	Search **markov*[tiab] OR monte carlo[tiab]**	33823
#53	Search **cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]**	6242
#52	Search **economic evaluation*[tiab] OR economic review*[tiab]**	5311
#51	Search **unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]**	19018
#50	Search **sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]**	15950
#49	Search **decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]**	8142
#48	Search **econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]**	95227
#47	Search **Decision Trees[mh]**	7742
#46	Search **"Value of Life"[mh]**	5190
#45	Search **Quality-Adjusted Life Years[mh]**	5245
#44	Search **Monte Carlo Method[mh]**	16020
#42	Search **Markov Chains[mh]**	7484
#41	Search **Models, Economic[mh]**	8263
#40	Search **"Costs and Cost Analysis"[mh]**	159980
#39	Search **Economics, Pharmaceutical[MAJR:NOEXP]**	1202
#38	Search **Economics, Medical[MAJR:NOEXP]**	5144
#37	Search **Economics[MAJR:NOEXP]**	10084
#36	Search **#5 OR #8 OR #11 OR #15 OR #18 OR #22 OR #29 OR #32 OR #35**	1680055
#35	Search **#33 OR #34**	401374
#34	Search **comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))**	367247
#33	Search **Comorbidity[mh]**	52132
#32	Search **#30 OR #31**	424945
#31	Search **(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])**	276652
#30	Search **Chronic Disease[mh]**	202004
#29	Search **#23 OR #24 OR #25 OR #26 OR #27 OR #28**	68130
#28	Search **chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]**	25491
#27	Search **Emphysema[mh]**	22452
#26	Search **chronic airflow obstruction[tiab]**	500
#25	Search **copd[tiab] OR coad[tiab]**	19861
#24	Search **chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])**	25329
#23	Search **Pulmonary Disease, Chronic Obstructive[mh]**	16987

Search	Query	Items found
#22	Search **#19 OR #20 OR #21**	63955
#21	Search **decubitus[tiab] OR bedsore*[tiab]**	3926
#20	Search **(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])**	39591
#19	Search **Skin Ulcer[mh]**	31354
#18	Search **#16 OR #17**	352235
#17	Search **diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]**	345642
#16	Search **Diabetes Mellitus, Type 2[mh]**	67907
#15	Search **#12 OR #13 OR #14**	157624
#14	Search **stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]**	124378
#13	Search **Ischemic Attack, Transient[mh]**	16351
#12	Search **Stroke[mh]**	66792
#11	Search **#9 OR #10**	157370
#10	Search **(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])**	135119
#9	Search **Heart Failure[mh]**	74920
#8	Search **#6 OR #7**	39905
#7	Search **(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]**	32918
#6	Search **Atrial Fibrillation[mh]**	28044
#5	Search **#1 OR #2 OR #3 OR #4**	285625
#4	Search **(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])**	74988
#3	Search **coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]**	20571
#2	Search **Myocardial Infarction[mh]**	133662
#1	Search **Coronary Artery Disease[mh]**	166906

Wiley Cochrane
Search run 2012Jan19

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585

#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	(Chronic Disease):ti	4464
#23	((chronic* NEAR/2 disease*) or (chronic* NEAR/2 ill*)):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	61123
#27	MeSH descriptor **Appointments and Schedules**, this term only	295
#28	MeSH descriptor **Health Services Accessibility**, this term only	410
#29	MeSH descriptor **Patient-Centered Care** explode all trees	203
#30	(patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) NEAR/2 (access* or appointment* or booking? or schedul*):ti,ab,kw	13
#31	(advanced NEAR/2 access*) or (enhanc* NEXT access*) or ((advanc* access or open access) NEXT (appointment* or schedul*)):ti,ab,kw	26
#32	(#27 OR #28 OR #29 OR #30)	902
#33	((#26 AND #32) OR #31)	119
#34	((#26 AND #32) OR #31), from 2002 to 2012	8

Centre for Reviews and Dissemination
Search run 2012Jan19

Search	Hits	
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	211
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	223
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	167
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	279
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549

10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	621
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1220
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	218
19	(copd or coad):TI	107
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	249
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4644
28	MeSH DESCRIPTOR Appointments and Schedules EXPLODE ALL TREES	84
29	MeSH DESCRIPTOR Health Services Accessibility EXPLODE ALL TREES	197
30	MeSH DESCRIPTOR Patient-Centered Care EXPLODE ALL TREES	40
31	((patient-driven or patientdriven or patient-centered or patientcentered or patient-centred or patientcentred or same-day or sameday) adj2 (access* or appointment* or booking? or schedul*)):TI	2
32	((advanced adj2 access*) or (enhanc* adj1 access*) or ((advanc* access or open access) adj1 (appointment* or schedul*))):TI	2
33	#28 OR #29 OR #30 OR #31	310
34	#27 AND #33	24
35	#32 OR #34	26

Nursing – Economic Search
2012Aug15

Search date: August 15th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, OviD EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)1946 to Present, EMBASE <1980 to 2012 Week 32>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	229118
2	exp Myocardial Infarction/ use prmz	137438
3	exp heart infarction/ use emez	231179
4	(coronary artery disease or cad or heart attack*).ti.	47837
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	156317
6	or/1-5	572283
7	exp Atrial Fibrillation/ use prmz	29796
8	exp heart atrium fibrillation/ use emez	61196
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	80553
10	or/7-9	108185
11	exp heart failure/	321154
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	252011
13	or/11-12	408033
14	exp Stroke/	192344
15	exp Ischemic Attack, Transient/ use prmz	16799
16	exp transient ischemic attack/ use emez	21128
17	exp stroke patient/ use emez	6274
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	107109
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	305035
20	or/14-19	421423
21	exp Diabetes Mellitus, Type 2/ use prmz	73613
22	exp non insulin dependent diabetes mellitus/ use emez	113928
23	exp diabetic patient/ use emez	15238
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	827576
25	or/21-24	854579
26	exp Skin Ulcer/	76033
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	30732
28	(decubitus or bedsore*).ti,ab.	8898
29	or/26-28	96132
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	18847
31	exp chronic obstructive lung disease/ use emez	59156
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	59336

33	(copd or coad).ti,ab.	50278
34	chronic airflow obstruction.ti,ab.	1090
35	exp Emphysema/	39015
36	exp chronic bronchitis/ use emez	7164
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	52943
38	or/30-37	169570
39	exp Chronic Disease/	358585
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	240358
41	or/39-40	540078
42	exp Comorbidity/	158025
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	227955
44	or/42-43	316167
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	3025391
46	exp nursing discipline/ or exp nurse/ or exp Team Nursing/ or exp nurse attitude/ or exp nurse patient relationship/ or exp doctor nurse relation/ or exp nursing staff/ use emez	346422
47	exp Nursing/ or exp nurse's practice patterns/ or exp nursing, team/ or exp nurses/ or exp nursing staff/ or exp Nurse's Role/ or exp Nurse-Patient Relations/ or exp physician-nurse relations/ or exp Nursing Process/ or exp nursing care/ or exp nursing services/ or exp Nursing Faculty Practice/ use prmz	792843
48	(nurse or nurses or nursing).ti,ab.	624089
49	or/46-48	1019656
50	exp Intermediate Care Facilities/ use prmz	603
51	(intermedia* adj2 care).ti,ab.	2522
52	exp ambulatory care/	78452
53	exp Ambulatory Care Facilities/ use prmz	40981
54	exp ambulatory care nursing/ use emez	9
55	exp Outpatients/ use prmz	7573
56	exp Outpatient Department/ use emez	34390
57	exp outpatient care/ use emez	18565
58	exp Community Health Services/ use prmz	457932
59	exp community care/ use emez	89835
60	exp Community Medicine/	3950
61	exp Subacute Care/ use prmz	714
62	exp General Practice/	126613
63	exp Primary Health Care/	162088
64	exp Physicians, Family/ or exp general practitioners/ or exp Physicians, Primary Care/ use prmz	65809
65	exp general practitioner/ use emez	49880
66	exp family medicine/ use emez	6089
67	exp Group Practice/ use prmz	22352
68	exp Team Nursing/ use emez	28
69	exp Primary Care Nursing/ use prmz	52
70	exp Patient Care Team/ use prmz	50441
71	exp Teamwork/ use emez	9602
72	*Patient Care Management/ use prmz	1311

73	((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)).ti,ab.	352478
74	((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*)).ti,ab.	52649
75	(team* or liaison).ti,ab.	192091
76	((general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nurse* or physician*)).ti,ab.	226044
77	or/50-76	1420221
78	*Economics/ use prmz	10178
79	*Economics, Medical/ use prmz	5163
80	*Economics, Pharmaceutical/ use prmz	1242
81	exp "Costs and Cost Analysis"/ use prmz	166708
82	exp Models, Economic/ use prmz	8787
83	Markov Chains/ use prmz	8188
84	Monte Carlo Method/ use prmz	17300
85	Quality-Adjusted Life Years/ use prmz	5814
86	"Value of Life"/ use prmz	5229
87	Decision Trees/ use prmz	8074
88	exp "Health Care Cost"/ use emez	178191
89	exp *Health Economics/ use emez	175532
90	exp Economic Evaluation/ use emez	186842
91	Quality Adjusted Life Year/ use emez	9437
92	*Statistical Model/ use emez	12546
93	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	217335
94	(decision adj1 (tree* or analy* or model*)).ti,ab.	19795
95	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	8385
96	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	40275
97	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	45977
98	(economic evaluation* or economic review*).ti,ab.	13059
99	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	123458
100	(markov* or monte carlo).ti,ab.	67096
101	or/78-100	846143
102	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	3031884
103	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	6182350
104	or/102-103	6295848
105	101 not 104	749545
106	Meta-Analysis.pt.	35484
107	Meta-Analysis as Topic/ or exp Technology Assessment, Biomedical/	36737
108	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	96595
109	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	9993

110	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	19322
111	(data synthes* or data extraction* or data abstraction*).ti,ab.	24863
112	(handsearch* or hand search*).ti,ab.	9790
113	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	23913
114	(met analy* or metanaly* or health technology assessment* or HTA or HTAs).ti,ab.	5632
115	(meta regression* or metaregression* or mega regression*).ti,ab.	3835
116	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	232371
117	(cochrane or health technology assessment or evidence report).jw.	22629
118	(Meta Analysis or Systematic Review or Biomedical Technology Assessment).sh.	141334
119	(Systematic Review Topic or Meta Analysis Topic).sh.	5857
120	or/106-119	313407
121	45 and 49 and 77 and 105 and 120	139
122	limit 121 to english language	136
123	limit 122 to yr="2002 -Current"	126
124	remove duplicates from 123	95

PubMed

Search	Query	Items found
#16	Search #1 AND #2 AND #5 AND #13 AND #14 AND #15	3
#15	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1776609
#14	Search systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]	212005
#13	Search #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12	1489596
#12	Search (general[tiab] OR family[tiab] OR primary care[tiab] OR community[tiab]) AND (practic*[tiab] OR clinic*[tiab] OR program*[tiab] OR doctor*[tiab] OR nurse*[tiab] OR physician*[tiab])	441737
#11	Search team*[tiab] OR liaison[tiab]	83975
#10	Search (transitional[tiab] OR multidisciplin*[tiab] OR multifacet*[tiab] OR multi-disciplin*[tiab] OR multi-facet*[tiab] OR cooperat*[tiab] OR co-operat*[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR collaborat*[tiab] OR multispecial*[tiab] OR multi-special*[tiab] OR share[tiab] OR sharing[tiab] OR shared[tiab] OR integrat*[tiab] OR joint[tiab] OR multi-modal[tiab] OR multimodal[tiab]) AND (care[tiab] OR team*[tiab])	102965
#9	Search (primary[tiab] OR family[tiab] OR community[tiab] OR outpatient*[tiab] OR ambulatory[tiab]) AND (care*[tiab] OR physician*[tiab] OR nurs*[tiab] OR service*[tiab] OR clinic*[tiab] OR facility[tiab] OR facilities[tiab])	572846
#8	Search intermedia*[tiab] AND care[tiab]	4988
#7	Search Physicians, Family[mh] OR General Practitioners[mh] OR Physicians, Primary Care[mh] OR Group Practice[mh] OR Primary Care Nursing[mh] OR Patient Care Team[mh] OR Patient Care Management[MAJR]	313992

Search	Query	Items found
#6	Search Intermediate Care Facilities[mh] OR Ambulatory Care[mh] OR Outpatients[mh] OR Ambulatory Care Facilities[mh] OR Community Health Services[mh] OR Community Medicine[mh] OR Subacute Care[mh] OR General Practice[mh] OR Primary Health Care[mh]	621977
#5	Search #3 OR #4	521843
#4	Search Nurse[tiab] OR nurses[tiab] OR nursing[tiab]	299207
#3	Search Nursing[mh] OR Nurse's Practice Patterns[mh] OR Nursing, Team OR Nurses[mh] OR Nursing Staff[mh] OR Nurse's Role[mh] OR Nurse-Patient Relations[mh] OR Physician-Nurse Relations[mh] OR Nursing Process[mh] OR Nursing Care[mh] OR Nursing Services[mh] OR Nursing Faculty Practice[mh]	406898
#2	Search ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	299301
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))))	1746102

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2279
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7899
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8592
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2185
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2379
#6	MeSH descriptor **Heart Failure** explode all trees	4856

#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5376
#8	MeSH descriptor **Stroke** explode all trees	4074
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	472
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	10042
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	7253
#12	(diabetes or diabetic* or niddm or t2dm):ti	16997
#13	MeSH descriptor **Skin Ulcer** explode all trees	1608
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	679
#15	(decubitus or bedsore*):ti	100
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1835
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2449
#18	(copd or coad):ti	3368
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	92
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1186
#22	MeSH descriptor **Chronic Disease** explode all trees	10062
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1721
#24	MeSH descriptor **Comorbidity** explode all trees	2011
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	664
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	69545
#27	MeSH descriptor **Intermediate Care Facilities** explode all trees	13
#28	(intermedia* NEAR/2 care):ti or (intermedia* NEAR/2 care):ab	96
#29	MeSH descriptor **Ambulatory Care Facilities** explode all trees	1434
#30	MeSH descriptor **Outpatients** explode all trees	694
#31	MeSH descriptor **Community Health Services** explode all trees	20115
#32	MeSH descriptor **Community Medicine** explode all trees	34
#33	MeSH descriptor **Subacute Care** explode all trees	16
#34	MeSH descriptor **General Practice** explode all trees	2121
#35	MeSH descriptor **Primary Health Care** explode all trees	2968
#36	MeSH descriptor **Physicians, Family** explode all trees	446
#37	MeSH descriptor **General Practitioners** explode all trees	33
#38	MeSH descriptor **Physicians, Primary Care** explode all trees	23
#39	MeSH descriptor **Group Practice** explode all trees	380
#40	MeSH descriptor **Primary Care Nursing** explode all trees	1
#41	MeSH descriptor **Patient Care Team** explode all trees	1181
#42	MeSH descriptor **Patient Care Management** explode all trees	13279

#43	((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ti and ((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ab	2123
#44	(transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ti or (transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ab	1128
#45	((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ti or ((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ab	8115
#46	(team* or liaison):ti or (team* or liaison):ab	3223
#47	(#27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46)	39654
#48	(#26 AND #47)	5369
#49	MeSH descriptor **Nurse's Role** explode all trees	270
#50	MeSH descriptor **Nursing** explode all trees	2716
#51	MeSH descriptor **Nurse's Practice Patterns** explode all trees	17
#52	MeSH descriptor **Nurses** explode all trees	830
#53	MeSH descriptor **Nursing, Team** explode all trees	17
#54	MeSH descriptor **Nursing Staff** explode all trees	450
#55	MeSH descriptor **Nurse-Patient Relations** explode all trees	269
#56	MeSH descriptor **Physician-Nurse Relations** explode all trees	19
#57	MeSH descriptor **Nursing Process** explode all trees	1741
#58	MeSH descriptor **Nursing Care** explode all trees	1447
#59	MeSH descriptor **Nursing Services** explode all trees	1380
#60	MeSH descriptor **Nursing Faculty Practice** explode all trees	4
#61	(nurse or nurses or nursing):ti and (nurse or nurses or nursing):ab	2323
#62	(#49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61)	6624
#63	(#48 AND #62)	878
#64	(#48 AND #62)	84

=15 results (2002-current; English) NHSEED

Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	313
2	(coronary artery disease or cad or heart attack*):TI	236
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	238
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	290
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0

6	((atrial or atrium or auricular) adj1 fibrillation*):TI	192
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	510
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	304
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	708
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	43
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	695
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	664
13	(diabetes or diabetic* or niddm or t2dm):TI	1357
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	283
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	81
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	298
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	240
19	(copd or coad):TI	123
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	19
22	((chronic adj2 bronchitis) or emphysema):TI	50
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	794
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	274
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	181
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	29
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	5255
28	MeSH DESCRIPTOR nursing EXPLODE ALL TREES	321
29	MeSH DESCRIPTOR Nurse-Patient Relations EXPLODE ALL TREES	21
30	MeSH DESCRIPTOR nursing staff EXPLODE ALL TREES	45
31	MeSH DESCRIPTOR nurses EXPLODE ALL TREES	121
32	MeSH DESCRIPTOR nursing, team EXPLODE ALL TREES	3
33	MeSH DESCRIPTOR physician-nurse relations EXPLODE ALL TREES	3
34	MeSH DESCRIPTOR Nursing Process EXPLODE ALL TREES	150

35	MeSH DESCRIPTOR Nursing care EXPLODE ALL TREES	219
36	MeSH DESCRIPTOR nursing services EXPLODE ALL TREES	284
37	MeSH DESCRIPTOR nursing faculty practice EXPLODE ALL TREES	0
38	MeSH DESCRIPTOR Nurse's Role EXPLODE ALL TREES	64
39	(nurse or nurses or nursing)	3393
40	#28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39	3556
41	MeSH DESCRIPTOR Intermediate Care Facilities EXPLODE ALL TREES	4
42	(intermedia* adj2 care)	40
43	MeSH DESCRIPTOR ambulatory care EXPLODE ALL TREES	350
44	MeSH DESCRIPTOR Ambulatory Care Facilities EXPLODE ALL TREES	207
45	MeSH DESCRIPTOR Outpatients EXPLODE ALL TREES	76
46	MeSH DESCRIPTOR Community Health Services EXPLODE ALL TREES	4191
47	MeSH DESCRIPTOR Community Medicine EXPLODE ALL TREES	3
48	MeSH DESCRIPTOR Subacute Care EXPLODE ALL TREES	7
49	MeSH DESCRIPTOR Primary Health Care EXPLODE ALL TREES	691
50	MeSH DESCRIPTOR Physicians, Family EXPLODE ALL TREES	50
51	MeSH DESCRIPTOR Group Practice EXPLODE ALL TREES	65
52	MeSH DESCRIPTOR Patient Care Team EXPLODE ALL TREES	213
53	MeSH DESCRIPTOR Patient Care Management EXPLODE ALL TREES	2456
54	(((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))) OR (((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*))) OR (team* or liaison) OR (general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nuse* or physician*)))	2158
55	#41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54	7685
56	#27 AND #40 AND #55	301

=113 results (2002-current; English) NHSEED

Cardiac Rehab – Economic Search
2012Feb14

Search date: February 14th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present (SR/MA/HTA filter) & 2010-present primary studies; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database**: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)**1946 to Present, EMBASE <1980 to 2012 Week 06>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212867
2	exp Myocardial Infarction/ use prmz	134000
3	exp heart infarction/ use emez	217674
4	(coronary artery disease or cad or heart attack*).ti.	45245
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149895
6	or/1-5	541796
7	exp heart failure/	302389
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	235747
9	or/7-8	383648
10	exp Chronic Disease/	341731
11	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	221492
12	or/10-11	508487
13	exp Comorbidity/	144447
14	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	205122
15	or/13-14	286249
16	6 or 9 or 12 or 15	1592562
17	*Rehabilitation/ use prmz	12293
18	exp Dance Therapy/ use prmz	169
19	exp Early Ambulation/ use prmz	1706
20	exp Exercise Therapy/ use prmz	24263
21	exp Occupational Therapy/ use prmz	9225
22	exp Recreation Therapy/ use prmz	16
23	*Rehabilitation/ use emez	21295
24	Athletic Rehabilitation/ use emez	71
25	Community Based Rehabilitation/ use emez	318
26	Community Reintegration/ use emez	184
27	Functional Assessment/ use emez	40338
28	Functional Training/ use emez	358
29	Geriatric Rehabilitation/ use emez	318
30	Home Rehabilitation/ use emez	186
31	Muscle Training/ use emez	4058
32	Occupational Therapy/ use emez	14406
33	Recreational Therapy/ use emez	138
34	Rejuvenation/ use emez	1996
35	Exercise/ use emez	144749
36	Kinesiotherapy/ use emez	19109
37	Physiotherapy/ use emez	43028

38	exp Rehabilitation Nursing/ use emez	864
39	exp Physical Therapy Modalities/ use prmz	108458
40	exp Rehabilitation Centers/ use prmz	10803
41	exp rehabilitation center/ or exp Rehabilitation Care/ or exp rehabilitation medicine/ use emez	28155
42	exp physical medicine/ use emez	328855
43	(rehabilitat* or (physical* adj (therap* or train*)) or (train* adj (aerobic* or resistance or strength*)) or (exercise* adj (therap* or train*)) or kinesiotherap* or physiotherap*).ti.	121737
44	or/17-43	737039
45	Heart Rehabilitation/ use emez	4143
46	((cardiac* or coronary or heart* or myocardial) adj3 rehab*).ti.	6643
47	or/45-46	8826
48	(16 and 44) or 47	79621
49	*Economics/ use prmz	10096
50	*Economics, Medical/ use prmz	5122
51	*Economics, Pharmaceutical/ use prmz	1204
52	exp "Costs and Cost Analysis"/ use prmz	160841
53	exp Models, Economic/ use prmz	8328
54	Markov Chains/ use prmz	7589
55	Monte Carlo Method/ use prmz	16225
56	Quality-Adjusted Life Years/ use prmz	5335
57	"Value of Life"/ use prmz	5197
58	Decision Trees/ use prmz	7814
59	exp "Health Care Cost"/ use emez	169779
60	exp *Health Economics/ use emez	166975
61	exp Economic Evaluation/ use emez	177072
62	Quality Adjusted Life Year/ use emez	8345
63	*Statistical Model/ use emez	11179
64	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	206032
65	(decision adj1 (tree* or analy* or model*)).ti,ab.	18196
66	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7846
67	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	36037
68	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42857
69	(economic evaluation* or economic review*).ti,ab.	12105
70	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114860
71	(markov* or monte carlo).ti,ab.	62381
72	or/49-71	804490
73	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2932274
74	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5827934
75	or/73-74	5933590
76	Meta-Analysis.pt.	31464
77	Meta-Analysis as Topic/ or exp Technology Assessment, Biomedical/	34121

78	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	84366
79	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	9315
80	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	17144
81	(data synthes* or data extraction* or data abstraction*).ti,ab.	22797
82	(handsearch* or hand search*).ti,ab.	8958
83	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	22092
84	(met analy* or metanaly* or health technology assessment* or HTA or HTAs).ti,ab.	5050
85	(meta regression* or metaregression* or mega regression*).ti,ab.	3202
86	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	207910
87	(cochrane or health technology assessment or evidence report).jw.	21051
88	(Meta Analysis or Systematic Review or Biomedical Technology Assessment).sh.	127577
89	(Systematic Review Topic or Meta Analysis Topic).sh.	3909
90	or/76-89	283909
91	48 and 72 and 90	361
92	limit 91 to english language	343
93	limit 92 to yr="2002 -Current"	300
94	remove duplicates from 93	273
95	48 and 72	3512
96	95 not 75	3045
97	limit 96 to english language	2669
98	limit 97 to yr="2010 -Current"	470
99	remove duplicates from 98	434
100	94 or 99	652

PubMed

Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/

AND

Rehabilitation[majr:noexp]
Dance Therapy[mh]
Early Ambulation[mh]
Exercise Therapy[mh]
Occupational Therapy[mh]
Recreation Therapy[mh]
Physical Therapy Modalities[mh]
Rehabilitation Centers[mh]
rehabilitat*[ti] OR physical* therap*[ti] OR physical* train*[ti] OR (train*[ti] AND (aerobic*[ti] OR resistance[ti] OR strength*[ti])) OR (exercise*[ti] AND (therap*[ti] OR train*[ti])) or kinesiotherap*[ti] OR physiotherap*[ti]

OR/
(cardiac*[ti] OR coronary[ti] OR heart*[ti] OR myocardial[ti]) AND rehab*[ti]

AND

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] ORcost* effectiveness[tiab] OR cost* efficac*[tiab] ORcost* benefit*[tiab] ORcost* consequence*[tiab] ORcost* analy*[tiab] ORcost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

AND

systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

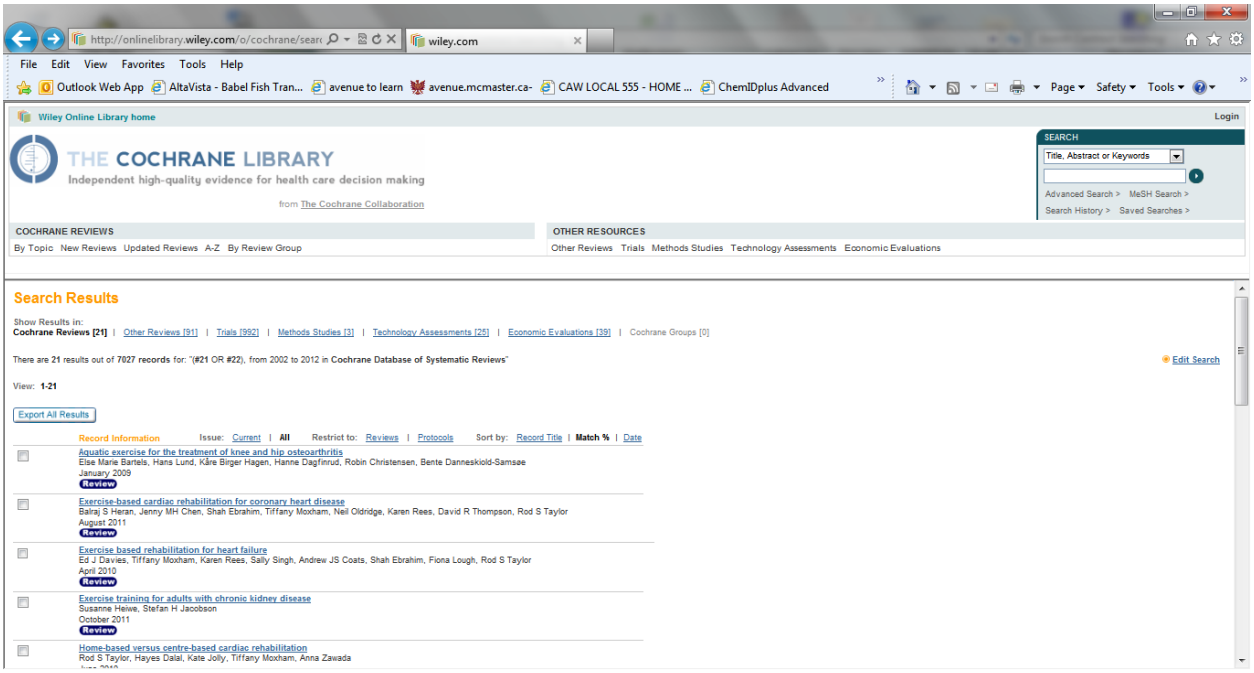
Limit to English

Search	Query	Items found
#45	Search #23 AND #41 AND #43 Limits: English	3
#44	Search #23 AND #41 AND #43	4
#43	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1690740
#42	Search systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]	198866
#41	Search #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40	290294
#40	Search markov*[tiab] OR monte carlo[tiab]	34080
#39	Search cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]	6294
#38	Search economic evaluation*[tiab] OR economic review*[tiab]	5350

Search	Query	Items found
#37	Search unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]	19151
#36	Search sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]	16146
#35	Search decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]	8210
#34	Search econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]	95728
#33	Search Decision Trees[mh]	7797
#32	Search "Value of Life"[mh]	5194
#31	Search Quality-Adjusted Life Years[mh]	5306
#30	Search Monte Carlo Method[mh]	16155
#29	Search Markov Chains[mh]	7553
#28	Search Models, Economic[mh]	8315
#27	Search "Costs and Cost Analysis"[mh]	160634
#26	Search Economics, Pharmaceutical[MAJR:NOEXP]	1203
#25	Search Economics, Medical[MAJR:NOEXP]	5145
#24	Search Economics[MAJR:NOEXP]	10093
#23	Search (#11 AND #21) OR #22	18432
#22	Search (cardiac*[ti] OR coronary[ti] OR heart*[ti] OR myocardial[ti]) AND rehab*[ti]	4071
#21	Search #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20	155810
#20	Search rehabilitat*[ti] OR physical* therap*[ti] OR physical* train*[ti] OR (train*[ti] AND (aerobic*[ti] OR resistance[ti] OR strength*[ti])) OR (exercise*[ti] AND (therap*[ti] OR train*[ti])) or kinesiotherap*[ti] OR physiotherap*[ti]	25664
#19	Search Rehabilitation Centers[mh]	10785
#18	Search Physical Therapy Modalities[mh]	108879
#17	Search Recreation Therapy[mh]	16
#16	Search Occupational Therapy[mh]	9257
#15	Search Exercise Therapy[mh]	24265
#14	Search Early Ambulation[mh]	1671
#13	Search Dance Therapy[mh]	169
#12	Search Rehabilitation[majr:noexp]	12429
#11	Search #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10	1168979
#10	Search comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))	369969
#9	Search Comorbidity[mh]	52636
#8	Search (chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])	278310
#7	Search Chronic Disease[mh]	202656
#6	Search (myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])	135803
#5	Search Heart Failure[mh]	75294
#1	Search (myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])	75195
#4	Search coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]	20680
#3	Search Myocardial Infarction[mh]	134110
#2	Search Coronary Artery Disease[mh]	167369

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Heart Failure** explode all trees	4710
#5	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#6	MeSH descriptor **Chronic Disease** explode all trees	9875
#7	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#8	MeSH descriptor **Comorbidity** explode all trees	1941
#9	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#10	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9)	30722
#11	MeSH descriptor **Rehabilitation**, this term only	259
#12	MeSH descriptor **Dance Therapy** explode all trees	23
#13	MeSH descriptor **Early Ambulation** explode all trees	255
#14	MeSH descriptor **Exercise Therapy** explode all trees	5072
#15	MeSH descriptor **Occupational Therapy** explode all trees	441
#16	MeSH descriptor **Recreation Therapy** explode all trees	4
#17	MeSH descriptor **Physical Therapy Modalities** explode all trees	12056
#18	MeSH descriptor **Rehabilitation Centers** explode all trees	495
#19	(rehabilitat*):ti or (physical* NEXT (therap* OR train*)):ti or (train* NEXT (aerobic* OR resistance OR strength*)):ti or (exercise* NEXT (therap* OR train*)):ti or (kinesiotherap* OR physiotherap*):ti	7131
#20	(#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19)	18066
#21	(#10 AND #20)	1685
#22	(cardiac* OR coronary OR heart* OR myocardial) NEAR/3 rehab*:ti	400
#23	(#21 OR #22), from 2002 to 2012	1171



Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	283
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atherosclerosis* or arteriosclerosis* or infarct*)):TI	225
4	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	479
5	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	283
6	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	753
7	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	253
8	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	158
9	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
10	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9	2128
11	MeSH DESCRIPTOR Rehabilitation	87
12	MeSH DESCRIPTOR Dance Therapy EXPLODE ALL TREES	1
13	MeSH DESCRIPTOR Early Ambulation EXPLODE ALL TREES	22
14	MeSH DESCRIPTOR Exercise Therapy EXPLODE ALL TREES	555
15	MeSH DESCRIPTOR Occupational Therapy EXPLODE ALL TREES	65
16	MeSH DESCRIPTOR Physical Therapy Modalities EXPLODE ALL TREES	1467

17	MeSH DESCRIPTOR Rehabilitation Centers EXPLODE ALL TREES	69
18	(rehabilitat*):TI OR (physical* adj (therap* or train*)):TI OR (train* adj (aerobic* or resistance or strength*)):TI OR (exercise* adj (therap* or train*)):TI OR (kinesiotherap* or physiotherap*):TI	699
19	#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18	1966
20	((cardiac* or coronary or heart* or myocardial) adj3 rehab*):TI	36
21	#10 AND #19	171
22	#20 OR #21	196
23	* FROM 2002 TO 2012	36226
24	#22 AND #23	172

Continuity of Care – Economic Search
2012Jan19

Search date: January 19th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination (HTA & NHSEED)

Limits: 2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database: Ovid MEDLINE(R) <1946 to January Week 2>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 18, 2012>, EMBASE <1980 to 2012 Week 02>
Search Strategy:

Search run 2012Jan19

#	Searches	Results
1	exp Coronary Artery Disease/	211683
2	exp Myocardial Infarction/ use prmz	133477
3	exp heart infarction/ use emez	216531
4	(coronary artery disease or cad or heart attack*).ti.	45038
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149415
6	or/1-5	539278
7	exp Atrial Fibrillation/ use prmz	28045
8	exp heart atrium fibrillation/ use emez	55357
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73301
10	or/7-9	99152
11	exp heart failure/	300244
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234111
13	or/11-12	381055
14	exp Stroke/	177671
15	exp Ischemic Attack, Transient/ use prmz	16364
16	exp transient ischemic attack/ use emez	19630
17	exp stroke patient/ use emez	5626
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	100872

19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	280505
20	or/14-19	390735
21	exp Diabetes Mellitus, Type 2/ use prmz	68071
22	exp non insulin dependent diabetes mellitus/ use emez	101327
23	exp diabetic patient/ use emez	12828
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	763637
25	or/21-24	788513
26	exp Skin Ulcer/	71958
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28634
28	(decubitus or bedsore*).ti,ab.	8517
29	or/26-28	90626
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	17004
31	exp chronic obstructive lung disease/ use emez	54556
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54290
33	(copd or coad).ti,ab.	45419
34	chronic airflow obstruction.ti,ab.	1062
35	exp Emphysema/	37372
36	exp chronic bronchitis/ use emez	6962
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50775
38	or/30-37	158909
39	exp Chronic Disease/	340455
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	219548
41	or/39-40	505746
42	exp Comorbidity/	143174
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	202840
44	or/42-43	283385
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2817908
46	Continuity of Patient Care/ use prmz	12345
47	"Referral and Consultation"/ use prmz	45944
48	(((continuity or continuum) adj5 (care or health care or healthcare or in-patient? or inpatient? or patient? or physician? or provider? or out-patient? or outpatient? or visit?)) or continuity-of-care or continuous care or continuous health care or continuous healthcare).ti,ab.	16205
49	((patient-physician relation* or physician-patient relation* or patient relation?) and (continuous* or length or time)).mp.	15487
50	*Patient Care/ use emez	36214
51	*Patient Referral/ use emez	11098
52	or/46-51	130598
53	*Economics/ use prmz	10087
54	*Economics, Medical/ use prmz	5122
55	*Economics, Pharmaceutical/ use prmz	1203
56	exp "Costs and Cost Analysis"/ use prmz	160206
57	exp Models, Economic/ use prmz	8274

58	Markov Chains/ use prmz	7519
59	Monte Carlo Method/ use prmz	16060
60	Quality-Adjusted Life Years/ use prmz	5271
61	"Value of Life"/ use prmz	5190
62	Decision Trees/ use prmz	7752
63	exp "Health Care Cost"/ use emez	168886
64	exp *Health Economics/ use emez	166475
65	exp Economic Evaluation/ use emez	176160
66	Quality Adjusted Life Year/ use emez	8255
67	*Statistical Model/ use emez	11107
68	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	204978
69	(decision adj1 (tree* or analy* or model*)).ti,ab.	18028
70	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7800
71	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	35630
72	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42556
73	(economic evaluation* or economic review*).ti,ab.	12038
74	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114050
75	(markov* or monte carlo).ti,ab.	61882
76	or/53-75	800409
77	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2921704
78	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5791799
79	or/77-78	5896307
80	45 and 52 and 76	1305
81	80 not 79	1198
82	limit 81 to english language	1102
83	limit 82 to yr="2002 -Current"	694
84	remove duplicates from 83	623

PubMed
Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
OR/
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
OR/
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
OR/
Stroke[mh]
Ischemic Attack, Transient[mh]
stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
OR/
Diabetes Mellitus, Type 2[mh]

diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
OR/
Skin Ulcer[mh]
(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])
decubitus[tiab] OR bedsore*[tiab]
OR/
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]
chronic airflow obstruction[tiab]
Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
OR/
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
OR/
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/
OR/

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

Continuity of Patient Care[mh]
"Referral and Consultation"[mh]
((continuity[tiab] OR continuum[tiab]) AND (care[tiab] OR health care[tiab] OR healthcare[tiab] OR in-patient*[tiab] OR inpatient*[tiab] OR patient*[tiab] OR physician*[tiab] OR provider*[tiab] OR out-patient*[tiab] OR outpatient*[tiab] OR visit*[tiab])) OR continuity-of-care[tiab] OR continuous care[tiab] OR continuous health care[tiab] OR continuous healthcare[tiab]
((patient-physician relation*[tiab] OR physician-patient relation*[tiab] OR patient relation*[tiab]) AND (continuous*[tiab] OR length OR time[tiab]))

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to 2002-present & English

Search run 2012Jan19

Search	Query	Items found
#9	Search #1 AND #6 AND #7 Limits: English, Publication Date from 2002 to 2012	3
#8	Search #1 AND #6 AND #7	4
#7	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1682875
#6	Search #2 OR #3 OR #4 OR #5	76103
#5	Search ((patient-physician relation*[tiab] OR physician-patient relation*[tiab] OR patient relation*[tiab]) AND (continuous*[tiab] OR length OR time[tiab]))	912
#4	Search ((continuity[tiab] OR continuum[tiab]) AND (care[tiab] OR health care[tiab] OR healthcare[tiab] OR in-patient*[tiab] OR inpatient*[tiab] OR patient*[tiab] OR physician*[tiab] OR provider*[tiab] OR out-patient*[tiab] OR outpatient*[tiab] OR visit*[tiab])) OR continuity-of-care[tiab] OR continuous care[tiab] OR continuous health care[tiab] OR continuous healthcare[tiab]	16418
#3	Search "Referral and Consultation"[mh]	50440
#2	Search Continuity of Patient Care[mh]	12348
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atherosclerosis*[ti] OR arteriosclerosis*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))))) AND ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	

Wiley Cochrane
Search run 2012Jan19

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atherosclero* or arteriosclero* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310

#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	(Chronic Disease):ti	4464
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR (multiple NEAR/2 (condition* OR disease* OR patient*))):ti	1535
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	61998
#27	MeSH descriptor **Continuity of Patient Care** explode all trees	418
#28	MeSH descriptor **Referral and Consultation** explode all trees	1474
#29	((continuity OR continuum) NEAR/5 (care OR "health care" OR healthcare OR in-patient* OR inpatient* OR patient* OR physician* OR provider* OR out-patient* OR outpatient* OR visit*)) OR "continuity-of-care" OR "continuous care" OR "continuous health care" OR "continuous healthcare":ti,ab,kw or ((patient-physician relation* OR physician-patient relation* OR patient relation?) AND (continuous* OR length OR time)):ti,ab,kw	954
#30	(#27 OR #28 OR #29)	2371
#31	(#26 AND #30), from 2002 to 2011	183
#32	(#26 AND #30), from 2002 to 2012(NHSEED)	14
#33	(#26 AND #30), from 2002 to 2012(HTA)	8

Centre for Reviews and Dissemination
Search run 2012Jan19

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	211

3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	223
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	167
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	279
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	621
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1220
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	218
19	(copd or coad):TI	107
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	249
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4644
28	MeSH DESCRIPTOR Continuity of Patient Care EXPLODE ALL TREES	72
29	MeSH DESCRIPTOR Referral and Consultation EXPLODE ALL TREES	278
30	(((continuity OR continuum) adj5 (care OR health care OR healthcare OR in-patient* OR inpatient* OR patient* OR physician* OR provider* OR out-patient* OR outpatient* OR	10

	visit*)) OR continuity-of-care OR continuous care OR continuous health care OR continuous healthcare):TI OR ((patient-physician relation* OR physician-patient relation* OR patient relation?) AND (continuous* OR length OR time)):TI	
31	#28 OR #29 OR #30	342
32	#27 AND #31	43

Depression – Economic Search
2012Jan24

Search date: January 24th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination (HTA & NHSEED)

Limits: 2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database: Ovid MEDLINE(R) <1946 to January Week 2>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 23, 2012>, EMBASE <1980 to 2012 Week 03>
Search Strategy:

Search run 2012Jan24

#	Searches	Results
1	exp Coronary Artery Disease/	211859
2	exp Myocardial Infarction/ use prmz	133477
3	exp heart infarction/ use emez	216783
4	(coronary artery disease or cad or heart attack*).ti.	45066
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149492
6	or/1-5	539673
7	exp Atrial Fibrillation/ use prmz	28045
8	exp heart atrium fibrillation/ use emez	55436
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	73408
10	or/7-9	99276
11	exp heart failure/	300628
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	234356
13	or/11-12	381546
14	exp Stroke/	177809
15	exp Ischemic Attack, Transient/ use prmz	16364
16	exp transient ischemic attack/ use emez	19656
17	exp stroke patient/ use emez	5632
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	100915
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	280886
20	or/14-19	391193
21	exp Diabetes Mellitus, Type 2/ use prmz	68071
22	exp non insulin dependent diabetes mellitus/ use emez	101510
23	exp diabetic patient/ use emez	12865
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	764276
25	or/21-24	789178

26	exp Skin Ulcer/	71985
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28655
28	(decubitus or bedsore*).ti,ab.	8523
29	or/26-28	90677
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	17004
31	exp chronic obstructive lung disease/ use emez	54703
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54411
33	(copd or coad).ti,ab.	45638
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37418
36	exp chronic bronchitis/ use emez	6977
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50824
38	or/30-37	159217
39	exp Chronic Disease/	340516
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	219887
41	or/39-40	506096
42	exp Comorbidity/	143277
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	203158
44	or/42-43	283744
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2820445
46	exp *Depression/ use prmz	35734
47	exp *Depressive Disorder/ use prmz	53303
48	exp *Depression/ use emez	135504
49	(depression* or depressive*).ti.	161726
50	exp *Anxiety/ use prmz	22377
51	exp *Anxiety Disorders/ use prmz	44601
52	exp *Anxiety/ or exp *Anxiety Disorder/ use emez	111975
53	(anxiety or panic).ti.	67269
54	or/46-53	389615
55	*Mass Screening/ use prmz	36958
56	exp *Psychological Tests/ use prmz	50530
57	exp *Psychiatric Status Rating Scales/ use prmz	7853
58	exp *Interview, Psychological/ use prmz	2344
59	*Severity of Illness Index/ use prmz	9325
60	*Diagnostic Self Evaluation/ use prmz	146
61	exp *Screening/ use emez	91501
62	exp *Psychologic Test/ use emez	40298
63	*Self Evaluation/ use emez	3048
64	((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	84713
65	case-finding.ti.	1644
66	or/55-65	318106

67	45 and 54 and 66	11073
68	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)).ti,ab.	127
69	67 or 68	11163
70	*Economics/ use prmz	10087
71	*Economics, Medical/ use prmz	5122
72	*Economics, Pharmaceutical/ use prmz	1203
73	exp "Costs and Cost Analysis"/ use prmz	160206
74	exp Models, Economic/ use prmz	8274
75	Markov Chains/ use prmz	7519
76	Monte Carlo Method/ use prmz	16060
77	Quality-Adjusted Life Years/ use prmz	5271
78	"Value of Life"/ use prmz	5190
79	Decision Trees/ use prmz	7752
80	exp "Health Care Cost"/ use emez	169111
81	exp *Health Economics/ use emez	166598
82	exp Economic Evaluation/ use emez	176357
83	Quality Adjusted Life Year/ use emez	8269
84	*Statistical Model/ use emez	11132
85	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	205148
86	(decision adj1 (tree* or analy* or model*)).ti,ab.	18055
87	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7808
88	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	35671
89	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42611
90	(economic evaluation* or economic review*).ti,ab.	12049
91	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114147
92	(markov* or monte carlo).ti,ab.	61975
93	or/70-92	801089
94	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2922023
95	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5796469
96	or/94-95	5901110
97	69 and 93	358
98	97 not 96	336
99	limit 98 to english language	321
100	limit 99 to yr="2002 -Current"	251
101	remove duplicates from 100 Embase <1980 to 2012 Week 03>(124) Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>(52)	176

PubMed
Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
OR/
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
OR/
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
OR/
Stroke[mh]
Ischemic Attack, Transient[mh]
stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
OR/
Diabetes Mellitus, Type 2[mh]
diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
OR/
Skin Ulcer[mh]
(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])
decubitus[tiab] OR bedsore*[tiab]
OR/
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]
chronic airflow obstruction[tiab]
Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
OR/
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
OR/
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/
OR/

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]

markov*[tiab] OR monte carlo[tiab]

Depression[MAJR]
Depressive Disorder[MAJR]
depression*[TI] OR depressive*[TI]
Anxiety[MAJR]
Anxiety Disorders[MAJR]
anxiety[ti] OR panic[ti]
Mass Screening[MAJR:NOEXP]
Psychological Tests[MAJR]
Psychiatric Status Rating Scales[MAJR]
Interview, Psychological[MAJR]
Severity of Illness Index[MAJR]
Diagnostic Self Evaluation[MAJR]
(depression*[tiab] OR depressive*[tiab] OR anxiety[tiab] OR anxieties[tiab]) AND (assessment*[tiab] OR detect*[tiab] OR diagnos*[tiab] OR inventor*[tiab] OR scale*[tiab] OR screen*[tiab] OR self-assessment*[tiab] OR test*[tiab])
case-finding[ti]
(cardiovascular care[tiab] OR cardiovascular disease*[tiab] OR cardio-vascular care[tiab] OR cardio-vascular disease*[tiab] OR heart disease*[tiab]) AND (depression*[tiab] OR depressive*[tiab] OR anxiety[tiab] OR anxieties[tiab]) AND (assessment*[tiab] OR detect*[tiab] OR diagnos*[tiab] OR inventor*[tiab] OR scale*[tiab] OR screen*[tiab] OR self-assessment*[tiab] OR test*[tiab])

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to 2002-present & English

Search run 2012Jan24

Search	Query	Items found
#25	Search #22 AND #23 Limits: English, Publication Date from 2002 to 2012	15
#24	Search #22 AND #23	18
#23	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1681697
#22	Search #18 OR #21	411
#21	Search #19 AND #20	74
#20	Search ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	289213
#19	Search (cardiovascular care[tiab] OR cardiovascular disease*[tiab] OR cardio-vascular care[tiab] OR cardio-vascular disease*[tiab] OR heart disease*[tiab]) AND (depression*[tiab] OR depressive*[tiab] OR anxiety[tiab] OR anxieties[tiab]) AND (assessment*[tiab] OR detect*[tiab] OR diagnos*[tiab] OR inventor*[tiab] OR scale*[tiab] OR screen*[tiab] OR self-assessment*[tiab] OR test*[tiab])	2454
#18	Search #1 AND #8 AND #17	351
#17	Search #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16	218546
#16	Search case-finding[ti]	872
#15	Search (depression*[tiab] OR depressive*[tiab] OR anxiety[tiab] OR anxieties[tiab]) AND (assessment*[tiab] OR detect*[tiab] OR diagnos*[tiab] OR inventor*[tiab] OR scale*[tiab] OR screen*[tiab] OR self-assessment*[tiab] OR test*[tiab])	120958

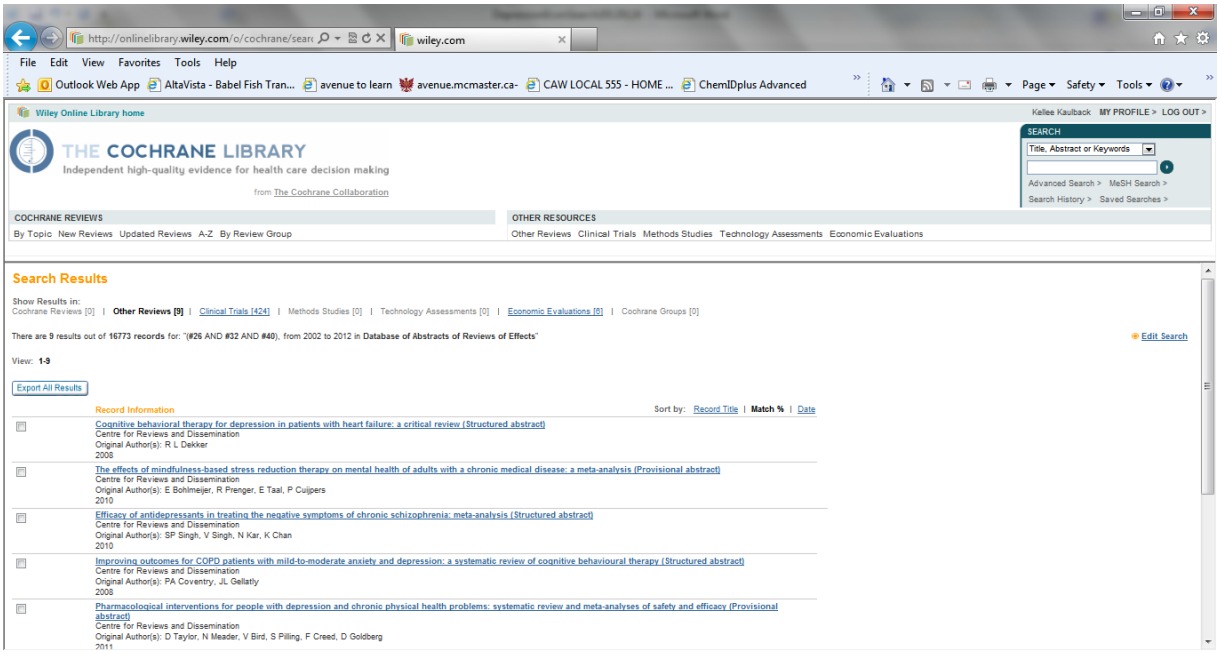
Search	Query	Items found
#14	Search Diagnostic Self Evaluation[MAJR]	144
#13	Search Severity of Illness Index[MAJR]	9368
#12	Search Interview, Psychological[MAJR]	2338
#11	Search Psychiatric Status Rating Scales[MAJR]	7845
#10	Search Psychological Tests[MAJR]	50763
#9	Search Mass Screening[MAJR:NOEXP]	36949
#8	Search #2 OR #3 OR #4 OR #5 OR #6 OR #7	165630
#7	Search anxiety[ti] OR panic[ti]	31190
#6	Search Anxiety Disorders[MAJR]	44591
#5	Search Anxiety[MAJR]	22468
#4	Search depression*[TI] OR depressive*[TI]	75134
#3	Search Depressive Disorder[MAJR]	53258
#2	Search Depression[MAJR]	87394
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))))) AND ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	28370

Wiley Cochrane
Search run 2012Jan24

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469

#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	MeSH descriptor **Chronic Disease** explode all trees	9875
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	68126
#27	MeSH descriptor **Depression** explode all trees	4309
#28	MeSH descriptor **Depressive Disorder** explode all trees	6395
#29	MeSH descriptor **Anxiety** explode all trees	4337
#30	MeSH descriptor **Anxiety Disorders** explode all trees	4159
#31	(depression* OR depressive*):ti or (anxiety OR panic):ti	16500
#32	(#27 OR #28 OR #29 OR #30 OR #31)	25361
#33	MeSH descriptor **Mass Screening** explode all trees	4120
#34	MeSH descriptor **Psychological Tests** explode all trees	9194
#35	MeSH descriptor **Psychiatric Status Rating Scales** explode all trees	7297
#36	MeSH descriptor **Interview, Psychological** explode all trees	459
#37	MeSH descriptor **Severity of Illness Index** explode all trees	11790
#38	MeSH descriptor **Diagnostic Self Evaluation** explode all trees	15
#39	(depression* OR depressive* OR anxiety OR anxieties) NEAR/2 (assessment* OR detect* OR diagnos* OR inventor* OR scale* OR screen* OR self-assessment* OR test*):ti or (case-finding):ti	486

#40	(#33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39)	30235
#41	(((cardiovascular OR cardio-vascular) NEXT (care OR disease*)) OR heart disease*) NEAR/5 (depression* OR depressive* OR anxiety OR anxieties) NEAR/2 (assessment* OR detect* OR diagnos* OR inventor* OR scale* OR screen* OR self-assessment* OR test*):ti	0
#42	(#26 AND #32 AND #40)	670
#43	(#26 AND #32 AND #40), from 2002 to 2012	439



Centre for Reviews and Dissemination
Search run 2012Jan24

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	230
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	224
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	225
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	168
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	418
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	280
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	549
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	32

11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	622
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	511
13	(diabetes or diabetic* or niddm or t2dm):TI	1223
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	253
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	73
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	237
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	219
19	(copd or coad):TI	108
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	10
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	687
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	251
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	146
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4655
28	MeSH DESCRIPTOR Depression EXPLODE ALL TREES	286
29	MeSH DESCRIPTOR Depressive Disorder EXPLODE ALL TREES	572
30	MeSH DESCRIPTOR Anxiety EXPLODE ALL TREES	134
31	MeSH DESCRIPTOR Anxiety Disorders EXPLODE ALL TREES	255
32	(depression* or depressive*):TI OR (anxiety or panic):TI	899
33	#28 OR #29 OR #30 OR #31 OR #32	1292
34	MeSH DESCRIPTOR Mass Screening EXPLODE ALL TREES	1704
35	MeSH DESCRIPTOR Psychological Tests EXPLODE ALL TREES	139
36	MeSH DESCRIPTOR Psychiatric Status Rating Scales EXPLODE ALL TREES	171
37	MeSH DESCRIPTOR Interview, Psychological EXPLODE ALL TREES	15
38	MeSH DESCRIPTOR Severity of Illness Index EXPLODE ALL TREES	575

39	(((depression* or depressive* or anxiety or anxieties) adj2 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*))):TI OR (case-finding):TI	34
40	#34 OR #35 OR #36 OR #37 OR #38 OR #39	2533
41	((((cardiovascular or cardio-vascular) adj (care or disease?)) or heart disease?) adj5 (depression* or depressive* or anxiety or anxieties) adj5 (assessment? or detect* or diagnos* or inventor* or scale? or screen* or self-assessment? or test*)):TI	0
42	#27 AND #33 AND #40	13
43	#41 OR #42	13

Discharge Planning – Economic Search
2012Feb14

Search date: February 14th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present (SR/MA/HTA filter) & 2010-present primary studies; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database**:** Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)1946 to Present, EMBASE <1980 to 2012 Week 04>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212867
2	exp Myocardial Infarction/ use prmz	134000
3	exp heart infarction/ use emez	217674
4	(coronary artery disease or cad or heart attack*).ti.	45245
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149895
6	or/1-5	541796
7	exp Atrial Fibrillation/ use prmz	28253
8	exp heart atrium fibrillation/ use emez	55964
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	74050
10	or/7-9	100117
11	exp heart failure/	302389
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	235747
13	or/11-12	383648
14	exp Stroke/	179066
15	exp Ischemic Attack, Transient/ use prmz	16399
16	exp transient ischemic attack/ use emez	19769
17	exp stroke patient/ use emez	5675
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101286
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	282730
20	or/14-19	393517
21	exp Diabetes Mellitus, Type 2/ use prmz	68717
22	exp non insulin dependent diabetes mellitus/ use emez	102160
23	exp diabetic patient/ use emez	13054

24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	768826
25	or/21-24	793902
26	exp Skin Ulcer/	72352
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28841
28	(decubitus or bedsore*).ti,ab.	8550
29	or/26-28	91144
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	17234
31	exp chronic obstructive lung disease/ use emez	54967
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54771
33	(copd or coad).ti,ab.	46040
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37547
36	exp chronic bronchitis/ use emez	6992
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50973
38	or/30-37	160008
39	exp Chronic Disease/	341731
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	221492
41	or/39-40	508487
42	exp Comorbidity/	144447
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	205122
44	or/42-43	286249
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2835314
46	exp Patient Discharge/ use prmz	16074
47	exp hospital discharge/ use emez	48567
48	((post-discharge or postdischarge or post-hospital or posthospital or discharge) adj2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*)).ti,ab.	46852
49	exp Medication Reconciliation/ use prmz	88
50	exp Medication Errors/pc use prmz	3739
51	exp medication therapy management/ use emez	789
52	exp medication error/pc use emez	2174
53	((medication* or drug*) adj2 (reconcil* or manage*)).ti,ab.	9761
54	or/46-53	108956
55	*Economics/ use prmz	10096
56	*Economics, Medical/ use prmz	5122
57	*Economics, Pharmaceutical/ use prmz	1204
58	exp "Costs and Cost Analysis"/ use prmz	160841
59	exp Models, Economic/ use prmz	8328
60	Markov Chains/ use prmz	7589
61	Monte Carlo Method/ use prmz	16225
62	Quality-Adjusted Life Years/ use prmz	5335
63	"Value of Life"/ use prmz	5197
64	Decision Trees/ use prmz	7814

65	exp "Health Care Cost"/ use emez	169779
66	exp *Health Economics/ use emez	166975
67	exp Economic Evaluation/ use emez	177072
68	Quality Adjusted Life Year/ use emez	8345
69	*Statistical Model/ use emez	11179
70	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	206032
71	(decision adj1 (tree* or analy* or model*)).ti,ab.	18196
72	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7846
73	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	36037
74	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42857
75	(economic evaluation* or economic review*).ti,ab.	12105
76	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114860
77	(markov* or monte carlo).ti,ab.	62381
78	or/55-77	804490
79	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2932274
80	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5827934
81	or/79-80	5933590
82	45 and 54 and 78	2392
83	Meta-Analysis.pt.	31464
84	Meta-Analysis as Topic/ or exp Technology Assessment, Biomedical/	34121
85	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	84366
86	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	9315
87	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	17144
88	(data synthes* or data extraction* or data abstraction*).ti,ab.	22797
89	(handsearch* or hand search*).ti,ab.	8958
90	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	22092
91	(met analy* or metanaly* or health technology assessment* or HTA or HTAs).ti,ab.	5050
92	(meta regression* or metaregression* or mega regression*).ti,ab.	3202
93	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	207910
94	(cochrane or health technology assessment or evidence report).jw.	21051
95	(Meta Analysis or Systematic Review or Biomedical Technology Assessment).sh.	127577
96	(Systematic Review Topic or Meta Analysis Topic).sh.	3909
97	or/83-96	283909
98	45 and 54 and 78 and 97	127
99	limit 98 to english language	122
100	limit 99 to yr="2002 -Current"	111
101	remove duplicates from 100	88
102	45 and 54 and 78	2392
103	102 not 81	2132

104	limit 103 to english language	2001
105	limit 104 to yr="2010 -Current"	354
106	remove duplicates from 105	285
107	101 or 106	357

PubMed
Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
Stroke[mh]
Ischemic Attack, Transient[mh]
stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
Diabetes Mellitus, Type 2[mh]
diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
Skin Ulcer[mh]
(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])
decubitus[tiab] OR bedsore*[tiab]
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]
chronic airflow obstruction[tiab]
Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

AND

Patient Discharge[mh]
(post-discharge[tiab] OR postdischarge[tiab] OR post-hospital[tiab] OR posthospital[tiab] OR discharge) AND (patient[tiab] OR hospital[tiab] OR support*[tiab] OR service*[tiab] OR plan*[tiab] OR summar*[tiab] OR coordinat*[tiab] OR co-ordinat*[tiab] OR manage*[tiab])
Medication Reconciliation[mh]

Medication Errors/prevention and control[mh]
(medication*[tiab] OR drug*[tiab]) AND (reconcil*[tiab] OR manage*[tiab])

AND

systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to English

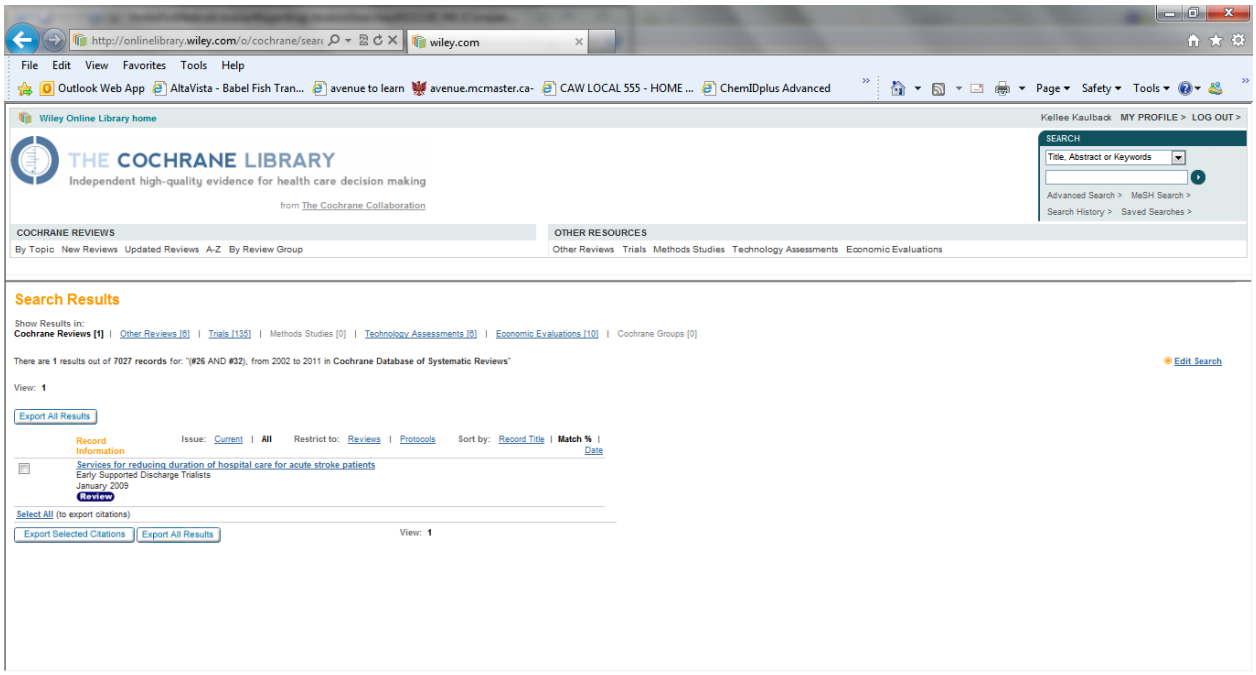
Search	Query	Items found
#14	Search #1 AND #7 AND #9 Limits: English, Publication Date from 2010 to 2012	54
#13	Search #1 AND #7 AND #9	86
#12	Search #1 AND #7 AND #8 AND #9	9
#9	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1690740
#8	Search systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]	198866
#7	Search #2 OR #3 OR #4 OR #5 OR #6	124245
#6	Search (medication*[tiab] OR drug*[tiab]) AND (reconcil*[tiab] OR manage*[tiab])	56929
#5	Search Medication Errors/prevention and control[mh]	3739
#4	Search Medication Reconciliation[mh]	88
#3	Search (post-discharge[tiab] OR postdischarge[tiab] OR post-hospital[tiab] OR posthospital[tiab] OR discharge) AND (patient[tiab] OR hospital[tiab] OR support*[tiab] OR service*[tiab] OR plan*[tiab] OR summar*[tiab] OR coordinat*[tiab] OR co-ordinat*[tiab] OR manage*[tiab])	60571
#2	Search Patient Discharge[mh]	16049
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))))) AND ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR	

Search	Query	Items found
	cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8469
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2310
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5252
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9902
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16585
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	669
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2415
#18	(copd or coad):ti	3319
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	(Chronic Disease):ti	4464
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1670
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649

#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	61123
#27	MeSH descriptor **Patient Discharge** explode all trees	863
#28	(post-discharge or postdischarge or post-hospital or posthospital or discharge) NEAR/2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*):ti	478
#29	MeSH descriptor **Medication Reconciliation** explode all trees	2
#30	MeSH descriptor **Medication Errors** explode all trees with qualifier: **PC**	103
#31	(medication* or drug*) NEAR/2 (reconcil* or manage*):ti	71
#32	(#27 OR #28 OR #29 OR #30 OR #31)	1285
#33	(#26 AND #32), from 2002 to 2011	158



Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	283
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	225
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	265
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	171
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	479
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	283

9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	645
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	40
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	623
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	594
13	(diabetes or diabetic* or niddm or t2dm):TI	1226
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	276
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	74
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	275
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	221
19	(copd or coad):TI	110
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	11
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	753
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	253
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	158
26	((comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*)))):TI	21
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4828
28	MeSH DESCRIPTOR Patient Discharge EXPLODE ALL TREES	158
29	(((post-discharge or postdischarge or post-hospital or posthospital or discharge) adj2 (patient or hospital or support* or service* or plan* or summar* or coordinat* or co-ordinat* or manage*))):TI	27
30	MeSH DESCRIPTOR Medication Errors EXPLODE ALL TREES WITH QUALIFIER PC	0
31	(((medication* or drug*) adj2 (reconcil* or manage*))):TI	20
32	#28 OR #29 OR #30 OR #31	183
33	#27 AND #32	35

Electronic Tools – Economic Search
2012Aug14

Search date: August 14th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits:2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database:Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to Present, EMBASE <1980 to 2012 Week 32>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	229118
2	exp Myocardial Infarction/ use prmz	137438
3	exp heart infarction/ use emez	231179
4	(coronary artery disease or cad or heart attack*).ti.	47830
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arteriioscleros* or infarct*)).ti.	156297
6	or/1-5	572256
7	exp Atrial Fibrillation/ use prmz	29796
8	exp heart atrium fibrillation/ use emez	61196
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	80518
10	or/7-9	108150
11	exp heart failure/	321154
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	251933
13	or/11-12	407955
14	exp Stroke/	192344
15	exp Ischemic Attack, Transient/ use prmz	16799
16	exp transient ischemic attack/ use emez	21128
17	exp stroke patient/ use emez	6274
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	107109
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	304938
20	or/14-19	421326
21	exp Diabetes Mellitus, Type 2/ use prmz	73613
22	exp non insulin dependent diabetes mellitus/ use emez	113928
23	exp diabetic patient/ use emez	15238
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	827339
25	or/21-24	854342
26	exp Skin Ulcer/	76033
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	30721
28	(decubitus or bedsore*).ti,ab.	8897
29	or/26-28	96120
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	18847
31	exp chronic obstructive lung disease/ use emez	59156
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	59303
33	(copd or coad).ti,ab.	50241

34	chronic airflow obstruction.ti,ab.	1090
35	exp Emphysema/	39015
36	exp chronic bronchitis/ use emez	7164
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	52934
38	or/30-37	169517
39	exp Chronic Disease/	358585
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	240287
41	or/39-40	540007
42	exp Comorbidity/	158025
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	227850
44	or/42-43	316062
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	3024761
46	exp Medical Informatics/ use prmz	280330
47	exp Medical Records Systems, Computerized/ use prmz	21517
48	exp *Data Processing/ use emez	465074
49	(ehr or ehealth or etool* or eprescri* or (computer* adj2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS).ti,ab.	14182
50	((electronic or e or computer*) adj2 (health or patient or medical) adj record*).ti,ab.	21724
51	((electronic or e or computer*) adj2 (management or tool* or system* or prescrib* or decision support or discharge or (medication adj2 reconciliation))).ti,ab.	41965
52	or/46-51	785556
53	exp Intermediate Care Facilities/ use prmz	603
54	(intermedia* adj2 care).ti,ab.	2522
55	exp ambulatory care/	78452
56	exp Ambulatory Care Facilities/ use prmz	40981
57	exp ambulatory care nursing/ use emez	9
58	exp Outpatients/ use prmz	7573
59	exp Outpatient Department/ use emez	34390
60	exp outpatient care/ use emez	18565
61	exp Community Health Services/ use prmz	457932
62	exp community care/ use emez	89835
63	exp Community Medicine/	3950
64	exp Subacute Care/ use prmz	714
65	exp General Practice/	126613
66	exp Primary Health Care/	162088
67	exp Physicians, Family/ or exp general practitioners/ or exp Physicians, Primary Care/ use prmz	65809
68	exp general practitioner/ use emez	49880
69	exp family medicine/ use emez	6089
70	exp Group Practice/ use prmz	22352
71	exp Team Nursing/ use emez	28
72	exp Primary Care Nursing/ use prmz	52
73	exp Patient Care Team/ use prmz	50441
74	exp Teamwork/ use emez	9602

75	*Patient Care Management/ use prmz	1311
76	((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)).ti,ab.	352398
77	((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*)).ti,ab.	52629
78	(team* or liaison).ti,ab.	192035
79	((general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nurse* or physician*)).ti,ab.	226015
80	or/53-79	1420078
81	*Economics/ use prmz	10178
82	*Economics, Medical/ use prmz	5163
83	*Economics, Pharmaceutical/ use prmz	1242
84	exp "Costs and Cost Analysis"/ use prmz	166708
85	exp Models, Economic/ use prmz	8787
86	Markov Chains/ use prmz	8188
87	Monte Carlo Method/ use prmz	17300
88	Quality-Adjusted Life Years/ use prmz	5814
89	"Value of Life"/ use prmz	5229
90	Decision Trees/ use prmz	8074
91	exp "Health Care Cost"/ use emez	178191
92	exp *Health Economics/ use emez	175532
93	exp Economic Evaluation/ use emez	186842
94	Quality Adjusted Life Year/ use emez	9437
95	*Statistical Model/ use emez	12546
96	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	217276
97	(decision adj1 (tree* or analy* or model*)).ti,ab.	19783
98	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	8382
99	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	40250
100	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	45952
101	(economic evaluation* or economic review*).ti,ab.	13054
102	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	123408
103	(markov* or monte carlo).ti,ab.	67068
104	or/81-103	846004
105	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	3031296
106	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	6181848
107	or/105-106	6295260
108	104 not 107	749412
109	limit 108 to english language	676480
110	45 and 52 and 80 and 109	584
111	limit 110 to yr="2002 -Current"	451
112	remove duplicates from 111	382

PubMed

Search	Query	Items found
#33	Search **#3 AND #9 AND #29 AND #30** Filters: **Publication date from 2002/01/01 to 2013/12/31; English**	41
#32	Search **#3 AND #9 AND #29 AND #30** Filters: **Publication date from 2002/01/01 to 2013/12/31**	42
#31	Search **#3 AND #9 AND #29 AND #30**	43
#30	Search **publisher[sb] OR in process[sb] OR pubmednotmedline[sb]**	1778611
#29	Search **#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28**	1489140
#28	Search **(general[tiab] OR family[tiab] OR primary care[tiab] OR community[tiab]) AND (practic*[tiab] OR clinic*[tiab] OR program*[tiab] OR doctor*[tiab] OR nurse*[tiab] OR physician*[tiab])**	441644
#27	Search **team*[tiab] OR liaison[tiab]**	83950
#26	Search **(transitional[tiab] OR multidisciplin*[tiab] OR multifacet*[tiab] OR multi-disciplin*[tiab] OR multi-facet*[tiab] OR cooperat*[tiab] OR co-operat*[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR collaborat*[tiab] OR multispecial*[tiab] OR multi-special*[tiab] OR share[tiab] OR sharing[tiab] OR shared[tiab] OR integrat*[tiab] OR joint[tiab] OR multi-modal[tiab] OR multimodal[tiab]) AND (care[tiab] OR team*[tiab])**	102938
#25	Search **(primary[tiab] OR family[tiab] OR community[tiab] OR outpatient*[tiab] OR ambulatory[tiab]) AND (care*[tiab] OR physician*[tiab] OR nurs*[tiab] OR service*[tiab] OR clinic*[tiab] OR facility[tiab] OR facilities[tiab])**	572713
#24	Search **Patient Care Management[MAJR]**	265486
#23	Search **Patient Care Team[mh]**	50137
#22	Search **Primary Care Nursing[mh]**	1964
#21	Search **Group Practice[mh]**	22278
#20	Search **Physicians, Family[mh] OR General Practitioners[mh] OR Physicians, Primary Care[mh]**	15652
#19	Search **Primary Health Care[mh]**	68924
#18	Search **General Practice[mh]**	60028
#17	Search **Subacute Care[mh]**	708
#16	Search **Community Medicine[mh]**	1830
#15	Search **Community Health Services[mh]**	451951
#14	Search **Outpatients[mh]**	7468
#13	Search **Ambulatory Care Facilities[mh]**	40496
#12	Search **ambulatory care[mh]**	42703
#11	Search **intermedia*[tiab] AND care[tiab]**	4987
#10	Search **Intermediate Care Facilities[mh]**	599
#9	Search **#4 OR #5 OR #6 OR #7 OR #8**	542662

Search	Query	Items found
#8	Search **(electronic[tiab] OR e[tiab] OR computer*[tiab]) AND (management[tiab] OR tool*[tiab] OR system*[tiab] OR prescrib*[tiab] OR decision support[tiab] OR discharge[tiab] OR (medication[tiab] AND reconciliation[tiab]))**	286417
#7	Search **(electronic[tiab] OR e[tiab] OR computer*[tiab]) AND (health[tiab] OR patient[tiab] OR medical[tiab]) AND record*[tiab]**	25634
#6	Search **ehr[tiab] OR ehealth[tiab] OR etool*[tiab] OR eprescri*[tiab] OR (computer*[tiab] AND physician order entry[tiab]) OR CPOE[tiab] OR clinical decision support system*[tiab] OR picture archiving communication* system*[tiab] OR PACS[tiab]**	5123
#5	Search **Medical Records Systems, Computerized[mh]**	21169
#4	Search **Medical Informatics[mh]**	275199
#3	Search **#1 AND #2**	29735
#2	Search **((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))**	299234
#1	Search **(((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))))**	1745752

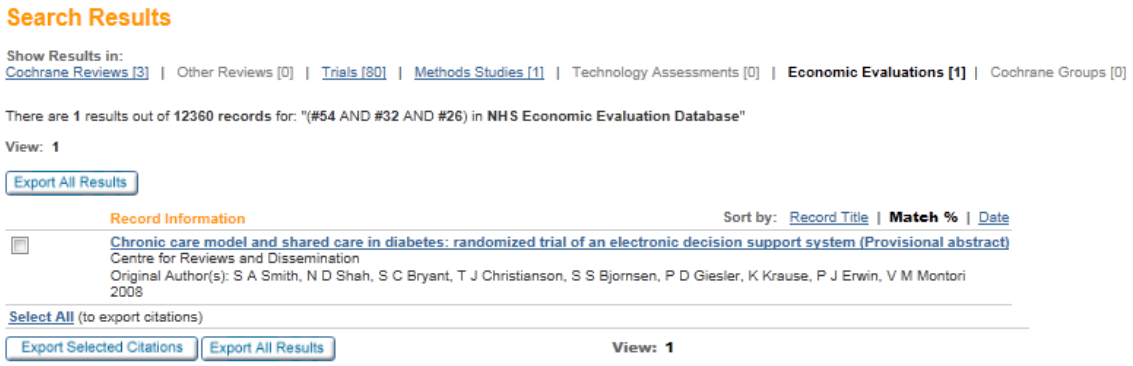
Wiley Cochrane, 3 of 4, July 2012

ID	Search	Hits

#1	MeSH descriptor Coronary Artery Disease explode all trees	2276
#2	MeSH descriptor Myocardial Infarction explode all trees	7892
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8587
#4	MeSH descriptor Atrial Fibrillation explode all trees	2184
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2378
#6	MeSH descriptor Heart Failure explode all trees	4855
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5375
#8	MeSH descriptor Stroke explode all trees	4063
#9	MeSH descriptor Ischemic Attack, Transient explode all trees	472
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	10038
#11	MeSH descriptor Diabetes Mellitus, Type 2 explode all trees	7242
#12	(diabetes or diabetic* or niddm or t2dm):ti	16983
#13	MeSH descriptor Skin Ulcer explode all trees	1608
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	679
#15	(decubitus or bedsore*):ti	100
#16	MeSH descriptor Pulmonary Disease, Chronic Obstructive explode all trees	1834
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2448
#18	(copd or coad):ti	3367
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor Emphysema explode all trees	92
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1185
#22	MeSH descriptor Chronic Disease explode all trees	10057
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1716
#24	MeSH descriptor Comorbidity explode all trees	2007
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	662
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	69497
#27	MeSH descriptor Medical Informatics explode all trees	7472
#28	MeSH descriptor Medical Records Systems, Computerized explode all trees	290
#29	((electronic or e or computer*) NEAR/2 (health or patient or medical) NEAR record*):ti or ((electronic or e or computer*) NEAR/2 (health or patient or medical) NEAR record*):ab	279
#30	(ehr or ehealth or etool* or eprescri* or (computer* NEAR/2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS):ti or (ehr or ehealth or etool* or eprescri* or (computer* NEAR/2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS):ab	358
#31	((electronic or e or computer*) NEAR/2 (management or tool* or system* or prescrib* or decision support or discharge or (medication NEAR/2 reconciliation))):ti or ((electronic or e or computer*) NEAR/2 (management or tool* or system* or prescrib* or decision support or discharge or (medication NEAR/2 reconciliation))):ab	894
#32	(#27 OR #28 OR #29 OR #30 OR #31)	8479

#33	MeSH descriptor Intermediate Care Facilities explode all trees	13
#34	(intermedia* NEAR/2 care):ti or (intermedia* NEAR/2 care):ab	96
#35	MeSH descriptor Ambulatory Care explode all trees	3204
#36	MeSH descriptor Ambulatory Care Facilities explode all trees	1434
#37	MeSH descriptor Outpatients explode all trees	694
#38	MeSH descriptor Community Health Services explode all trees	20097
#39	MeSH descriptor Community Medicine explode all trees	34
#40	MeSH descriptor Subacute Care explode all trees	16
#41	MeSH descriptor General Practice explode all trees	2118
#42	MeSH descriptor Primary Health Care explode all trees	2963
#43	MeSH descriptor Physicians, Family explode all trees	446
#44	MeSH descriptor General Practitioners explode all trees	33
#45	MeSH descriptor Physicians, Primary Care explode all trees	23
#46	MeSH descriptor Group Practice explode all trees	380
#47	MeSH descriptor Primary Care Nursing explode all trees	1
#48	MeSH descriptor Patient Care Team explode all trees	1179
#49	MeSH descriptor Patient Care Management explode all trees	13262
#50	((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ti and ((primary or family or community or outpatient* or ambulatory) NEAR/2 (care* or physician* or nurs* or service* or clinic* or facility or facilities)):ab	2120
#51	(transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ti or (transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin* or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) NEAR/2 (care or team*):ab	1126
#52	((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ti or ((general or family or primary care or community) NEAR/2 (practic* or clinic* or program* or doctor* or nuse* or physician*)):ab	8105
#53	(team* or liaison):ti or (team* or liaison):ab	3218
#54	(#50 OR #51 OR #52 OR #53)	12407
#55	(#54 AND #32 AND #26)	85

NHSEED=1 record



Centre for Reviews and Dissemination

Search	Hits	
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	313
2	(coronary artery disease or cad or heart attack*):TI	236
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	238
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	290
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	192
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	510
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	304
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	708
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	43
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	695
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	664
13	(diabetes or diabetic* or niddm or t2dm):TI	1356
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	283
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	81
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	298
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	240
19	(copd or coad):TI	123
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	19
22	((chronic adj2 bronchitis) or emphysema):TI	50
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	794
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	274
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	181
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	29
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	5254
28	MeSH DESCRIPTOR medical informatics EXPLODE ALL TREES	2398

29	MeSH DESCRIPTOR Medical Records Systems, Computerized EXPLODE ALL TREES	54
30	((ehr or ehealth or etool* or eprescri* or (computer* adj2 physician order entry) or CPOE or clinical decision support system* or picture archiving communication* system* or PACS))	68
31	(((electronic or e or computer*) adj2 (health or patient or medical) adj record*))	89
32	((electronic or e or computer*) adj2 (management or tool* or system* or prescrib* or decision support or discharge or (medication adj2 reconciliation)))	356
33	#28 OR #29 OR #30 OR #31 OR #32	2678
34	MeSH DESCRIPTOR Intermediate Care Facilities EXPLODE ALL TREES	4
35	(intermedia* adj2 care)	40
36	MeSH DESCRIPTOR ambulatory care EXPLODE ALL TREES	350
37	MeSH DESCRIPTOR Ambulatory Care Facilities EXPLODE ALL TREES	207
38	MeSH DESCRIPTOR Outpatients EXPLODE ALL TREES	76
39	MeSH DESCRIPTOR Community Health Services EXPLODE ALL TREES	4191
40	MeSH DESCRIPTOR Community Medicine EXPLODE ALL TREES	3
41	MeSH DESCRIPTOR Subacute Care EXPLODE ALL TREES	7
42	MeSH DESCRIPTOR Primary Health Care EXPLODE ALL TREES	691
43	MeSH DESCRIPTOR Physicians, Family EXPLODE ALL TREES	50
44	MeSH DESCRIPTOR Group Practice EXPLODE ALL TREES	65
45	MeSH DESCRIPTOR Patient Care Team EXPLODE ALL TREES	213
46	MeSH DESCRIPTOR Patient Care Management EXPLODE ALL TREES	2456
47	(((primary or family or community or outpatient* or ambulatory) adj2 (care* or physician* or nurs* or service* or clinic* or facility or facilities))) OR ((((transitional or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin* or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat* or joint or multi-modal or multimodal) adj2 (care or team*))) OR (team* or liaison) OR (general or family or primary care or community) adj2 (practic* or clinic* or program* or doctor* or nuse* or physician*)))	2158
48	#34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47	7685
49	#27 AND #33 AND #48	68

Home Care – Economic Search
2012Feb15

Search date: February 15th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database**: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)** 1946 to Present, EMBASE <1980 to 2012 Week 06>

Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212867
2	exp Myocardial Infarction/ use prmz	134000
3	exp heart infarction/ use emez	217674
4	(coronary artery disease or cad or heart attack*).ti.	45250
5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149911
6	or/1-5	541817
7	exp Atrial Fibrillation/ use prmz	28253
8	exp heart atrium fibrillation/ use emez	55964
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	74061
10	or/7-9	100128
11	exp heart failure/	302389
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	235776
13	or/11-12	383677
14	exp Stroke/	179066
15	exp Ischemic Attack, Transient/ use prmz	16399
16	exp transient ischemic attack/ use emez	19769
17	exp stroke patient/ use emez	5675
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101286
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	282777
20	or/14-19	393564
21	exp Diabetes Mellitus, Type 2/ use prmz	68717
22	exp non insulin dependent diabetes mellitus/ use emez	102160
23	exp diabetic patient/ use emez	13054
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	768968
25	or/21-24	794044
26	exp Skin Ulcer/	72352
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28844
28	(decubitus or bedsore*).ti,ab.	8553
29	or/26-28	91149
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	17234
31	exp chronic obstructive lung disease/ use emez	54967
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54780
33	(copd or coad).ti,ab.	46051
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37547
36	exp chronic bronchitis/ use emez	6992
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50975
38	or/30-37	160022
39	exp Chronic Disease/	341731
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	221536

41	or/39-40	508531
42	exp Comorbidity/	144447
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	205176
44	or/42-43	286303
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2835629
46	exp Home Care Services/ use prmz	36959
47	exp Home Care/ use emez	46985
48	exp Home Care Agencies/ or exp Home Health Aides/ use prmz	48501
49	exp House Calls/ use prmz	2060
50	((home or domicil* or communit*) adj2 (visit* or care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)).ti,ab.	87404
51	(homecare or homemaker service* or home nurs* or meals on wheels).ti,ab.	3990
52	or/46-51	143884
53	*Economics/ use prmz	10096
54	*Economics, Medical/ use prmz	5122
55	*Economics, Pharmaceutical/ use prmz	1204
56	exp "Costs and Cost Analysis"/ use prmz	160841
57	exp Models, Economic/ use prmz	8328
58	Markov Chains/ use prmz	7589
59	Monte Carlo Method/ use prmz	16225
60	Quality-Adjusted Life Years/ use prmz	5335
61	"Value of Life"/ use prmz	5197
62	Decision Trees/ use prmz	7814
63	exp "Health Care Cost"/ use emez	169779
64	exp *Health Economics/ use emez	166975
65	exp Economic Evaluation/ use emez	177072
66	Quality Adjusted Life Year/ use emez	8345
67	*Statistical Model/ use emez	11179
68	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	206057
69	(decision adj1 (tree* or analy* or model*)).ti,ab.	18201
70	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7847
71	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	36052
72	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42865
73	(economic evaluation* or economic review*).ti,ab.	12107
74	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114884
75	(markov* or monte carlo).ti,ab.	62399
76	or/53-75	804558
77	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2932728
78	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5828310
79	or/77-78	5934044

80	Meta-Analysis.pt.	31464
81	Meta-Analysis as Topic/ or exp Technology Assessment, Biomedical/	34121
82	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	84417
83	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	9317
84	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	17149
85	(data synthes* or data extraction* or data abstraction*).ti,ab.	22798
86	(handsearch* or hand search*).ti,ab.	8959
87	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	22095
88	(met analy* or metanaly* or health technology assessment* or HTA or HTAs).ti,ab.	5053
89	(meta regression* or metaregression* or mega regression*).ti,ab.	3204
90	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	207977
91	(cochrane or health technology assessment or evidence report).jw.	21051
92	(Meta Analysis or Systematic Review or Biomedical Technology Assessment).sh.	127577
93	(Systematic Review Topic or Meta Analysis Topic).sh.	3909
94	or/80-93	283987
95	45 and 52 and 76 and 94	177
96	limit 95 to english language	171
97	limit 96 to yr="2002 -Current"	157
98	remove duplicates from 97	118
99	45 and 52 and 76	2862
100	99 not 79	2626
101	limit 100 to english language	2387
102	limit 101 to yr="2010 -Current"	314
103	remove duplicates from 102	230
104	98 or 103	330

PubMed

Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
Stroke[mh]
Ischemic Attack, Transient[mh]
stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
Diabetes Mellitus, Type 2[mh]
diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
Skin Ulcer[mh]
(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])
decubitus[tiab] OR bedsore*[tiab]
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]
chronic airflow obstruction[tiab]

Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))
OR/

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

AND

Home Care Services[mh]
Home Care Agencies[mh] OR Home Health Aides[mh]
House Calls[mh]
(home[tiab] OR domicil*[tiab] OR communit*[tiab]) AND (visit*[tiab] OR care[tiab] OR caring[tiab] OR caregiver*[tiab] OR healthcare[tiab] OR assist*[tiab] OR aid*[tiab] OR agenc*[tiab] OR service*[tiab] OR rehabilitation[tiab])
homecare[tiab] OR homemaker service*[tiab] OR home nurs*[tiab] OR meals on wheels[tiab]

AND

systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to English

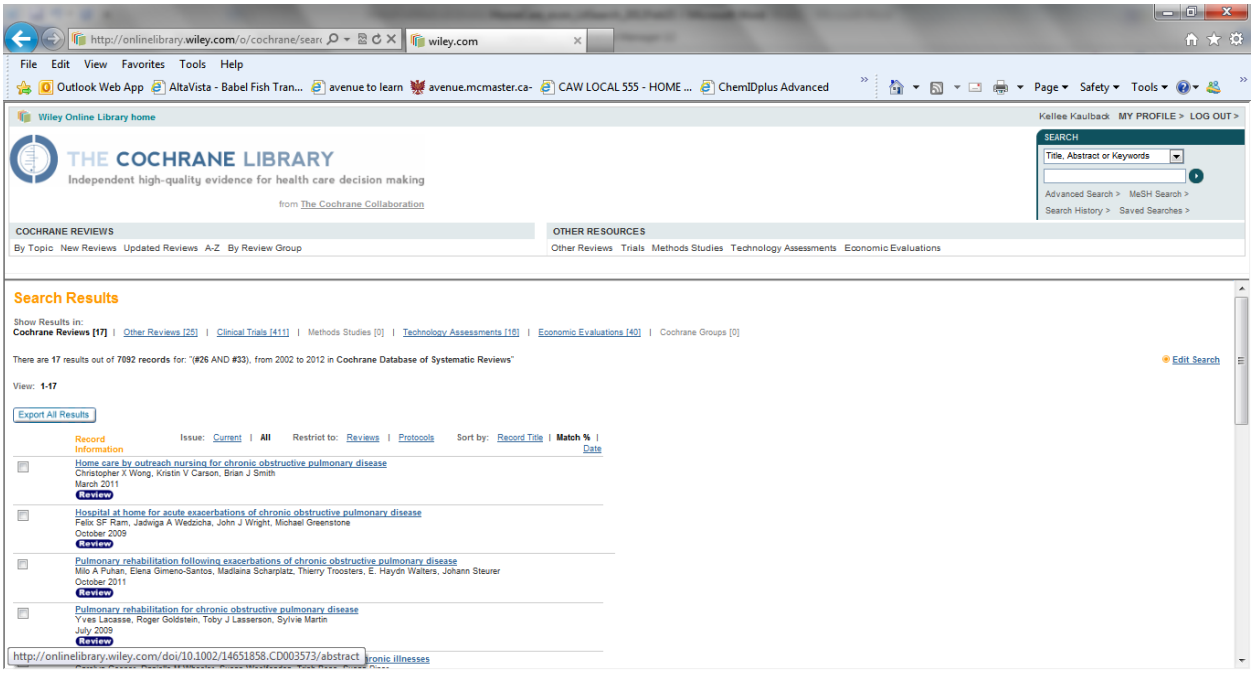
Search	Query	Items found
#12	Search #1 AND #7 AND #9 Limits: English, Publication Date from 2002 to 2012	63
#11	Search #1 AND #7 AND #9	71
#10	Search #1 AND #7 AND #8 AND #9	8
#9	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1689981

Search	Query	Items found
#8	Search systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]	198949
#7	Search #2 OR #3 OR #4 OR #5 OR #6	177554
#6	Search homecare[tiab] OR homemaker service*[tiab] OR home nurs*[tiab] OR meals on wheels[tiab]	1811
#5	Search (home[tiab] OR domicil*[tiab] OR communit*[tiab]) AND (visit*[tiab] OR care[tiab] OR caring[tiab] OR caregiver*[tiab] OR healthcare[tiab] OR assist*[tiab] OR aid*[tiab] OR agenc*[tiab] OR service*[tiab] OR rehabilitation[tiab])	156951
#4	Search House Calls[mh]	2053
#3	Search Home Care Agencies[mh] OR Home Health Aides[mh]	1518
#2	Search Home Care Services[mh]	36935
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))))) AND ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	28533

Wiley Cochrane

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2157
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7836
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8560

#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2124
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2349
#6	MeSH descriptor **Heart Failure** explode all trees	4731
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5249
#8	MeSH descriptor **Stroke** explode all trees	3876
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	470
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9954
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	7006
#12	(diabetes or diabetic* or niddm or t2dm):ti	16492
#13	MeSH descriptor **Skin Ulcer** explode all trees	1599
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	671
#15	(decubitus or bedsore*):ti	101
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1772
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2399
#18	(copd or coad):ti	3367
#19	(chronic airflow obstruction):ti	70
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1198
#22	MeSH descriptor **Chronic Disease** explode all trees	9841
#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1674
#24	MeSH descriptor **Comorbidity** explode all trees	1925
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	638
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	68167
#27	MeSH descriptor **Home Care Services** explode all trees	1884
#28	MeSH descriptor **Home Care Agencies** explode all trees	7
#29	MeSH descriptor **Home Health Aides** explode all trees	18
#30	MeSH descriptor **House Calls** explode all trees	216
#31	((home or domicil* or communit*) NEAR/2 (care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)):ti or ((home or domicil* or communit*) NEAR/2 (care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation)):ab	2184
#32	(homecare or homemaker service*):ti and (homecare or homemaker service*):ab	9
#33	(#27 OR #28 OR #29 OR #30 OR #31 OR #32)	3674
#34	(#26 AND #33), from 2002 to 2012	509



Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	282
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atherosclero* or arterioscleros* or infarct*)):TI	226
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	265
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	171
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	479
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	283
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	645
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	40
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	623
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	595
13	(diabetes or diabetic* or niddm or t2dm):TI	1228
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	276
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	74
16	(decubitus or bedsore*):TI	0

17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	276
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	222
19	(copd or coad):TI	110
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	11
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	754
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	253
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	158
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22
27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4833
28	MeSH DESCRIPTOR home care services EXPLODE ALL TREES	397
29	MeSH DESCRIPTOR home care agencies EXPLODE ALL TREES	1
30	MeSH DESCRIPTOR home health aides EXPLODE ALL TREES	2
31	MeSH DESCRIPTOR house calls EXPLODE ALL TREES	34
32	(((home or domicil* or communit*) adj2 (visit* or care or caring or caregiver* or healthcare or assist* or aid* or agenc* or service* or rehabilitation))) FROM 2006 TO 2012	793
33	#28 OR #29 OR #30 OR #31 OR #32	1067
34	#27 AND #33	198
35	#27 AND #33 FROM 2002 TO 2012	168

Self-Management – Economic Search
2012Feb15

Search date: February 15th, 2012
Databases searched: Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid EMBASE, PubMed (for non-MEDLINE records), Wiley Cochrane (HTA & NHSEED), Centre for Reviews and Dissemination

Limits: 2002-present; English; NOT comments, editorials, letters, conference abstract (EMBASE)

Database**: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)** 1946 to Present, EMBASE <1980 to 2012 Week 06>
Search Strategy:

#	Searches	Results
1	exp Coronary Artery Disease/	212867
2	exp Myocardial Infarction/ use prmz	134000
3	exp heart infarction/ use emez	217674
4	(coronary artery disease or cad or heart attack*).ti.	45250

5	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)).ti.	149911
6	or/1-5	541817
7	exp Atrial Fibrillation/ use prmz	28253
8	exp heart atrium fibrillation/ use emez	55964
9	((atrial or atrium or auricular) adj1 fibrillation*).ti,ab.	74061
10	or/7-9	100128
11	exp heart failure/	302389
12	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)).ti,ab.	235776
13	or/11-12	383677
14	exp Stroke/	179066
15	exp Ischemic Attack, Transient/ use prmz	16399
16	exp transient ischemic attack/ use emez	19769
17	exp stroke patient/ use emez	5675
18	exp brain infarction/ or exp cerebrovascular accident/ use emez	101286
19	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA).ti,ab.	282777
20	or/14-19	393564
21	exp Diabetes Mellitus, Type 2/ use prmz	68717
22	exp non insulin dependent diabetes mellitus/ use emez	102160
23	exp diabetic patient/ use emez	13054
24	(diabetes or diabetic* or niddm or t2dm).ti,ab.	768968
25	or/21-24	794044
26	exp Skin Ulcer/	72352
27	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)).ti,ab.	28844
28	(decubitus or bedsore*).ti,ab.	8553
29	or/26-28	91149
30	exp Pulmonary Disease, Chronic Obstructive/ use prmz	17234
31	exp chronic obstructive lung disease/ use emez	54967
32	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab.	54780
33	(copd or coad).ti,ab.	46051
34	chronic airflow obstruction.ti,ab.	1063
35	exp Emphysema/	37547
36	exp chronic bronchitis/ use emez	6992
37	((chronic adj2 bronchitis) or emphysema).ti,ab.	50975
38	or/30-37	160022
39	exp Chronic Disease/	341731
40	((chronic* adj2 disease*) or (chronic* adj2 ill*)).ti,ab.	221536
41	or/39-40	508531
42	exp Comorbidity/	144447
43	(comorbid* or co-morbid* or multimorbid* or multi-morbid* or (complex* adj patient*) or "patient* with multiple" or (multiple adj2 (condition* or disease*))).ti,ab.	205176
44	or/42-43	286303
45	6 or 10 or 13 or 20 or 25 or 29 or 38 or 41 or 44	2835629

46	exp Self Care/ use prmz	34221
47	Self-Help Groups/ use prmz	7183
48	exp Consumer Participation/ use prmz	28082
49	Self Efficacy/ use prmz	9335
50	exp Self Care/ use emez	39721
51	Self Concept/ use emez	49572
52	Self Injection/ use emez	716
53	Self Monitoring/ use emez	2916
54	Patient Participation/ use emez	13437
55	Empowerment/ use emez	1649
56	(selfadminist* or selfcar* or selfinject* or selfmanag* or selfmeasur* or selfmedicat* or selfmonitor* or selfregulat* or selftest* or selftreat*).ti,ab.	1240
57	(self-administ* or self-car* or self-inject* or self-manag* or self-measur* or self-medicat* or self-monitor* or self-regulat* or self-test* or self-treat*).ti,ab.	107590
58	(selfactivation or selfdevelop* or selfintervention).ti,ab.	11
59	(self-activation or self-develop* or self-intervention).ti,ab.	1892
60	((patient? or consumer?) adj3 (activation or coach* or empowerment or involv* or participat*)).ti,ab.	116251
61	health coach*.ti,ab.	203
62	((behaviour* adj (coach* or modif*)) or (behavior* adj (coach* or modif*))).ti,ab.	6999
63	(dsmp or cdsmp or dsme or smp or sme or smt).ti,ab.	5790
64	(medication? adherence adj5 self*).ti,ab.	508
65	or/46-64	378082
66	*Economics/ use prmz	10096
67	*Economics, Medical/ use prmz	5122
68	*Economics, Pharmaceutical/ use prmz	1204
69	exp "Costs and Cost Analysis"/ use prmz	160841
70	exp Models, Economic/ use prmz	8328
71	Markov Chains/ use prmz	7589
72	Monte Carlo Method/ use prmz	16225
73	Quality-Adjusted Life Years/ use prmz	5335
74	"Value of Life"/ use prmz	5197
75	Decision Trees/ use prmz	7814
76	exp "Health Care Cost"/ use emez	169779
77	exp *Health Economics/ use emez	166975
78	exp Economic Evaluation/ use emez	177072
79	Quality Adjusted Life Year/ use emez	8345
80	*Statistical Model/ use emez	11179
81	(econom* or cost or costly or costing or costed or price or prices or pricing or priced or discount or discounts or discounted or discounting or expenditure or expenditures or budget* or afford* or pharmacoeconomic* or pharmaco-economic*).ti.	206057
82	(decision adj1 (tree* or analy* or model*)).ti,ab.	18201
83	((value or values or valuation) adj2 (money or monetary or life or lives or costs or cost)).ti,ab.	7847
84	(sensitivity analysis or sensitivity analyses or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc* or disability adjusted life or health adjusted life).ti,ab.	36052

85	(unit cost* or drug cost* or hospital cost* or health care cost* or medical cost*).ti,ab.	42865
86	(economic evaluation* or economic review*).ti,ab.	12107
87	(cost* adj2 (util* or effectiveness or efficac* or benefit* or consequence* or analy* or minimi*)).ti,ab.	114884
88	(markov* or monte carlo).ti,ab.	62399
89	or/66-88	804558
90	Case Reports/ or Comment.pt. or Editorial.pt. or Letter.pt. use prmz	2932728
91	Case Report/ or Editorial/ or Letter/ or Conference Abstract.pt. use emez	5828310
92	or/90-91	5934044
93	Meta-Analysis.pt.	31464
94	Meta-Analysis as Topic/ or exp Technology Assessment, Biomedical/	34121
95	((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab.	84417
96	((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab.	9317
97	((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab.	17149
98	(data synthes* or data extraction* or data abstraction*).ti,ab.	22798
99	(handsearch* or hand search*).ti,ab.	8959
100	(mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab.	22095
101	(met analy* or metanaly* or health technology assessment* or HTA or HTAs).ti,ab.	5053
102	(meta regression* or metaregression* or mega regression*).ti,ab.	3204
103	(meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw.	207977
104	(cochrane or health technology assessment or evidence report).jw.	21051
105	(Meta Analysis or Systematic Review or Biomedical Technology Assessment).sh.	127577
106	(Systematic Review Topic or Meta Analysis Topic).sh.	3909
107	or/93-106	283987
108	45 and 65 and 89 and 107	341
109	limit 108 to english language	335
110	limit 109 to yr="2002 -Current"	306
111	remove duplicates from 110	237
112	45 and 65 and 89	3531
113	112 not 92	3184
114	limit 113 to english language	2996
115	limit 114 to yr="2010 -Current"	564
116	remove duplicates from 115	436
117	111 or 116	620

PubMed

Coronary Artery Disease[mh]
Myocardial Infarction[mh]
coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]
(myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti])
Atrial Fibrillation[mh]
(atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab]
Heart Failure[mh]
(myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab])
Stroke[mh]
Ischemic Attack, Transient[mh]

stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab]
Diabetes Mellitus, Type 2[mh]
diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab]
Skin Ulcer[mh]
(pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])
decubitus[tiab] OR bedsore*[tiab]
Pulmonary Disease, Chronic Obstructive[mh]
chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])
copd[tiab] OR coad[tiab]
chronic airflow obstruction[tiab]
Emphysema[mh]
chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab]
Chronic Disease[mh]
(chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab])
Comorbidity[mh]
comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab]))

Economics[MAJR:NOEXP]
Economics, Medical[MAJR:NOEXP]
Economics, Pharmaceutical[MAJR:NOEXP]
"Costs and Cost Analysis"[mh]
Models, Economic[mh]
Markov Chains[mh]
Monte Carlo Method[mh]
Quality-Adjusted Life Years[mh]
"Value of Life"[mh]
Decision Trees[mh]
econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]
decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]
sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]
unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]
economic evaluation*[tiab] OR economic review*[tiab]
cost* util*[tiab] OR cost* effectiveness[tiab] OR cost* efficac*[tiab] OR cost* benefit*[tiab] OR cost* consequence*[tiab] OR cost* analy*[tiab] OR cost* minimi*[tiab]
markov*[tiab] OR monte carlo[tiab]

Self Care[mh]
Self-Help Groups[mh:noexp]
Consumer Participation[mh]
Self Efficacy[mh:noexp]
selfadminist*[tiab] OR selfcar*[tiab] OR selfinject*[tiab] OR selfmanag*[tiab] OR selfmeasur*[tiab] OR selfmedicat*[tiab] OR selfmonitor*[tiab] OR selfregulat*[tiab] OR selftest*[tiab] OR selftreat*[tiab]
self-administ*[tiab] OR self-car*[tiab] OR self-inject*[tiab] OR self-manag*[tiab] OR self-measur*[tiab] OR self-medicat*[tiab] OR self-monitor*[tiab] OR self-regulat*[tiab] OR self-test*[tiab]OR self-treat*[tiab]
selfactivation[tiab] OR selfdevelop*[tiab] OR selfintervention[tiab] OR self-activation[tiab] OR self-develop*[tiab] OR self-intervention[tiab]
(patient*[tiab] OR consumer*[tiab]) AND (activation[tiab] OR coach*[tiab] OR empowerment[tiab] OR involv*[tiab] OR participat*[tiab])
health coach*[tiab] OR behaviour* coach*[tiab] OR behaviour* modif*[tiab] OR behavior* coach*[tiab] OR behavior* modif*[tiab]
dsmp[tiab] OR cdsmp[tiab] OR dsme[tiab] OR smp[tiab] OR sme[tiab] OR smt[tiab]
medication* adherence[tiab]AND self*[tiab]

systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research

integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]

publisher[sb] OR in process[sb] OR pubmednotmedline[sb]

Limit to English

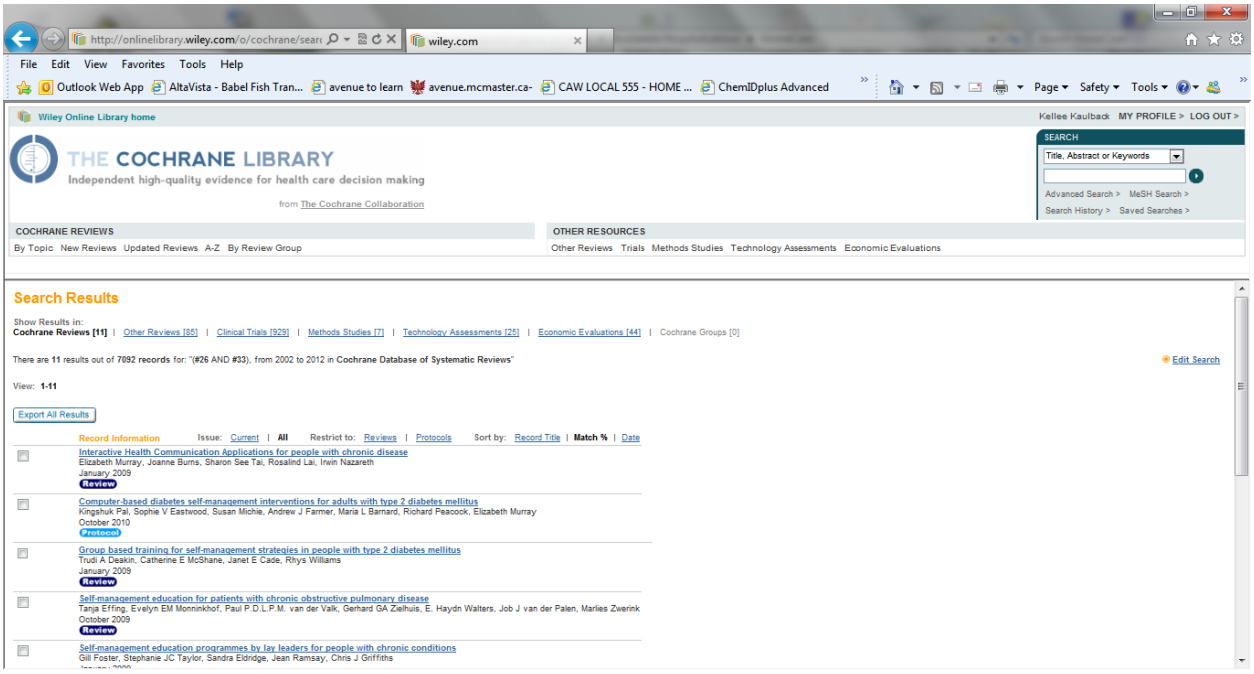
Search	Query	Items found
#20	Search #18 OR #19 Limits: English, Publication Date from 2002 to 2012	75
#19	Search #1 AND #13 AND #14 AND #15 Limits: English, Publication Date from 2002 to 2012	23
#18	Search #1 AND #13 AND #15 Limits: English, Publication Date from 2010 to 2012	70
#17	Search #1 AND #13 AND #15	116
#16	Search #1 AND #13 AND #14 AND #15	24
#15	Search publisher[sb] OR in process[sb] OR pubmednotmedline[sb]	1689981
#14	Search systematic[sb] OR meta-analysis[pt] OR meta-analysis as topic[mh] OR meta analy*[tw] OR metanaly*[tw] OR metaanaly*[tw] OR met analy*[tw] OR integrative research[tiab] OR integrative review*[tiab] OR integrative overview*[tiab] OR research integration*[tiab] OR research overview*[tiab] OR collaborative review*[tiab] OR collaborative overview*[tiab] OR systematic review*[tiab] OR technology assessment*[tiab] OR "Technology Assessment, Biomedical"[mh] OR HTA[tiab] OR HTAs[tiab] OR "Cochrane Database Syst Rev"[Journal:__jrid21711] OR "health technology assessment winchester, england"[Journal] OR "Evid Rep Technol Assess (Full Rep)"[Journal] OR "Evid Rep Technol Assess (Summ)"[Journal]	198949
#13	Search #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12	629372
#12	Search medication* adherence[tiab] AND self*[tiab]	1872
#11	Search dsmp[tiab] OR cdsmp[tiab] OR dsme[tiab] OR smp[tiab] OR sme[tiab] OR smt[tiab]	2734
#10	Search health coach*[tiab] OR behaviour* coach*[tiab] OR behaviour* modif*[tiab] OR behavior* coach*[tiab] OR behavior* modif*[tiab]	37042
#9	Search (patient*[tiab] OR consumer*[tiab]) AND (activation[tiab] OR coach*[tiab] OR empowerment[tiab] OR involv*[tiab] OR participat*[tiab])	488330
#8	Search selfactivation[tiab] OR selfdevelop*[tiab] OR selfintervention[tiab] OR self-activation[tiab] OR self-develop*[tiab] OR self-intervention[tiab]	834
#7	Search self-administ*[tiab] OR self-car*[tiab] OR self-inject*[tiab] OR self-manag*[tiab] OR self-measur*[tiab] OR self-medicat*[tiab] OR self-monitor*[tiab] OR self-regulat*[tiab] OR self-test*[tiab] OR self-treat*[tiab]	51364
#6	Search selfadminist*[tiab] OR selfcar*[tiab] OR selfinject*[tiab] OR selfmanag*[tiab] OR selfmeasur*[tiab] OR selfmedicat*[tiab] OR selfmonitor*[tiab] OR selfregulat*[tiab] OR selftest*[tiab] OR selftreat*[tiab]	145
#5	Search Self Efficacy[mh:noexp]	9302
#4	Search Consumer Participation[mh]	28053
#3	Search Self-Help Groups[mh:noexp]	7178
#2	Search Self Care[mh]	34101
#1	Search (((Coronary Artery Disease[mh]) OR (Myocardial Infarction[mh]) OR (coronary artery disease[ti] OR cad[ti] OR heart attack*[ti]) OR ((myocardi*[ti] OR heart[ti] OR cardiac[ti] OR coronary[ti]) AND (atheroscleros*[ti] OR arterioscleros*[ti] OR infarct*[ti]))) OR ((Atrial Fibrillation[mh]) OR ((atrial[tiab] OR atrium[tiab] OR auricular[tiab]) AND fibrillation*[tiab])) OR ((Heart Failure[mh]) OR ((myocardi*[tiab] OR heart[tiab] OR cardiac[tiab]) AND (failure[tiab] OR decompensation[tiab] OR insufficiency[tiab]))) OR ((Stroke[mh]) OR (Ischemic Attack, Transient[mh]) OR (stroke[tiab] OR tia[tiab] OR transient ischemic attack[tiab] OR cerebrovascular apoplexy[tiab] OR cerebrovascular accident[tiab] OR cerebrovascular infarct*[tiab] OR brain infarct*[tiab] OR CVA[tiab])) OR ((Diabetes Mellitus, Type 2[mh]) OR (diabetes[tiab] OR diabetic*[tiab] OR niddm[tiab] OR t2dm[tiab])) OR ((Skin Ulcer[mh]) OR ((pressure[tiab] OR bed[tiab] OR skin[tiab]) AND (ulcer*[tiab] OR sore*[tiab] OR wound*[tiab])) OR (decubitus[tiab] OR bedsore*[tiab])) OR ((Pulmonary Disease, Chronic Obstructive[mh]) OR (chronic obstructive[tiab] AND (lung*[tiab] OR pulmonary[tiab] OR airway*[tiab] OR airflow[tiab] OR respiratory[tiab]) AND (disease*[tiab] OR disorder*[tiab])) OR (copd[tiab] OR coad[tiab]) OR (chronic airflow obstruction[tiab]) OR (Emphysema[mh]) OR (chronic[tiab] AND bronchitis[tiab] OR emphysema[tiab])) OR ((Chronic	

Search	Query	Items found
	Disease[mh]) OR ((chronic*[tiab] AND disease*[tiab]) OR (chronic*[tiab] AND ill*[tiab]))) OR ((Comorbidity[mh]) OR (comorbid*[tiab] OR co-morbid*[tiab] OR multimorbid*[tiab] OR multi-morbid*[tiab] OR (complex*[tiab] AND patient*[tiab]) OR "patient* with multiple"[tiab] OR (multiple[tiab] AND (condition*[tiab] OR disease*[tiab])))) AND ((Economics[MAJR:noexp]) OR (Economics, Medical[MAJR:noexp]) OR (Economics, Pharmaceutical[MAJR:noexp]) OR ("Costs and Cost Analysis"[mh]) OR (Models, Economic[mh]) OR (Markov Chains[mh]) OR (Monte Carlo Method[mh]) OR (Quality-Adjusted Life Years[mh]) OR ("Value of Life"[mh]) OR (Decision Trees[mh]) OR (econom*[ti] OR cost[ti] OR costly[ti] OR costing[ti] OR costed[ti] OR price[ti] OR prices[ti] OR pricing[ti] OR priced[ti] OR discount[ti] OR discounts[ti] OR discounted[ti] OR discounting[ti] OR expenditure[ti] OR expenditures[ti] OR budget*[ti] OR afford*[ti] OR pharmacoeconomic*[ti] OR pharmaco-economic*[ti]) OR (decision tree*[tiab] OR decision analy*[tiab] OR decision model*[tiab]) OR (sensitivity analysis[tiab] OR sensitivity analyses[tiab] OR "willingness to pay"[tiab] OR quality-adjusted life year*[tiab] OR quality adjusted life year*[tiab] OR quality-adjusted life expectanc*[tiab] OR quality adjusted life expectanc*[tiab] OR disability adjusted life[tiab] OR health adjusted life[tiab]) OR (unit cost*[tiab] OR drug cost*[tiab] OR hospital cost*[tiab] OR health care cost*[tiab] OR medical cost*[tiab]) OR (economic evaluation*[tiab] OR economic review*[tiab]) OR (cost* AND util*[tiab] OR cost* AND effectiveness[tiab] OR cost* AND efficac*[tiab] OR cost* AND benefit*[tiab] OR cost* AND consequence*[tiab] OR cost* AND analy*[tiab] OR cost* AND minimi*[tiab]) OR (markov*[tiab] OR monte carlo[tiab]))	

ID	Search	Hits
#1	MeSH descriptor **Coronary Artery Disease** explode all trees	2183
#2	MeSH descriptor **Myocardial Infarction** explode all trees	7746
#3	(myocardi* or heart or cardiac or coronary) NEAR/2 (atheroscleros* or arterioscleros* or infarct*):ti or (coronary artery disease or cad or heart attack*):ti	8479
#4	MeSH descriptor **Atrial Fibrillation** explode all trees	2102
#5	(atrial NEAR/2 fibrillation* or atrium NEAR/2 fibrillation* or auricular NEAR/2 fibrillation*):ti	2316
#6	MeSH descriptor **Heart Failure** explode all trees	4710
#7	(myocardi* NEAR/2 (failure or decompensation or insufficiency)):ti or (heart NEAR/2 (failure or decompensation or insufficiency)):ti or (cardiac NEAR/2 (failure or decompensation or insufficiency)):ti	5264
#8	MeSH descriptor **Stroke** explode all trees	3899
#9	MeSH descriptor **Ischemic Attack, Transient** explode all trees	466
#10	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):ti	9913
#11	MeSH descriptor **Diabetes Mellitus, Type 2** explode all trees	6993
#12	(diabetes or diabetic* or niddm or t2dm):ti	16640
#13	MeSH descriptor **Skin Ulcer** explode all trees	1572
#14	(pressure or bed or skin) NEAR/2 (ulcer* or sore* or wound*):ti	670
#15	(decubitus or bedsore*):ti	98
#16	MeSH descriptor **Pulmonary Disease, Chronic Obstructive** explode all trees	1754
#17	(chronic obstructive NEAR/2 (lung* or pulmonary or airway* or airflow or respiratory)):ti	2418
#18	(copd or coad):ti	3321
#19	(chronic airflow obstruction):ti	72
#20	MeSH descriptor **Emphysema** explode all trees	91
#21	(chronic NEAR/2 bronchitis) or emphysema:ti	1183
#22	MeSH descriptor **Chronic Disease** explode all trees	9875

#23	(chronic* NEAR/2 disease* or chronic* NEAR/2 ill*):ti	1673
#24	MeSH descriptor **Comorbidity** explode all trees	1941
#25	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* NEXT patient*) OR "patient* with multiple" OR (multiple NEAR/2 (condition* OR disease*))):ti	649
#26	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25)	68227
#27	MeSH descriptor **Self Care** explode all trees	3018
#28	MeSH descriptor **Self-Help Groups**, this term only	501
#29	MeSH descriptor **Consumer Participation** explode all trees	850
#30	MeSH descriptor **Self Efficacy** explode all trees	1167
#31	(selfadminist* OR selfcar* OR selfinject* OR selfmanag* OR selfmeasur* OR selfmedicat* OR selfmonitor* OR selfregulat* OR selftest* OR selftreat*):ti or (self-administ* OR self-car* OR self-inject* OR self-manag* OR self-measur* OR self-medicat* OR self-monitor* OR self-regulat* OR self-test* OR self-treat*):ti or (selfactivation OR selfdevelop* OR selfintervention):ti or (self-activation OR self-develop* OR self-intervention):ti or (patient? OR consumer?) NEAR/3 (activation OR coach* OR empowerment OR involv* OR participat*):ti	2059
#32	(health coach*):ti or (behaviour* NEXT (coach* OR modif*)) OR (behavior* NEXT (coach* OR modif*)):ti or (dsmp OR cdsmp OR dsme OR smp OR sme OR smt):ti or (medication? adherence NEAR/5 self*):ti	188
#33	(#27 OR #28 OR #29 OR #30 OR #31 OR #32)	6479
#34	(#26 AND #33)	1413
#35	(#26 AND #33), from 2002 to 2012	1101

Wiley Cochrane



Centre for Reviews and Dissemination

Line	Search	Hits
1	MeSH DESCRIPTOR coronary artery disease EXPLODE ALL TREES	282
2	(coronary artery disease or cad or heart attack*):TI	213
3	((myocardi* or heart or cardiac or coronary) adj2 (atheroscleros* or arterioscleros* or infarct*)):TI	226
4	MeSH DESCRIPTOR Atrial Fibrillation EXPLODE ALL TREES	265
5	(((atrial or atrium or auricular) adj1 fibrillation*):TI	0
6	((atrial or atrium or auricular) adj1 fibrillation*):TI	171
7	MeSH DESCRIPTOR heart failure EXPLODE ALL TREES	479
8	((myocardi* or heart or cardiac) adj2 (failure or decompensation or insufficiency)):TI	283
9	MeSH DESCRIPTOR stroke EXPLODE ALL TREES	645
10	MeSH DESCRIPTOR Ischemic Attack, Transient EXPLODE ALL TREES	40
11	(stroke or tia or transient ischemic attack or cerebrovascular apoplexy or cerebrovascular accident or cerebrovascular infarct* or brain infarct* or CVA):TI	623
12	MeSH DESCRIPTOR Diabetes Mellitus, Type 2 EXPLODE ALL TREES	595
13	(diabetes or diabetic* or niddm or t2dm):TI	1228
14	MeSH DESCRIPTOR Skin Ulcer EXPLODE ALL TREES	276
15	((pressure or bed or skin) adj2 (ulcer* or sore* or wound*)):TI	74
16	(decubitus or bedsore*):TI	0
17	MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive EXPLODE ALL TREES	276
18	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory)):TI	222
19	(copd or coad):TI	110
20	(chronic airflow obstruction):TI	0
21	MeSH DESCRIPTOR Emphysema EXPLODE ALL TREES	11
22	((chronic adj2 bronchitis) or emphysema):TI	47
23	MeSH DESCRIPTOR Chronic Disease EXPLODE ALL TREES	754
24	((chronic* adj2 disease*) or (chronic* adj2 ill*)):TI	253
25	MeSH DESCRIPTOR Comorbidity EXPLODE ALL TREES	158
26	(comorbid* OR co-morbid* OR multimorbid* OR multi-morbid* OR (complex* adj1 patient*) OR "patient* with multiple" OR (multiple adj2 (condition* OR disease*))):TI	22

27	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26	4833
28	MeSH DESCRIPTOR Self Care EXPLODE ALL TREES	369
29	MeSH DESCRIPTOR Self-Help Groups EXPLODE ALL TREES	66
30	MeSH DESCRIPTOR Consumer Participation EXPLODE ALL TREES	80
31	MeSH DESCRIPTOR Self Efficacy EXPLODE ALL TREES	31
32	(selfadminist* OR selfcar* OR selfinject* OR selfmanag* OR selfmeasur* OR selfmedicat* OR selfmonitor* OR selfregulat* OR selftest* OR selftreat*):TI OR (self-administ* OR self-car* OR self-inject* OR self-manag* OR self-measur* OR self-medicat* OR self-monitor* OR self-regulat* OR self-test*OR self-treat*):TI OR (selfactivation OR selfdevelop* OR selfintervention):TI OR (self-activation OR self-develop* OR self-intervention):TI OR ((patient? OR consumer?) ADJ3 (activation OR coach* OR empowerment OR involv* OR participat*)):TI	26
33	(health coach*):TI OR ((behaviour* ADJ1 (coach* OR modif*)) OR (behavior* ADJ1 (coach* OR modif*))):TI OR (dsmp OR cdsmp OR dsme OR smp OR sme OR smt):TI OR (medication? adherence ADJ5 self*):TI	2
34	#28 OR #29 OR #30 OR #31 OR #32 OR #33	522
35	#27 AND #34 FROM 2002 TO 2012	153

Appendix 2: Disease Cohort Definitions

Table A1: Disease Cohort Definitions

Disease	Algorithm	Index Date	Source
Diabetes	Ontario Diabetes Database	As per Ontario Diabetes Database	ICES[a]
CAD	Canadian Institute for Health Information admission dx10code for I09.9, I11.0, I13.0, I25.5, I42.0, I42.5–I42.9, I43.x, or I50.x	First Canadian Institute for Health Information admission dx10code for I09.9, I11.0, I13.0, I25.5, I42.0, I42.5–I42.9, I43.x, or I50.x	So et al, 2006 (14), validation study of acute myocardial infarction population
CHF	Ontario Congestive Heart Failure Database	As per Ontario Congestive Heart Failure Database	ICES[a]
COPD	Ontario Chronic Obstructive Pulmonary Disease Database, sensitive definition	As per Ontario Chronic Obstructive Pulmonary Disease Database	ICES[a]

Abbreviation: CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ICES, Institute for Clinical Evaluative Sciences.
[a]Data provided by ICES, December 17, 2012.

Appendix 3: Quality-of-Life Data

Table A2: Study Characteristics and Utilities Reported by Studies Identified in the Systematic Clinical and Economic Literature Review

Study (Location)	Mean Age, years	Male, %	Comorbidities	Study Identified in Tufts Cost-Effectiveness Analysis	Population Characteristics	Measure (Preference Weights)	Baseline Utility	Marginal Effects on Baseline Utility
Discharge Planning for Patients With CHF								
Phillips et al, 2004 (Australia, Canada, England, Holland, Ireland, Italy, Sweden, USA[a]) (31)	70	62	No additional data reported NYHA class NR	Aidelsburger et al, 2008 (Germany) (43)	—	EQ-5D (German)	NYHA class I: 0.97 NYHA class II: 0.80 NYHA class III: 0.65 NYHA class IV: 0.30	—
In-Home Care for Patients With CHF								
Aguado et al, 2010 (Spain) (25)	77	70	Hypertension: 58% Diabetes mellitus: 38% Hypercholesterolemia: 30% COPD: 31% Chronic renal failure: 20% Chronic liver disease: 6% Cerebrovascular accident: 15% Smoking: 37% NYHA class II: 47% NYHA class III: 30% NYHA class IV: 23%	Aidelsburger et al, 2008 (Germany) (43)	—	EQ-5D (German)	NYHA class I: 0.97 NYHA class II: 0.80 NYHA class III: 0.65 NYHA class IV: 0.30	—
				Gohler et al, 2008 (multiple countries) (7)	—	EQ-5D (German)	—	Index event: 0.840 First rehospitalization: 0.816
Continuity of Care for Patients With Diabetes								
Chen and Cheng, 2011 (Taiwan) (8)	60.7	45.4	*Diabetes Complications Severity Index* 0 = 47.2% 1 = 27.7% 2+ = 25.1%	Clarke et al, 2002 (UK) (21)	Diabetes type: 2 Mean age: 62.3 Male: NR Most common clinical event: myocardial infarction, 6.2% Least common clinical event: amputation, 0.7%	EQ-5D (UK)	0.77	Myocardial infarction: −0.055 Ischemic heart disease: −0.090 Stroke: −0.164 Heart failure: −0.108 Amputation: −0.280 Blindness (1 eye): −0.074
Worrall and Knight, 2011 (Canada) (44)	74.3	42.6	NR					

Hong et al, 2010 (Korea) (36)	70.6	38.3	Heart disease: 19.5% Stroke: 17.0% Renal disease: 3.5% Hypertension: 76.5%					
Lin et al, 2010 (Taiwan) (35)	58.8	48.6	NR					
Liu et al, 2010 (United States) (45)	58.7	35.4	Arthritis: 38.4% CAD: 16.9% Cancer: 26.6% CHF: 12.5% COPD: 7.2% Cerebrovascular disease: 10.5% Hypertension: 80.1% Psychiatric disease: 28.2%					
Atlas et al, 2009 (USA) (46)	47.8	45.3	Mean Charlson Comorbidity Index Score: 0.5					
Knight et al, 2009 (Canada) (34)	74.6	45.1	NR					
Mainous et al, 2004; (47) Koopman et al, 2003; (48) Harvey, 2004 (49) (United States)	NR	37	NR					
Continuity of Care for Patients With COPD								
Hong et al, 2010 (Korea) (36)	70	45.8	COPD severity: NR *Comorbidity* Heart disease: 20.3% Stroke: 15.5% Renal disease: 3.6% Hypertension: 59.9% Heart failure: 12.3% Diabetes mellitus: 24.6% Pneumonia: 30.2% *Mean Number of Comorbid Conditions* 0: 17.8% 1: 29.8% 2: 26.7%	Borg et al, 2004 (Sweden) (50)	—	EQ-5D	Very severe: 0.55 Severe: 0.75 Moderate: 0.76 Mild: 0.90	—
				NICE COPD, based on O'Reilly et al, 2007 (UK) (51)	*Number of comorbid conditions* 1 (COPD only): 54% 2: 26% 3: 12% 4+: 8%	EQ-5D	—	First 2 weeks: −0.120 Week 2 to 12: 0.389

			3+: 25.7%					
eTools for Patients With Diabetes								
Branger et al, 1999 (Netherlands) (52)	60.0	47	—	Clarke et al, 2002 (UK) (21)	Diabetes type: 2 Mean age: 62.3 Male: NR Most common clinical event: myocardial infarction, 6.2% Least common clinical event: amputation, 0.7%	EQ-5D (UK)	0.77	Myocardial infarction: −0.055 Ischemic heart disease: −0.090 Stroke: −0.164 Heart failure: −0.108 Amputation: −0.280 Blindness (1 eye): −0.074
Cebul et al, 2011 (USA) (53)	—	—	—					
Crosson et al, 2012 (USA) (54)	—	—	—					
Herrin et al, 2012 (USA) (55)	—	—	—					
Khan et al, 2010 (USA) (38)	—	—	—					
Montori et al, 2002 (USA) (56)	—	—	—					
Wells and Hill-Smith, 1996 (UK) (57)	—	—	—					
Atienza et al, 2004 (Spain) (58)	68	60	Most common cause of heart failure was ischemic heart disease (29%) NYHA class I: 10% NYHA class II: 40% NYHA class III: 40% NYHA class IV: 40%	Gohler et al, 2008 (multiple countries) (7)	—	EQ-5D (German)	—	Index event: 0.840 First rehospitalization: 0.816

Abbreviation: CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; EQ-5D, European Quality of Life 5 Domain; eTool, electronic tool; ICD-9, International Classification of Diseases, 9th edition; NR, not reported; NYHA, New York Heart Association.

[a]Systematic review with 18 randomized controlled trials from 8 different countries.

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How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis

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Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

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In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

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This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

Diet modification is an important part of self-management for patients with diabetes and/or heart disease (including coronary artery disease, heart failure, and atrial fibrillation). Many health care providers and community-based programs advise lifestyle and diet modification as part of care for people with these conditions. This report synthesizes qualitative information on how patients respond differently to the challenges of diet modification. Qualitative and descriptive evidence can illuminate challenges that may affect the success and equitable impact of dietary modification interventions.

Objectives

To (a) examine the diet modification challenges faced by diabetes and/or heart disease patients; and (b) compare and contrast the challenges faced by patients who are members of vulnerable and nonvulnerable groups as they change their diet in response to clinical recommendations.

Data Sources

This report synthesizes 65 primary qualitative studies on the topic of dietary modification challenges encountered by patients with diabetes and/or heart disease. Included papers were published between 2002 and 2012 and studied adult patients in North America, Europe, and Australia/New Zealand.

Review Methods

Qualitative meta-synthesis was used to integrate findings across primary research studies.

Results

Analysis identified 5 types of challenges that are common to both vulnerable and nonvulnerable patients: self-discipline, knowledge, coping with everyday stress, negotiating with family members, and managing the social significance of food. Vulnerable patients may experience additional barriers, many of which can magnify or exacerbate those common challenges.

Limitations

While qualitative insights are robust and often enlightening for understanding experiences and planning services in other settings, they are not intended to be generalizable. The findings of the studies reviewed here—and of this synthesis—do not strictly generalize to the Ontario (or any specific) population. This evidence must be interpreted and applied carefully, in light of expertise and the experiences of the relevant community.

Conclusions

Diet modification is not simply a matter of knowing what to eat and making the rational choice to change dietary practices. Rather, diet and eating practices should be considered as part of the situated lives of patients, requiring an individualized approach that is responsive to the conditions in which each patient is

attempting to make a change. Common challenges include self-discipline, knowledge, coping with everyday stress, negotiating with family members, and managing the social significance of food. An individualized approach is particularly important when working with patients who have vulnerabilities.

Plain Language Summary

Health care providers often encourage people with diabetes and/or heart disease to change their diet. They advise people with diabetes to eat less sugar, starch, and fat. They advise people with heart disease to eat less fat and salt. However, many patients find it difficult to change what they eat. This report examines the challenges people may face when making such changes. It also examines the special challenges faced by people who are vulnerable due to other factors, such as poverty, lack of education, and difficulty speaking English. Five themes were common to all people who make diet changes: self-discipline, knowledge, coping with stress, negotiating with family members, and managing the social aspect of food. Members of vulnerable groups also reported other challenges, such as affording fresh fruit and vegetables or understanding English instructions. This report may help health care providers work with patients more effectively to make diet changes.

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CAD	Coronary artery disease
OHTAC	Ontario Health Technology Advisory Committee

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
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- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

To (a) examine the diet modification challenges faced by heart disease and/or diabetes patients; and (b) compare and contrast the challenges faced by patients who are members of vulnerable and nonvulnerable groups as they change their diet in response to clinical recommendations.

Clinical Need and Target Population

Diabetes

Diabetes is a metabolic condition characterized by a deficiency in either insulin production or uptake. It is a chronic disease associated with multiple complications, including cardiovascular disease, stroke, blindness, kidney damage/failure, nerve damage, and amputations. (1) More than 90% of people with diabetes have type 2 diabetes, a form that is associated with increased age, body weight, and family history. (1) The number of Canadians with diabetes has increased dramatically over the last decade: in 2008/2009, almost 2.4 million people were living with the disease. (1)

Heart Disease

Heart disease is a term that encompasses multiple cardiovascular conditions, including coronary artery disease (CAD), heart failure, and atrial fibrillation. CAD is a narrowing of the blood vessels that supply blood and oxygen to the heart. Over 1.3 million Canadians self-reported CAD, which is the leading cause of death for men and women in Canada. (2) Heart failure is a complex set of symptoms indicating a weakened heart muscle and may follow CAD. The estimated prevalence of heart disease in Canadians over age 45 ranges from 2.2% (3) to 12%. (4) Atrial fibrillation is characterized by an irregular heart rate and may also coincide with CAD or other conditions of abnormal heart muscle function. Canadian prevalence figures are not available, but in the United States, 1 in 200 people aged 50 to 60 years has atrial fibrillation, rising to 1 in 10 people over the age of 80 years. (5)

Vulnerability

Development and Use

Following a review of the literature on vulnerability, a theoretical definition was created to sort the literature related to dietary modification. Paying attention to vulnerability is congruent with the Ontario Ministry of Health and Long-Term Care's focus on health equity as a way of reducing the incidence of costly and preventable illnesses; addressing inequitable access to high-quality care can lead to a better understanding of the specific needs of health-disadvantaged populations. (6)

The definition was derived from a narrative review of the relevant literature; it informed understanding of vulnerability and highlighted groups that could be conceptualized as vulnerable to adverse health outcomes stemming from diabetes and/or heart disease. The definition was used to categorize papers according to whether they included a vulnerable or a nonvulnerable population.

Definition

While there is no clear definition of what constitutes "vulnerable populations," they may be understood as social groups with an increased relative risk of or susceptibility to adverse health outcomes. This differential risk (or vulnerability) is evidenced by increased comparative morbidity, premature mortality, and diminished quality of life. The fundamental causes of increased susceptibility to disease are low social and economic status and lack of environmental resources. Groups recognized as vulnerable are the poor; those who are subjected to discrimination, intolerance, subordination, and stigma; and those who are politically marginalized, disenfranchised, and denied human rights. Vulnerable groups typically

include women and children, visible minorities, immigrants, gay men and lesbians, the homeless, and the elderly. (7, 8)

The concept of vulnerability is linked to the idea of risk as a result of exposure to contingencies and stress, and difficulty coping with such exposures. (9, 10) There are 2 sides to vulnerability: an *external* side of susceptibility to risks, shocks, and stress; and an *internal* side, which is a lack of capacity or means to cope without damaging loss. (9, 10) Vulnerability is situational and viewed as a dynamic continuum: a person's vulnerability can change, increasing during life transitions and major life changes. It is seen as an attribute of the total interaction between the person and his/her external environment. (10, 11)

Technique

Diet modification is part of the treatment and self-management recommendations for patients with diabetes and/or heart disease. (12, 13) For people with diabetes, sustained diet modification is an essential part of maintaining glycemic control, (14) and it is recommended as a preventative measure for people who may be at risk of developing type 2 diabetes. (12) Diet modification is also an important factor in the prevention and treatment of heart disease; (13) excess body weight and high cholesterol and sodium levels may exacerbate heart dysfunction.

Given the significant number of dietary changes recommended for people with diabetes and/or heart disease, (12, 13), the scope of this report was not limited to any 1 type or method of dietary change. Instead, this meta-synthesis considered any reports of a patient's attempt to change his/her diet, regardless of the type of intervention, education program, or health care provider involvement. Equally relevant were reports of successes, failures, and ongoing efforts related to dietary change. This broad scope reflected our interest in the patient's experience of dietary modification, which may inform the design and implementation of a variety of self-management interventions or programs.

Evidence-Based Analysis

Research Questions

1. What are the diet modification challenges faced by diabetes and heart disease patients?
2. Do patients who are members of vulnerable and nonvulnerable groups experience different challenges as they change their diets in response to clinical recommendations? What challenges do they face, and how do those challenges change the experience of diet modification?

Research Methods

Literature Search

Search Strategy

A literature search was performed on May 3, 2012, using OVID MEDLINE and EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL) and on May 4, 2012, using ISI Web of Science Social Sciences Citation Index (SSCI), for studies published from January 1, 2002, until May 2012. We developed a qualitative mega-filter by combining existing published qualitative filters. (15-17) The filters were compared and redundant search terms were deleted. We added exclusionary terms to the search filter that would be likely to identify quantitative research and reduce the number of false positives. We then applied the qualitative mega-filter to 9 condition-specific search filters (atrial fibrillation, chronic conditions, chronic obstructive pulmonary disease, chronic wounds, congestive heart failure, CAD, diabetes, multiple morbidities, and stroke). Appendix 1 provides details of the search strategy. Titles and abstracts were reviewed by 2 reviewers and, for those studies meeting the eligibility criteria, full-text articles were obtained.

Inclusion Criteria

English language full-reports

- published between January 1, 2002, and May 2, 2012
- primary qualitative empirical research (using any descriptive or interpretive qualitative methodology, including the qualitative component of mixed-methods studies) and secondary syntheses of primary qualitative empirical research
- adult patients (> 18 years of age)
- Canada, United States, Europe, Australia, and New Zealand
- published research work (no theses)
- studies addressing any aspect of the experience of dietary modification, nutrition, food, or meals (as indicated in the title or abstract)
- participants were patients with diabetes or heart disease

Exclusion Criteria

- studies addressing topics other than the experience of dietary modification, nutrition, food, or meals, or this topic was not sufficiently prominent to be mentioned in the title or abstract
- studies that did not include patients with diabetes or heart disease
- studies labelled "qualitative" but that did not use a qualitative descriptive or interpretive methodology (e.g., case studies, experiments, or observational analyses using qualitative categorical variables)
- quantitative research (i.e., using statistical hypothesis testing, using primarily quantitative data or analyses, or expressing results in quantitative or statistical terms)
- studies that did not pose an empirical research objective or question, or involve primary or secondary analysis of empirical data

Qualitative Analysis

We analyzed published qualitative research using techniques of integrative qualitative meta-synthesis. (18-21) Qualitative meta-synthesis, also known as qualitative research integration, is an integrative technique that summarizes research over a number of studies with the intent of combining findings from multiple papers. Qualitative meta-synthesis has 2 objectives: first, the aggregate of a result should reflect the range of findings while retaining the original meaning; second, by comparing and contrasting findings across studies, a new integrative interpretation should be produced. (22)

Predefined topic and research questions guided research collection, data extraction, and analysis. Topics were defined in stages as relevant literature was identified and corresponding evidence-based analyses proceeded. All qualitative research relevant to the conditions under analysis was retrieved. In consultation with Health Quality Ontario, a theoretical sensitivity to patient centredness and vulnerability was used to further refine the dataset. Finally, specific research questions were chosen and a final search performed to retrieve papers relevant to these questions. The current analysis included papers that addressed the issue of dietary modification challenges, patients with diabetes and heart disease, and both vulnerable and nonvulnerable groups.

Data extraction focused on—and was limited to—findings that were relevant to this research topic. Qualitative findings are the "data-driven and integrated discoveries, judgments, and/or pronouncements researchers offer about the phenomena, events, or cases under investigation." (19) In addition to the researchers' findings, original data excerpts (participant quotes, stories, or incidents) were also extracted to illustrate specific findings and, when useful, to facilitate communication of findings.

Through a staged coding process similar to that of grounded theory, (23, 24) findings were broken into their component parts (key themes, categories, concepts) and then regrouped across studies and related to each other thematically. This process allowed for organization and reflection on the full range of interpretative insights across the body of research. (19, 25) These categorical groupings provided the foundation from which interpretations of the social and personal phenomena relevant to diet modification were synthesized. A "constant comparative" and iterative approach was used, in which preliminary categories were repeatedly compared with the research findings, raw data excerpts, and coinvestigators' interpretations of the studies, as well as with the original Ontario Health Technology Assessment Committee (OHTAC)–defined topic, emerging clinical evidence-based analyses of related technologies, (26) and feedback from OHTAC deliberations and expert panels on issues related to the topic.

Quality of Evidence

For valid epistemological reasons, the field of qualitative research lacks consensus on the importance of, and methods/standards for, critical appraisal. (27) Qualitative health researchers conventionally underreport procedural details, (20) and the quality of findings tends to rest more on the conceptual prowess of the researchers than on methodological processes. (27) Theoretically sophisticated findings are promoted as a marker of study quality for making valuable theoretical contributions to social science academic disciplines. (28) However, theoretical sophistication is not necessary to contribute potentially valuable information to a synthesis of multiple studies, or to inform questions posed by the interdisciplinary and interprofessional field of health technology assessment. Qualitative meta-synthesis researchers typically do not exclude qualitative research on the basis of independently appraised quality. This approach is common to multiple types of interpretive qualitative synthesis. (18, 19, 22, 28-32)

For this review, the academic peer review and publication process was used to eliminate scientifically unsound studies according to current standards. Beyond this, all topically relevant, accessible research using any qualitative interpretive or descriptive methodology was included. The value of the research findings was appraised solely in terms of their relevance to our research questions and the presence of data that supported the authors' findings.

Results of Evidence-Based Analysis

The database search yielded 49,676 citations published between January 1, 2002, and May 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract; 2 reviewers reviewed all titles and abstracts to confine the database to qualitative research relevant to any of the chronic diseases. Figure 1 shows the breakdown of when and for what reason citations were excluded from the analysis.

Sixty-four studies met the inclusion criteria. The reference lists of the included studies were hand-searched to identify any additional potentially relevant studies, and 1 additional citation was included, for a total of 65 studies. Of those studies, 41 included patients who were members of vulnerable populations and 24 included patients who were not identified as members of vulnerable populations. Fifty-four mainly addressed patients with diabetes, and 11 mainly addressed patients with heart disease.

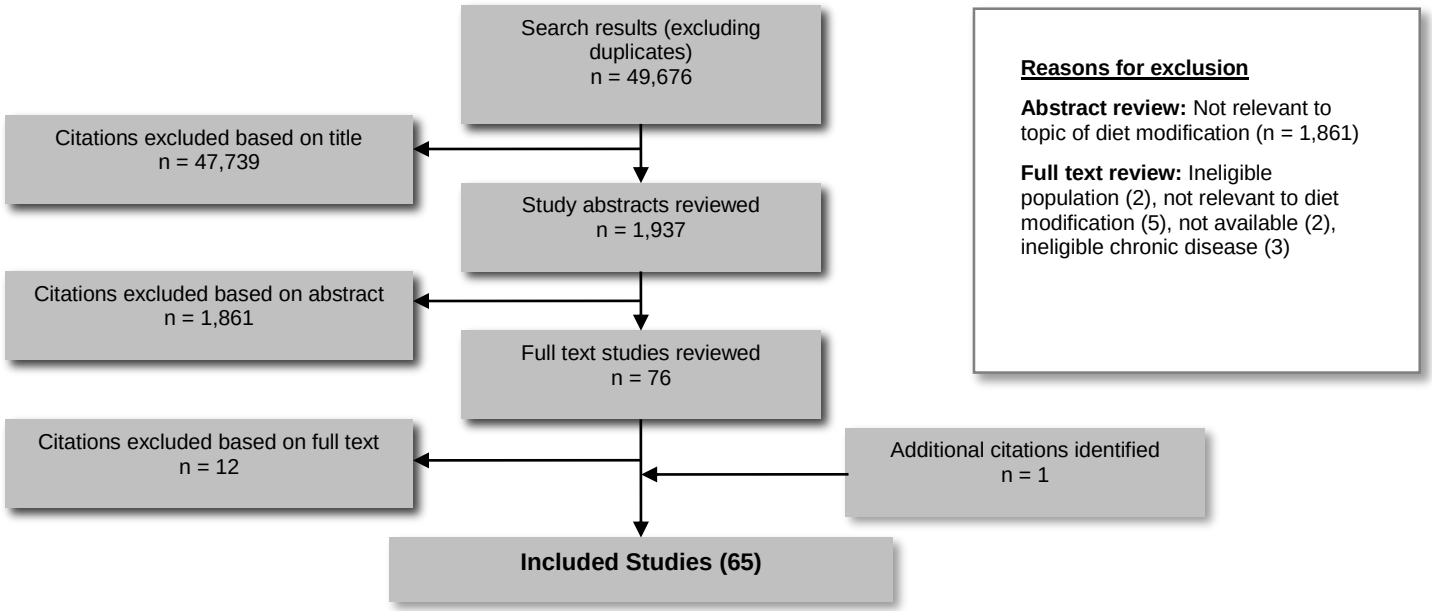

Figure 1: Citation Flow Chart

For each included study (n = 65), the study design and location were identified and are summarized in Tables 1 and 2, respectively. For each included study about vulnerable populations (n = 41), types of vulnerabilities were identified and are summarized in Table 3.

Table 1: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
Content analysis	8
Ethnographic analysis	6
Framework analysis	4
Grounded theory/constant comparative analysis	11
Other (case study, comparative, discourse analysis, narrative, participatory)	10
Phenomenological	7
Qualitative (otherwise unspecified)	19
Total	**65**

Table 2: Body of Evidence Examined According to Study Location

Study Location	Number of Eligible Studies
Australia/New Zealand	6
Canada (not Ontario)	4
Europe	19
Ontario	3
United States	33
Total	**65**

Table 3: Body of Evidence Examined According to Type of Vulnerability Identified

Type of Vulnerability Identified	Number of Eligible Studies[a]
Minority ethnicity or culture	36
Aboriginal	6
Hispanic	6
Afro-Caribbean or Black	9
South Asian immigrants	7
Asian immigrants	3
African or Middle Eastern immigrants	3
"Minority" otherwise unspecified	2
Low socioeconomic status	16
Female	5
Rural dweller	6
Physical impairment	1
Total	**64**

[a]Many studies mentioned multiple vulnerabilities, so the total equals more than 41.

Context

Of the 41 papers describing vulnerable groups, 36 described patients with diabetes and 5 described patients with heart disease. An analysis of the issues faced by diabetes and heart disease patients when modifying their diet revealed that all patients encounter some common challenges, but that vulnerabilities tend to magnify experiences of common challenges and introduce additional ones. An individual's particular challenges will reflect his or her unique set of circumstances and vulnerabilities.

Although some challenges may be characteristic of specific vulnerabilities, members of vulnerable groups do not share uniform experiences. Each patient is located in a particular social context, with a unique standpoint, situation, and access to or deprivation from certain resources. (33) This review identified a range of common issues, but the qualitative studies also found sufficient diversity and variation to preclude stereotypes. An individual's context is shaped by many simultaneous pressures. For example, a program may serve 2 people with diabetes who are female, Bangladeshi immigrants, and senior citizens, but due to their particular social supports, financial resources, health care experiences, educational levels, time in Canada, and other factors, these women may have completely different experiences in adopting dietary modification guidelines. The aim of this report is to describe the issues that patients are likely to face; clinicians who counsel patients about dietary change must spend time exploring each individual's particular challenges.

Themes

Five themes were identified as common to all patients making dietary modifications: self-discipline, knowledge, coping with everyday stress, negotiating with family members, and managing the social significance of food. Common challenges are outlined below; associated issues for people from vulnerable populations are also described, in relation to how they may exacerbate common challenges.

Self-Discipline

All studies reported that patients often described the challenge of trying to resist food they wanted to eat but knew wasn't healthy, eat food they knew was healthy but didn't enjoy, and reduce portion sizes.

Self-discipline is described as both an enabler of and a barrier to dietary change. Descriptions of control and self-discipline are common in diabetes, which often positions the patient as an agent with the power to exert control over his/her food consumption and therefore over his/her blood glucose levels. (34-41) However, this pervasive emphasis on self-discipline may also help explain why patients reported feelings of helplessness and frustration when they adhered to their diet but did not see corresponding improvements in their blood glucose readings. (42) Heart disease patients studied by Doyle (43) also described self-control as a major factor in their success, and a lack of willpower as one of the main causes of failure. Self-discipline was described as an enabler of change for patients who believed that dietary change was important: "regardless of challenges faced and lack of support, participants repeatedly expressed attitudes and beliefs that they could make the necessary changes to control diabetes." (40) However, it was also understood as a barrier when patients described failure to resist food that was not diet-appropriate, (35-38) but that was enjoyable and brought satisfaction. (39, 41)

In many papers, participants admitted that they regularly succumbed to temptation and ate prohibited foods, because they desired a particular food for the pleasure it brought, (37, 44) as a means of coping with stress or emotion, (45-47) or because consumption of particular foods was linked to identity and belonging. (40, 48-52) Some papers suggested that stress might trigger consumption of unhealthy "comfort" foods. (53) When patients did not like recommended foods, the motivation for increased consumption of those foods was very low. (44, 54) Taste was mentioned frequently by patients from other culinary cultures; they perceived North American food to be bland and tasteless. (50, 53, 55-57) In some

instances, the issue of culture can be dealt with by exploring culturally specific foods that are linked to taste (e.g., spices); some may be congruent with a diabetes- or heart-friendly diet. (50) Several authors suggested working with patients to create a diet that suited their palate.

Reducing portion sizes was described as a feasible task in multiple studies, (35, 36, 53, 57-62) and as a means of addressing the problem of limiting favourite unhealthy foods. (58) Many understood portion control to be a main component of dietary modification. However, *implementing* portion control was challenging. Many patients had difficulty understanding portion sizes and appropriate amounts of different food types. Some used general strategies such as avoiding second helpings (59) or preparing less food. (36, 53) Others spoke about the need to more precisely monitor the amount of food they consumed—"the diabetic diet consists of measuring and weighing every single thing you eat" (61)—but the extra effort required to measure portions was often described as cumbersome. (57, 60)

Another challenge related to portion control was feeling satisfied and overcoming feelings of hunger. (59) Patients who tried to decrease food portions and increase physical activity simultaneously found portion control very difficult. (41, 63) Others had difficulty understanding that not all food intake needed to be reduced; some understood dietary modification to mean that they should only eliminate unhealthy foods, not add healthy alternatives. (39) This finding was present among patients from both vulnerable and nonvulnerable groups, but communication between health care providers and patients from other cultural contexts may have exacerbated this misunderstanding, so that patients struggled with hunger. (39, 59) Lawton (50) described many anecdotes of deprivation and feelings of hunger resulting from misunderstandings about portion control. For example, some participants with diabetes described not being able to sleep because they were hungry, reporting that they would sit awake in bed with the light on, waiting for a blood glucose reading that was low enough to eat something. (50)

A third challenge to portion control was cultural understandings of health and etiology of disease. For Hmong people living in the United States, limiting food intake and feeling hungry is perceived to cause the body to fall out of balance, resulting in illness. The Hmong believe that someone who is ill should eat to satiety, (49) a cultural belief that is incompatible with the idea of portion control. Reducing intake of particular types of food may be problematic for those who believe that particular foods are necessary to keep the body in balance; for instance, traditional Chinese medicine holds that certain foods must be eaten in greater amounts to restore balance. As a result, patients with such beliefs may think that eliminating or reducing intake of certain foods will worsen their condition. (48, 64)

Knowledge

Various knowledge-related challenges were reported by patients: understanding what they should eat, understanding the link between their diet and blood glucose levels, and employing techniques they learned from health care professionals to count carbohydrates or monitor salt intake. These challenges were exacerbated for patients with low levels of health literacy, or with difficulty communicating effectively with health care provider due to language issues.

Knowledge deficits were widely reported in papers examining both vulnerable and nonvulnerable patients. Reported knowledge deficits included basic understanding of types of food that were diabetes- or heart-friendly; (54, 65) the relationship between diet and blood glucose levels; (61, 66, 67) the link between exercise, food, and blood glucose levels; (37, 42, 63, 65) the etiology and effects of diabetes; (68, 69) counting calories or carbohydrates; (38) and what foods were vegetables (versus carbohydrates). (70) Among heart disease patients, knowledge about dietary fibre was low, (71) which may explain other findings that fibre intake was seldom increased, even among those who were successful at making other dietary changes. (45)

Knowledge was generally seen as a wholly positive influence on dietary modification; for instance, it was described as empowering, increasing both motivation and feelings of self-efficacy. (34, 40, 72, 73) Doyle (43) referred to "poor recall of information" rather than lack of knowledge, drawing attention to the fact that it was difficult to evaluate whether a patient's reported or demonstrated lack of knowledge meant a lack of opportunity to acquire knowledge or poor retention of knowledge that had been shared.

There were inconsistent reports about the level of knowledge needed for successful dietary modification. While most papers documented knowledge deficits, 2 emphasized that knowledge was *not* a barrier to dietary change. (45, 74) Clark and colleagues (45) studied Canadian heart disease patients of low socioeconomic status; participants demonstrated a high level of knowledge about the types of foods that increased cardiac risk and identified barriers other than knowledge to implementing dietary change. Greenhalgh and colleagues (74) emphasized that knowledge of dietary "facts" was not a main barrier to dietary change, even though significant knowledge deficits were prevalent among their sample of multiethnic British patients with diabetes. The authors stressed the importance of knowledge gained via "legitimate peripheral participation," (74) rather than the acquisition of socially disembodied facts. By participating in their own self-management and interacting with peers and health care providers, patients were better able to develop socially and personally relevant knowledge and strategies for managing their diabetes. (74)

Read together, the papers by Greenhalgh (74) and Clark (45) provide a nuanced analysis of the relationship between knowledge and dietary change—one that may help explain and unite the more disparate findings in the literature. Knowledge that is applicable and useful may be most helpful to patients who are implementing self-management activities (including, but not limited to, dietary modification). Health care professionals should be encouraged to think of dietary counselling beyond the transfer of knowledge and skills, (75) and to help patients understand how to modify their diet in the unique context of their own life. For example, Aboriginal participants in Australia reported difficulty applying the knowledge they learned in a diabetes cooking course because of family/household preferences and the affordability of food. (76)

For immigrant patients whose first language was not English, language and communication barriers were cited as detrimental to the acquisition of knowledge. "We have a bit of a problem in English. In Punjabi, we can ask something in full. We can ask questions in full: What is this? What is that? What isn't it? In English, we don't always understand everything." (71) Sometimes patients had to rely on friends or family to interpret information provided by the health care provider, which had the potential to upset customary parent/child roles, or result in crucial information being withheld (intentionally or unintentionally). (55) Participants who were able to communicate with a health care provider in their own language spoke positively about this opportunity and the cultural information that was shared, such as the implications of *roti* for cardiac health, (71) an issue that caused consternation for South Asian patients in another study. (50) The accessibility of patient education materials is also important. The use of pictures was suggested for people with low literacy levels, poor English skills, or lack of familiarity with North American food. (55, 60, 77) Translated patient education materials were helpful but did not alleviate the issue of English-only signage in stores and information on food labels. (60, 77)

Language is not the only communication barrier, however; cultural values related communication styles and preferences may also affect how information is understood and received. For example, Dussart (46) described people with diabetes from the Warlpiri Aboriginal group in Australia. For the Warlpiri, personal autonomy is a cultural value, and "advice" from health care professionals is often poorly received because "the imperative form and associated threats, so pervasive in bio-medical diagnosis and recommendations is an anathema to the Warlpiri people." To ask a Warlpiri patient to refrain from eating a certain food would infringe on that person's autonomy. (46)

Coping With Everyday Stress

All patients reported challenges related to routine events (such as co-ordinating family schedules); being forced to eat at particular times because of work; and avoiding convenience foods when busy. Patients who experienced higher levels of stress, or who had fewer resources to cope with stress, cited additional challenges that negatively affected attempts to modify their diet.

Healthy eating habits were described as particularly difficult to maintain for patients under emotional stress. (35, 45-47) A diagnosis of diabetes or heart disease in itself may be a cause of stress and/or fear, and for patients who had already experienced negative side effects from their disease, fear was also a commonly reported stressful emotion. (43, 78) Patients may require more support from health care providers to manage stress. (79)

Emotional stress was also linked to increased fatigue and decreased ability to cope with other life events, (80) resulting in frustration. For some participants, the idea of prioritizing their own physical and emotional well-being over that of their family was very challenging. (80) Similarly, emotional stress was reported when patients were asked to prioritize their own needs in other ways, such as preparing meals that were diet-friendly but not enjoyed by other family members, (81) or diverting limited financial resources to pay for more expensive healthy food, medication, or medical supplies. (42, 81)

Everyday stressors, such as busy work schedules, family responsibilities, or the need to co-ordinate meals for multiple family members with different time requirements and dietary preferences were also cited as barriers. (51, 54, 60, 80-83) This may be particularly challenging for diabetes patients, who are often instructed to eat at regular times every day. If work schedule, childcare responsibilities, or a family member's schedule disrupted regular mealtimes, patients found it difficult to manage these challenges and find alternative solutions. (84) Some talked about the importance of routine and scheduling, including the need to anticipate difficulties that might arise due to family and work schedules, and to plan food and meals accordingly. (35, 41, 85)

Stress may have more of an impact on vulnerable people, who may have additional everyday stressors and fewer resources to cope. Additional stress can come from intermediate factors such as financial insecurity or discrimination; this may lead to physiologic responses, and both may affect dietary practices. (86) The pervasive stress of poverty, including emotional pressures and fear about not being able to make recommended changes, may compound everyday stressors. (42, 45, 73, 87) People who are living in a new place, far away from their customary way of life and comforts, may also experience increased stress. (49, 51, 52, 57, 78, 79)

Negotiating With Family Members

Considering the influence of spouses and family members on meal planning and eating practices is important, since "food and eating form a large part of the 'normal' but essential activities of families, across cultures." (88) Consequently, any type of dietary modification involves some degree of negotiation with other members of the household. Family members, especially spouses, can be a positive or negative influence on dietary change. It is important to consider the role of family members when planning dietary modification interventions; since meal planning and preparation is a shared activity, interventions aimed at the patient alone may mean that the one who receives dietary advice is not the one who does the cooking or serving. (83) A number of papers specifically addressed the spousal relationship and its effect on dietary modification. (72, 89-92) Others focused on the family relationship. (48, 55, 59, 80, 81, 88, 93, 94) The influence of spouses and family members is very important; the actions of family members may enable or inhibit dietary change (or neither), and this influence may change over time. (90)

Support at home is universally described as an essential component of successful dietary modification. *Support* (emotional understanding, respect for needs) is differentiated from *help* (instrumental assistance

in chores, physical tasks, financial help, informational assistance); both types of assistance were seen as important, but support was described as essential by some participants. (80) Positive support (e.g., encouraging, reminders, emotional support, empowering patient to make change independently) was more successful than negative support (e.g., nagging, monitoring, restricting). (72, 80, 90)

Positive support at home helps patients make better food-related decisions while maintaining the interpersonal relationships that are essential for emotional understanding. Emotional support from family members was helpful in encouraging patients to keep working, and to help them realize that dietary change was an achievable goal. (36, 85) Instrumental help from family members, such as buying only healthy food, was also an important part of the positive value of relationships. (35) Family and friends were a key source of emotional support; those who were living well with diabetes or heart disease often acted as role models for successful change. (59, 82) Some patients reported that their own diagnosis of diabetes inspired concern for other family members and was a positive motivator for dietary change. (95) In other households, family members had high expectations for the patient, and such concern was cited as a motivating factor to comply with dietary modifications. (48) However, the concern of family members was also described as stressful, especially when it was focused on an issue that the patient could or would not change, (59) or when repeated reminders/help changed a spousal partnership to a parent-child dynamic. (92) Overzealous attention from family members can cause patients to take less responsibility and exhibit less self-control, letting family members make food-related choices and monitor/control food intake. (72)

Dietary change for a single patient has the potential to improve the diet of the whole family, (81, 82, 94) but can also be the cause of disagreements. (48, 55) Patients struggled to avoid tempting food when family members consumed it in their presence. (59) Family members were seldom inspired to alter their own diets to support patients, (94) and some participants spoke of trying to make dietary modifications that family members wouldn't notice, such as switching to sweetener from sugar in baking, (93) or pouring skim milk into a whole milk jug. (59)

The links between food and family are complex, influenced by family and broader cultures, and by gender roles related to cooking, meal planning, and diet modification. Several papers discussed how dietary modification might be different for male and female patients. (48, 51, 53-55, 57, 61, 68, 72, 75, 81, 82, 86, 93, 96) The female patients in Beverley's study (72) perceived that they received less support from their husbands than male patients received from their wives. Peel (96) found that female diabetes patients tended to describe dietary modification as an individual challenge, but male patients described dietary modification as a family matter. In many families, women have the main responsibility for food preparation, although not always the final say over the menu. (48, 55, 72, 81, 93) Control over dietary routines did not necessarily mean success in implementing dietary modification, due to the food preferences of other family members. (81) Astin (55) observed that in South Asian families, the adaptation of family members to the patient's diet was linked to gender: if the patient was male, the whole family would typically adopt the modified diet; if the patient was female, she would typically prepare separate food for herself, not wanting to subject other family members to her dietary restriction. Due to the extra time and effort involved in preparing a separate, modified meal, female patients were more likely to lapse into an unmodified diet. (55)

Other considerations that affected family relations included balancing cultural understandings of how to care for an ill person with Western biomedical instructions. For Chinese spouses, restricting food during illness may be counterintuitive: instead, "special foods and disease-specific medicinal foods should appropriately be provided for patients as both a means of supporting health and demonstrating family solicitousness." (48)

Family culture is a significant influence on food perceptions and eating practices, shaping understanding of the role of food in daily life. (81) Sometimes this influence is negative (emphasizing the consumption of food that is outside of the diet plan), but sometimes it is positive. One woman spoke of watching her mother adopt a diabetes-friendly diet and noticing how her health improved; this observation inspired the daughter to make more of an effort with respect to her own dietary change. (81) Sometimes, family culture and food are inextricable: for example, baking and sharing birthday cakes is a way of demonstrating caring. (88) Not being able to participate in these food-based family rituals is a challenge for patients and family members.

Managing the Social Significance of Food

Many studies emphasized patient reports that maintaining diet modification was especially difficult when visiting or hosting friends and family members, and during holiday or social occasions. Because of the central role of food in social gatherings, patients often felt left out or separated when they could not consume special foods.

Participants commented that it was especially difficult to exercise self-discipline and refuse favourite foods during social situations. (36, 48, 73, 87, 95) Difficulty in following disease-specific diets during social occasions meant that some patients chose not to attend these functions, leading to feelings of isolation and withdrawal. (48) Eating differently in social situations may also result in stigma; patients reported feeling distressed when their diabetes was a focus of attention at social events because they were not eating the same food as others. (48, 87) As a result, attempts at diet modification were more likely to fail during social occasions. (36) Sociocultural expectations related to good hosting are also often linked to the amount and type of food that is served. Patients developed strategies for socializing in a diet-friendly way in their own homes, but when visiting others, many talked about the social difficulties of maintaining restrictive diets but not refusing hospitality. (81, 93) The social stigma related to refusing food may be stronger in some cultures than others; for instance, Filipino patients discussed the centrality of food in their familial and social relationships. (97)

Food also plays a central role in religious practice, and dietary restrictions may cause patients to feel alienated from their spiritual community. Many religious holidays have associated food traditions that are not congruent with diabetes- or heart-friendly diets. Similar to social occasions, religious holidays were frequently cited as times when it was most difficult to maintain healthy eating habits. (48, 52) For patients with diabetes who observe periods of religious fasting, it may be a struggle to maintain stable blood glucose levels, and they may choose not to participate in the fast for the sake of their health. (57) Culturally appropriate diet counselling for patients who wish to fast may include recommendations about how or to what extent they may participate in fasting activities.

For some patients, particular foods have significant cultural meaning and are intrinsically linked with identity and belonging. Studies focusing on Asian and South Asian patients often mentioned rice as a symbolically important food, one that was particularly difficult to restrict or omit. (40, 48-51, 97) Other patients mentioned *roti*, (50, 71) *ghee*, (52) or corn tortillas (36, 53, 76, 79) as culturally significant foods. Patients often mentioned that no alternatives to these foods were suggested by health care providers, (50) or that the suggested alternatives were unsatisfactory: "patients and families were challenged by being asked to restrict rice and change from familiar white 'fragrant' rice to foreign 'chewy' and 'tasteless' brown, red, or black rice. These challenges were persistently noted by participants who felt called upon to cope with this change in communal meals." (48)

The link between food and cultural identity is strong. For immigrants, food is often a link to their culture of origin. In the Chinese diet, for example, rice is a multifaceted and nuanced symbol of holistic health and well-being. (48) For Filipino-Americans, rice is "viewed as a symbol of strength, sustenance, sacrifice, wealth, and togetherness and may be eaten at every meal. Reducing or eliminating rice from

one's diet may be perceived as rejecting Filipino culture." (97) For African-Americans, food has a rich symbolism and meaning, with slavery often mentioned as the originating site of the symbolism and meaning of food: "food became wealth in that it was available for them to share and enjoy when no other tangible resources were truly their own. Power over the production, consumption, and distribution of food likely served to affirm the personhood and identity of the slaves in an environment that relegated them to the status of property." (75) The social and cultural meaning rooted in this history may still affect the way that food is understood, and the place and meaning of food in the lives of African-American people.

Summary

To assist in challenges with self-discipline, health care providers can work with patients to create a diabetes- or heart-friendly diet that suits and satisfies their palate. Challenges related to knowledge may be partially addressed by recognizing the need for health information that is applicable and useful to patients' specific circumstances; this includes the provision of culturally specific dietary recommendations and informational or counselling materials available in other languages or pictorial forms. Providers may also wish to address the role of food, emotions, and stress to help patients develop strategies and coping techniques. Support for patients' diet modification also requires taking into account their role in the family, in meal preparation, and in social and religious communities. Dietary counselling that attends to these dimensions can better help patients meet related challenges. Providers must be aware of the types of challenges that all patients face and how these may be magnified in vulnerable populations, but they should also continue to see their patients as individuals with unique experiences and circumstances.

Limitations

Qualitative research provides theoretical and contextual insights into the experiences of limited numbers of people in specific settings. Qualitative research findings are not intended to generalize directly to populations, although meta-synthesis across a number of qualitative studies builds an increasingly robust understanding that is more likely to be transferable. While qualitative insights are robust and often enlightening for understanding experiences and planning services in other settings, the findings of the studies reviewed here—and of this synthesis—do not strictly generalize to the Ontario (or any specific) population. Findings are limited to the conditions included in the body of literature synthesized (i.e., diabetes and heart disease). The types of vulnerability discussed here reflect those seen in the literature; many other types of vulnerability may impact dietary modification, but may not have been studied, or may have been excluded as part of the search criteria (e.g. substance abuse, mental health issues). This evidence must be interpreted and applied carefully, in light of expertise and the experiences of the relevant community.

Conclusions

Diet modification is not simply a matter of knowing what to eat and making the rational choice to change dietary practices. Rather, diet and eating practices should be considered as part of the situated lives of patients, requiring an individualized approach that is responsive to the conditions in which each patient is attempting to make a change. Common challenges include self-discipline, knowledge, coping with everyday stress, negotiating with family members, and managing the social significance of food. An individualized approach is particularly important when working with patients who have vulnerabilities.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

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Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Mega Filter: OVID MEDLINE

1. Interviews+
2. (theme$ or thematic).mp.
3. qualitative.af.
4. Nursing Methodology Research/
5. questionnaire$.mp.
6. ethnological research.mp.
7. ethnograph$.mp.
8. ethnonursing.af.
9. phenomenol$.af.
10. (grounded adj (theor$ or study or studies or research or analys?s)).af.
11. (life stor$ or women* stor$).mp.
12. (emic or etic or hermeneutic$ or heuristic$ or semiotic$).af. or (data adj1 saturat$).tw. or participant observ$.tw.
13. (social construct$ or (postmodern$ or post- structural$) or (post structural$ or poststructural$) or post modern$ or post-modern$ or feminis$ or interpret$).mp.
14. (action research or cooperative inquir$ or co operative inquir$ or co- operative inquir$).mp.
15. (humanistic or existential or experiential or paradigm$).mp.
16. (field adj (study or studies or research)).tw.
17. human science.tw.
18. biographical method.tw.
19. theoretical sampl$.af.
20. ((purpos$ adj4 sampl$) or (focus adj group$)).af.
21. (account or accounts or unstructured or open-ended or open ended or text$ or narrative$).mp.
22. (life world or life-world or conversation analys?s or personal experience$ or theoretical saturation).mp
23. (lived or life adj experience$.mp
24. cluster sampl$.mp.
25. observational method$.af.
26. content analysis.af.
27. (constant adj (comparative or comparison)).af.
28. ((discourse$ or discurs$) adj3 analys?s).tw.
29. narrative analys?s.af.
30. heidegger$.tw.
31. colaizzi$.tw.
32. spiegelberg$.tw.
33. (van adj manen$).tw.
34. (van adj kaam$).tw.
35. (merleau adj ponty$).tw
36. .husserl$.tw
37. foucault$.tw.
38. (corbin$ adj2 strauss$).tw
39. glaser$.tw.

NOT

40. p =.ti,ab.
41. p<.ti,ab.
42. p>.ti,ab.
43. p =.ti,ab.
44. p<.ti,ab.
45. p>.ti,ab.
46. p-value.ti,ab.
47. retrospective.ti,ab.
48. regression.ti,ab.
49. statistical.ti,ab.

Mega Filter: EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL)

1. Interviews+
2. MH audiorecording
3. MH Grounded theory
4. MH Qualitative Studies
5. MH Research, Nursing
6. MH Questionnaires+
7. MH Focus Groups (12639)
8. MH Discourse Analysis (1176)
9. MH Content Analysis (11245)
10. MH Ethnographic Research (2958)
11. MH Ethnological Research (1901)
12. MH Ethnonursing Research (123)
13. MH Constant Comparative Method (3633)
14. MH Qualitative Validity+ (850)
15. MH Purposive Sample (10730)
16. MH Observational Methods+ (10164)
17. MH Field Studies (1151)
18. MH theoretical sample (861)
19. MH Phenomenology (1561)
20. MH Phenomenological Research (5751)
21. MH Life Experiences+ (8637)
22. MH Cluster Sample+ (1418)
23. Ethnonursing (179)
24. ethnograph* (4630)
25. phenomenol* (8164)
26. grounded N1 theor* (6532)
27. grounded N1 study (601)
28. grounded N1 studies (22)
29. grounded N1 research (117)
30. grounded N1 analys?s (131)
31. life stor* (349)
32. women's stor* (90)
33. emic or etic or hermeneutic$ or heuristic$ or semiotic$ (2305)
34. data N1 saturat* (96)
35. participant observ* (3417)
36. social construct* or postmodern* or post-structural* or post structural* or poststructural* or post

modern* or post-modern* or feminis* or interpret* (25187)

37. action research or cooperative inquir* or co operative inquir* or co-operative inquir* (2381)
38. humanistic or existential or experiential or paradigm* (11017)
39. field N1 stud* (1269)
40. field N1 research (306)
41. human science (132)
42. biographical method (4)
43. theoretical sampl* (983)
44. purpos* N4 sampl* (11299)
45. focus N1 group* (13775)
46. account or accounts or unstructured or open-ended or open ended or text* or narrative* (37137)
47. life world or life-world or conversation analys?s or personal experience* or theoretical saturation (2042)
48. lived experience* (2170)
49. life experience* (6236)
50. cluster sampl* (1411)
51. theme* or thematic (25504)
52. observational method* (6607)
53. questionnaire* (126686)
54. content analysis (12252)
55. discourse* N3 analys?s (1341)
56. discurs* N3 analys?s (35)
57. constant N1 comparative (3904)
58. constant N1 comparison (366)
59. narrative analys?s (312)
60. Heidegger* (387)
61. Colaizzi* (387)
62. Spiegelberg* (0)
63. van N1 manen* (261)
64. van N1 kaam* (34)
65. merleau N1 ponty* (78)
66. husserl* (106)
67. Foucault* (253)
68. Corbin* N2 strauss* (50)
69. strauss* N2 corbin* (88)
70. glaser* (302)

NOT

71. TI statistical OR AB statistical
72. TI regression OR AB regression
73. TI retrospective OR AB retrospective
74. TI p-value OR AB p-value
75. TI p< OR AB p<
76. TI p< OR AB p<
77. TI p= OR AB p=

Mega Filter: ISI Web of Science, Social Science Citation Index

1. TS=interview*
2. TS=(theme*)
3. TS=(thematic analysis)
4. TS=qualitative
5. TS=nursing research methodology
6. TS=questionnaire
7. TS=(ethnograph*)
8. TS= (ethnonursing)
9. TS=(ethnological research)
10. TS=(phenomenol*)
11. TS=(grounded theor*) OR TS=(grounded stud*) OR TS=(grounded research) OR TS=(grounded analys?s)
12. TS=(life stor*) OR TS=(women's stor*)
13. TS=(emic) OR TS=(etic) OR TS=(hermeneutic) OR TS=(heuristic) OR TS=(semiotic) OR TS=(data saturat*) OR TS=(participant observ*)
14. TS=(social construct*) OR TS=(postmodern*) OR TS=(post structural*) OR TS=(feminis*) OR TS=(interpret*)
15. TS=(action research) OR TS=(co-operative inquir*)
16. TS=(humanistic) OR TS=(existential) OR TS=(experiential) OR TS=(paradigm*)
17. TS=(field stud*) OR TS=(field research)
18. TS=(human science)
19. TS=(biographical method*)
20. TS=(theoretical sampl*)
21. TS=(purposive sampl*)
22. TS=(open-ended account*) OR TS=(unstructured account) OR TS=(narrative*) OR TS=(text*)
23. TS=(life world) OR TS=(conversation analys?s) OR TS=(theoretical saturation)
24. TS=(lived experience*) OR TS=(life experience*)
25. TS=(cluster sampl*)
26. TS=observational method*
27. TS=(content analysis)
28. TS=(constant comparative)
29. TS=(discourse analys?s) or TS =(discurs* analys?s)
30. TS=(narrative analys?s)
31. TS=(heidegger*)
32. TS=(colaizzi*)
33. TS=(spiegelberg*)
34. TS=(van manen*)
35. TS=(van kaam*)
36. TS=(merleau ponty*)
37. TS=(husserl*)
38. TS=(foucault*)
39. TS=(corbin*)
40. TS=(strauss*)
41. TS=(glaser*)

NOT

42. TS=(p-value)
43. TS=(retrospective)
44. TS=(regression)
45. TS=(statistical)

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Chronic Disease Patients' Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis

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Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders, and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

Rurality can contribute to the vulnerability of people with chronic diseases. Qualitative research can identify a wide range of health care access issues faced by patients living in a remote or rural setting.

Objective

To systematically review and synthesize qualitative research on the advantages and disadvantages rural patients with chronic diseases face when accessing both rural and distant care.

Data Sources

This report synthesizes 12 primary qualitative studies on the topic of access to health care for rural patients with chronic disease. Included studies were published between 2002 and 2012 and followed adult patients in North America, Europe, Australia, and New Zealand.

Review Methods

Qualitative meta-synthesis was used to integrate findings across primary research studies.

Results

Three major themes were identified: geography, availability of health care professionals, and rural culture. First, geographic distance from services poses access barriers, worsened by transportation problems or weather conditions. Community supports and rurally located services can help overcome these challenges. Second, the limited availability of health care professionals (coupled with low education or lack of peer support) increases the feeling of vulnerability. When care is available locally, patients appreciate long-term relationships with individual clinicians and care personalized by familiarity with the patient as a person. Finally, patients may feel culturally marginalized in the urban health care context, especially if health literacy is low. A culture of self-reliance and community belonging in rural areas may incline patients to do without distant care and may mitigate feelings of vulnerability.

Limitations

Qualitative research findings are not intended to generalize directly to populations, although meta-synthesis across a number of qualitative studies builds an increasingly robust understanding that is more likely to be transferable. Selected studies focused on the vulnerability experiences of rural dwellers with chronic disease; findings emphasize the patient rather than the provider perspective.

Conclusions

This study corroborates previous knowledge and concerns about access issues in rural and remote areas, such as geographical distance and shortage of health care professionals and services. Unhealthy behaviours and reduced willingness to seek care increase patients' vulnerability. Patients' perspectives also highlight rural culture's potential to either exacerbate or mitigate access issues.

Plain Language Summary

People who live in a rural area may feel more vulnerable—that is, more easily harmed by their health problems or experiences with the health care system. Qualitative research looks at these experiences from the patient's point of view. We found 3 broad concerns in the studies we looked at. The first was *geography:* needing to travel long distances for health care can make care hard to reach, especially if transportation is difficult or the weather is bad. The second concern was *availability of health professionals:* rural areas often lack health care services. Patients may also feel powerless in "referral games" between rural and urban providers. People with low education or without others to help them may find navigating care more difficult. When rural services are available, patients like seeing clinicians who have known them for a long time, and like how familiar clinicians treat them as a whole person. The third concern was *rural culture*: patients may feel like outsiders in city hospitals or clinics. As well, in rural communities, people may share a feeling of self-reliance and community belonging. This may make them more eager to take care of themselves and each other, and less willing to seek distant care. Each of these factors can increase or decrease patient vulnerability, depending on how health services are provided.

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List of Abbreviations

CAD	Coronary artery disease
CHEPA	Centre for Health Economics and Policy Analysis
COPD	Chronic obstructive pulmonary disease
EDS	Evidence Development and Standards branch
HQO	Health Quality Ontario
OHTAC	Ontario Health Technology Advisory Committee
PATH	Programs for Assessment of Technology in Health Research Institute
THETA	Toronto Health Economics and Technology Assessment Collaborative

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

To systematically review and synthesize qualitative research on the advantages and disadvantages rural patients with chronic diseases face when accessing both rural and distant care.

Clinical Need and Target Population

This systematic review addresses health care access issues faced by patients living in a remote or rural setting. Rurality can be considered a type of *vulnerability*, a concept that was first identified and defined in a review of relevant conceptual literature. Rurality increases patients' potential susceptibility to health risks. It may also contribute to a sense of defenselessness or marginalization when patients experience difficulties accessing either local or remote health care services.

The target population of this review was adults (> 18 years of age) with specific chronic conditions (congestive heart failure, atrial fibrillation, coronary artery disease, stroke, chronic obstructive pulmonary disease, diabetes, wounds, and chronic disease/multimorbidities) who live in rural and remote areas. Definitions of *rural and remote* vary and may relate to population density, population size, or distance from an urban area or an essential service. (1) For this analysis, we use the Statistics Canada and Organization of Economic Cooperation and Development definition of *rural*: small towns and villages with fewer than 1,000 inhabitants and a population density that ranges from 150 to 400 individuals per square kilometre. (1)

Vulnerability

A narrative synthesis of seminal conceptual published and grey literature on vulnerability was conducted to inform the articulation of study objectives and the literature retrieval process. In general, vulnerability is defined as a characteristic of groups that may be wounded or harmed. (2-4) Vulnerability is the result of the total interaction between the person and the external environment. (3, 4) In particular, vulnerable groups have an increased relative risk of, or susceptibility to, adverse health outcomes. (3) Evidence of higher vulnerability or risk includes higher morbidity, premature mortality, and diminished quality of life. Low social and economic status and lack of external and environmental resources may contribute to disease susceptibility and are therefore indicators of vulnerability. Vulnerability is largely situational, with individuals typically becoming more vulnerable during life transitions and major life changes.

Importantly, the concept of vulnerability is linked to the idea of risk and defenselessness due to exposure to contingencies, stress, and difficulty coping with them. (4, 5) Vulnerability requires both an *external* element of risk, shock, and stress to which an individual is exposed (crises), and an *internal* element of defenselessness, or a lack of means to cope without damaging loss. (4, 5) Vulnerability further depends on the probability of exposure over time. (3) It has several dimensions: susceptibility to exposure, capacity for coping with a crisis, potential serious consequences of exposure to a crisis, (5, 6) and uncertainty about the foreseeability of crises. (7) Terms and concepts often related to vulnerability include *helplessness, defenselessness, dependency, fragility, insecurity, centrality, absence of effective regulation, low resiliency, susceptibility to health problems, harm or neglect, marginalized,* and *different*. The opposite of vulnerability is *resiliency*, the positive capacity to absorb and recover from crisis events. (8)

Groups often characterized as vulnerable include the poor; people subjected to discrimination, intolerance, subordination, or stigma; and people who are politically marginalized, disenfranchised, or denied human rights. (9) Vulnerable groups may include women and children, visible minorities, immigrants, lesbians and gay men, the homeless, and the elderly. (9) Health conditions themselves can also render people vulnerable, especially conditions such as terminal illness or mental illness, or

psychological, cognitive, functional, or communication impairments. (8, 10) Vulnerability can arise from factors that contribute to socioeconomic status, such as age, sex, race, ethnicity, social capital (e.g., family or marital status, social networks), and human capital (e.g., education, employment, income, and housing). (3, 8, 11)

Geographic location also contributes to vulnerability. (12) Rurality in particular may affect the health of patients by increasing the level of risk due to isolation and lack of access to health care services. Therefore, rurality increases the level of susceptibility to risk, as well as the sense of defenselessness and marginalization, affecting patients' well-being and willingness to seek care when ill. It is common knowledge, for example, that rural communities lack access to secondary and tertiary health services, so rural individuals may be more vulnerable to complications from complex or chronic health problems. However, we lack a comprehensive understanding of rural groups' experiences of vulnerability and resiliency in relation to access to health care for chronic conditions. This review helps fill these knowledge gaps with empirically grounded evidence of rural dwellers' experiences.

Ontario Context

Ontario (and Canada as a whole) faces great challenges in providing health care services to remote and rural populations. About 15% of Ontario's population lives in remote and rural areas, and such populations tend to be exposed to higher health risks because of where they live. (1) It is important to address access issues for populations who live in remote and rural areas of the province.

Evidence-Based Analysis

Research Questions

What advantages and disadvantages do rural patients experience when accessing both rural and distant health care?

Research Methods

Literature Search

Search Strategy

A literature search was performed on May 3, 2012, using Ovid MEDLINE and EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL), and on May 4, 2012, using ISI Web of Science Social Sciences Citation Index (SSCI), for studies published from January 1, 2002, until May 2, 2012. We developed a qualitative mega-filter by combining existing published qualitative filters. (13-15) The filters were compared, and redundant search terms were deleted. We added exclusionary terms to the search filter to identify quantitative research and reduce the number of false positives. We then applied the qualitative mega-filter to 9 condition-specific search filters (atrial fibrillation, diabetes, chronic conditions, chronic obstructive pulmonary disease [COPD], chronic wounds, coronary artery disease, congestive heart failure, multiple morbidities, and stroke). Appendix 1 provides details of the search strategy. Titles and abstracts were reviewed by 2 reviewers and, for those studies meeting the eligibility criteria, full-text articles were obtained.

Inclusion Criteria

English language full-reports

- published between January 1, 2002, and May 2, 2012
- primary qualitative empirical research (using any descriptive or interpretive qualitative methodology, including the qualitative component of mixed-methods studies) and secondary syntheses of primary qualitative empirical research
- adult patients (> 18 years of age)
- Canada, United States, Europe, New Zealand, and Australia
- published research work (no theses)
- studies that addressed “vulnerability”
- rural context-specific

Exclusion Criteria

- studies addressing topics other than the lived experience of rural patients
- studies labelled "qualitative" but that did not use a qualitative descriptive or interpretive methodology (e.g., case studies, experiments, or observational analyses using qualitative categorical variables)
- quantitative research (i.e., using statistical hypothesis testing, using primarily quantitative data or analyses, or expressing results in quantitative or statistical terms)
- studies that did not pose an empirical research objective or question, or involve primary or secondary analysis of empirical data

Qualitative Analysis

We analyzed published qualitative research using techniques of integrative qualitative meta-synthesis. (16-19) Qualitative meta-synthesis, also known as qualitative research integration, is an integrative technique that summarizes research over a number of studies with the intent of combining findings from multiple papers. Qualitative meta-synthesis has 2 objectives: first, summarizing the aggregate of a result should reflect the range of findings that exist while retaining the original meaning of the authors; second, through a process of comparing and contrasting findings across studies, a new integrative interpretation of the phenomenon should be produced. (20)

Predefined topic and research questions guided research collection, data extraction, and analysis. Topics were defined in stages, as available relevant literature was identified and the corresponding evidence-based analyses proceeded. All qualitative research relevant to the conditions under analysis was retrieved. In consultation with Health Quality Ontario, a theoretical sensitivity to patient centredness and vulnerability was used to further refine the dataset. Finally, specific topics were chosen and a final search was performed to retrieve papers relevant to these questions. This analysis focused on the conditions of vulnerability that stem from living in rural and remote areas, addressing the advantages and disadvantages rural dwellers face when accessing local and remote health care services.

Data extraction focused on, and was limited to, findings relevant to this research topic. Qualitative findings are the "data-driven and integrated discoveries, judgments, and/or pronouncements researchers offer about the phenomena, events, or cases under investigation." (17) In addition to the researchers' findings, original data excerpts (participant quotes, stories, or incidents) embedded in the findings were also extracted to help illustrate specific findings and, when useful, to facilitate communication of meta-synthesis findings.

Through a staged coding process similar to that of grounded theory, (21, 22) studies' findings were broken into their component parts (key themes, categories, concepts) and then gathered across studies to regroup and relate to each other thematically. This process allowed for organization and reflection on the full range of interpretative insights across the body of research. (17, 23) These categorical groupings provided the foundation from which interpretations of the social and personal phenomena relevant to rural vulnerability were synthesized. A "constant comparative" and iterative approach was used, in which preliminary categories were repeatedly compared to research findings, raw data excerpts, and co-investigators' interpretations of the same studies, as well as to the original Ontario Health Technology Assessment Committee (OHTAC)–defined topic, emerging evidence-based analyses of clinical evaluations of related technologies, and feedback from OHTAC deliberations and expert panels on issues emerging in relation to the topic.

Quality of Evidence

For valid epistemological reasons, the field of qualitative research lacks consensus on the importance of, and methods/standards for, critical appraisal. (24) Qualitative health researchers conventionally under-report procedural details, (18) and the quality of findings tends to rest more on the conceptual prowess of the researchers than on methodological processes. (24) Theoretically sophisticated findings are promoted as a marker of study quality for making valuable theoretical contributions to social science academic disciplines. (25) However, theoretical sophistication is not necessary for contributing potentially valuable information to a synthesis of multiple studies, or to inform questions posed by the interdisciplinary and interprofessional field of health technology assessment. Qualitative meta-synthesis researchers typically do not exclude qualitative research on the basis of independently appraised quality. This approach is common to multiple types of interpretive qualitative synthesis. (16, 17, 20, 25-29)

For this review, the academic peer review and publication process was used to eliminate scientifically unsound studies according to current standards. Beyond this, all topically relevant, accessible research studies using any qualitative, interpretive, or descriptive methodology were included. The value of the research findings was appraised solely in terms of their relevance to our research questions and the presence of data that supported the authors' findings.

Results of Evidence-Based Analysis

The database search yielded 1,937 studies published between January 1, 2002, and May 2, 2012 (with duplicates removed). Articles were excluded based on information in the title and abstract. Two reviewers reviewed all titles and abstracts to refine the database to qualitative research relevant to any of the chronic diseases. Figure 1 shows the breakdown of the steps and reasons for excluding studies from the analysis.

Twelve studies met the inclusion criteria. The reference lists of the included studies were hand searched to identify any additional potentially relevant studies, but no additional citations were included.

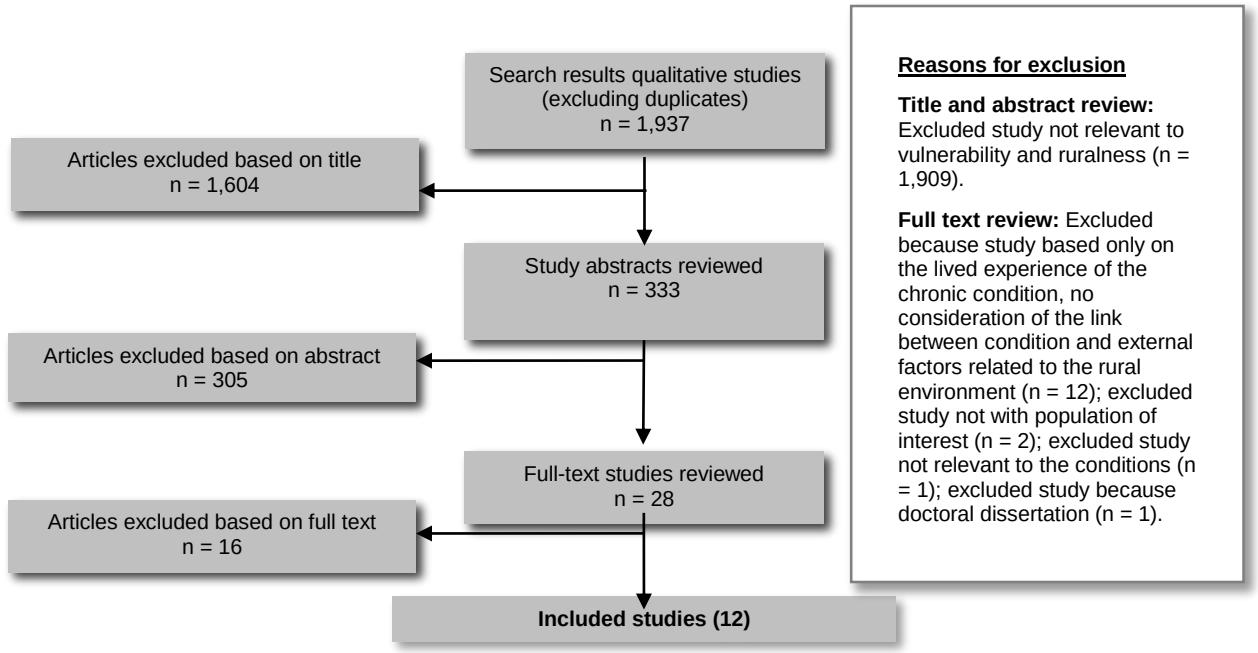

Figure 1: Study Flow Chart

For each included study, the study design, jurisdiction, condition, and rural subgroup were identified and are summarized below (Tables 1 to 4).

Table 1: Body of Evidence by Study Design

Study Design	Number
Unspecified qualitative methodology	7
Ethnographic study	3
Grounded theory study	1
Qualitative multicase study	1
Total	12

Table 2: Body of Evidence by Jurisdiction

Jurisdiction	Number
Canada (not Ontario)	4
Ontario	2
United States	5
United Kingdom	1
Total	12

Table 3: Body of Evidence by Condition

Condition	Number
Diabetes	7
Heart (myocardial infarction and coronary artery disease)	4
Chronic obstructive pulmonary disease	1
Total	12

Table 4: Body of Evidence by Rural Subgroup

Rural Subgroup	Number
Rural Aboriginal people	3
Rural African American people	1
Rural women	2
Rural African American women	1
Unspecified rural population	5
Total	12

Themes

Consistent with the conceptual literature, the included studies characterized vulnerability as a broad interaction between the individual and the environment, and likewise emphasized the relationship between external risk and internal defenselessness and incapacity to face harm. (3-5)

The major themes that emerged from this analysis focused on 3 different aspects of health care access in the rural environment: geography, the availability of health care professionals, and rural culture. Issues concerning geography and availability of health care providers resonated with common knowledge about access issues in rural settings. The third theme is perhaps less commonly recognized, but evidence indicated that culture can either mitigate or exacerbate access challenges in rural and remote locations. This report highlights not only rural groups' access challenges and problems but also some advantages of rural health care systems from the perspective of persons with chronic diseases. In the following discussion, key sub-themes are indicated in italics.

Geography

Geography characterizes access issues in remote and rural settings. Access to health care for chronic diseases is affected by distance, isolation, weather, and transportation. These factors impede access to distant services and favour access to local services.

Rural patients commonly understood *distance* as the geographic space between their place of residence and points of access to the health care system—in particular, access to the local hospital and to the nearest tertiary system. (30-34)

Some patients reported experiencing *isolation* as a result of distance, which in turn intensified the perception of distance as a major structural barrier to access. Both distance and isolation contributed to stress for rural chronic disease patients, their families, and caregivers. (30-34) Local conditions of the rural environment also contributed to stress, as rural areas presented logistical challenges to moving freely and receiving immediate care. (31, 35)

Weather affected both access and willingness to seek care in rural areas. (35) People feared that if they experienced transportation difficulties, they would not receive the help they needed. Their vulnerability grew in the face of travel under adverse conditions. Even where rural health care services (such as primary care) were available, logistical challenges of local travel made it difficult to seek care. (30)

Transportation presented another major barrier to access to health care services in rural areas. (30-32, 34) Individuals with chronic diseases lacked access to or knowledge about the transportation system and means for reaching health services. (35) Patients considered transportation to referral appointments to be their personal responsibility; arranging transportation was often described as a cause of stress, exacerbated by poor weather conditions and the acuity of the health issue. (34) For example, patients may not be sure how long it will take to drive to urban care, whether they risk an emergency during the drive, or when an ambulance or patient transport is more appropriate or available. (35) Distance-related challenges often meant that "driving a vehicle was critically important to accessing health care," (30) as public transportation is often underdeveloped in rural areas and using taxis for long distances may not be affordable. (31, 32, 34) Patients without vehicles had to "depend on the good will of family and friends when they needed to access health care," (30) meaning time off from work for the driver as well as the patient. (35) Sometimes, appointments were not scheduled in a way that considered the significant travel time involved for rural patients and required them to make multiple trips or arrange overnight accommodation to make an early-morning appointment. (35) Transportation also came with associated costs (gas, overnight stays, parking), and this was a burden to many patients. (31, 32, 35)

Although distance, isolation, weather, and transportation presented obvious challenges, qualitative research also found that these factors had some positive impacts on patients' social environment. Personal relationships among rural dwellers developed to mitigate the stressful effects of distance, isolation, weather, and transportation problems. (30, 33, 34) A strong experience of *place*, conceptualized as a web of relationships, made challenges more tolerable. (30, 33, 35, 36)

Availability of Health Care Providers

Availability of health care providers clearly influenced access to health care, treatment, and rehabilitation for chronic conditions in the rural context. This issue pervaded the rural health care literature on access. (30, 31, 34, 36-40) Three particular issues affected experiences of health providers' access, availability, and responsiveness: the rural-urban *referral* system; *health care professional shortages* in rural areas; and the lack of *educational opportunities* and *peer support programs* in the rural context. At the same time, persons with chronic diseases valued experience and some higher-quality dimensions as a part of rural care—particularly the *patient-centredness* that emerged from long-term relationships and providers' familiarity with the patient's context, history, and community.

Rural dwellers with chronic diseases faced many barriers to access specialized and tertiary health care services, (30, 33, 34) beginning at the point of *referral*. Patients relied on their primary care providers to be gatekeepers to urban services. A study in southwestern Ontario (34) examined "referral games" and their impact on women following a myocardial infarction. Rural providers' relationships and interactions with urban providers affected successful referral and access to specialized care. The perception of a "game" implied "that there [are] rules, players, and the possibility of winning or losing with regard to accessing a particular service. For the most part, the women were silent players in the referral game." (35) Patients may feel helpless and defenseless in negotiations between rural and urban providers, and relatively disadvantaged because of their location: "For all participants, living in a rural community meant one had to accept the fact that some services would not be available nearby, and the women and their families were not keen to challenge that reality." (35) Rural dwellers may see urban providers as "urban-centric," and both rural providers and patients sometimes feared that advocating or complaining would prejudice urban providers against them. (35) Some patients felt that urban providers misunderstood their rural living circumstances, or that urban providers judged patients, their family, and even their rural providers negatively (e.g., as "country bumpkins"). (35) For rural patients who also belonged to a minority cultural group, an additional layer of misunderstanding and mistrust was reported. (38, 39) Following hospitalization or specialized care, health care information and follow-up plans may not be communicated clearly back to the rural setting. Some providers saw prolonged hospitalization as a way to give rural patients access to follow-up care that would have been too difficult to arrange after a more timely discharge. (34)

All of the studies noted local *health care professional shortages* as a crucial barrier to access. (30-41) Rural care was characterized by a high turnover of primary care clinicians and prevalent lack of physician specialists. Primary care providers took on a larger role in rural health care, as many patients "rarely ventured to urban centres for appointments with [specialists] and depended almost exclusively on the local family physicians." (30) Local primary care physicians were highly valued by rural patients with chronic conditions, especially when they remained in the community long enough to get to know the patients. (30) High professional turnover was reported as distressing, and indicative that the physician was not "loyal" to the community. (31) Long-term relationships and the opportunity to get to know patients better may also have alleviated concerns expressed by some Aboriginal patients that it was difficult to communicate with health care professionals. (38) Some patients suggested that this difficulty could be alleviated if health care professionals made the effort to relate to them in a more personal manner. (38) Rural dwellers reported a chronic need not only for more primary care physicians, but also for other professionals including nutritionists, dietitians, health educators, and pharmacists. (32, 33) When

community members left to gain health professional education, they found upon their return that they could not practice the way they were taught in urban centres. (36)

Many rural dwellers with chronic conditions turned to alternative therapies for treatment or self-management. For example, an African American group of people with diabetes reported strategies including teas, dietary products, nutritional supplements, and herbs. (33) An Aboriginal group of people with diabetes reported commonplace use of traditional medicines to complement biomedical treatment. (38) Other studies reported very limited mentions of home or folk remedies. In Arcury's (37) study of rural white patients with diabetes in the southern United States, only 1 of 39 participants mentioned using an herbal remedy.

Rural dwellers with chronic conditions realized the importance of *educational opportunities* and *peer support programs* to improve the management of their condition. (30-33, 36-40) They perceived in particular that physicians lacked time to "teach you all the things you need to know," (33) and valued simply "being able to talk" to knowledgeable others (either lay or professional) about their condition. (30) Health literacy may be low among rural dwellers with chronic diseases. (33) However, health education programs and community support groups were underprovided in rural and remote areas. (30, 32, 33, 40) Culturally appropriate education programs were highly valued; for instance, Aboriginal participants emphasized the "need for traditional ceremonies to be part of diabetes education programs" (38) and the need for programs that accommodate traditional understandings of illness and medicine. (39)

Despite the provider shortages endemic to rural health services, the qualitative research also identified some quality advantages to rural health care, particularly, the personalization of care. (30, 32, 34-37, 41) The few clinicians serving rural communities tended to be very familiar with their patients and their families, histories, and circumstances. This put clinicians in a better position to provide *patient-centred care*: they are better able to tailor care to the patient and work with other health care professionals such as pharmacists. (30-32, 34, 35, 38) Rural dwellers with chronic diseases highly valued this feature of their local care. They also tended to expect and experience the opposite (e.g., "to be treated as a number") when they ventured to urban settings for health services. (30, 35) The degree of integration of a health service or program into the rural community affected people's willingness to seek care, as well as their adherence to treatment. Participants expected service integration with the community to impact effectiveness of care, complication rates, and health outcomes. (30, 34-36, 38, 41)

Rural Culture

Most studies emphasized the influence of rural culture on health care experiences and the importance of understanding how rural culture affected the success of health care services in rural and remote areas. Rural culture can both impede and facilitate access to care. *Cultural marginalization* of rural dwellers in the urban health context, *low health literacy*, and *reticence to seek care* posed barriers to care for rural dwellers with chronic conditions. On the other hand, rural traditions of *self-reliance* and *community belonging* facilitated access to care.

Cultural differences between rural and urban communities can lead to *cultural marginalization* of rural patients in urban settings. (30, 34-36, 38-41) In urban care contexts, rural dwellers with chronic diseases felt stigmatized and marginalized, increasing their experiences of vulnerability and decreasing their willingness to seek care outside the rural setting. (35) "Women described feeling like 'outsiders' during some of their interactions and experiences in tertiary settings. Sometimes this occurred in response to an interaction with a health professional who made what were perceived as negative comments about rural life or who gave information that had little or no relevance to their rural context." (34) This experience may be especially acute for those who are also members of a minority cultural or ethnic group. (38, 39, 41)

Low health literacy (an inability to access and understand information important for maintaining and improving one's health) has been found to be common among rural dwellers with chronic diseases, highlighting the need for relevant and culturally meaningful health education. (31, 32, 36-40) The knowledge necessary for self-management of chronic diseases can be complex, and patients may face many novel problems that they must solve on their own. (33) Low health literacy can foster false beliefs and unhealthy behaviours, making rural dwellers more vulnerable to adverse health outcomes. (32, 33, 36, 37, 39, 40) Literacy, like other dimensions of vulnerability, is not only an attribute of the person but also of his/her environment—specifically, the sources, terms, format, and languages conveying available information. For example, in Baffin Island, instructions and labels in English (rather than Inuktitut) were unintelligible to many. (39) Some found that rural providers were too busy to tell them all they needed to know. (33) Other sources consulted for guidance on self-care included case managers, pharmacists, local support groups, the Internet, and family and friends. (31-35)

Many studies found that rural dwellers with chronic diseases expressed a surprising tolerance for barriers to health care due to their rurality, and they expressed a *reticence to seek care*. (31, 34, 35) "The 'persona' associated with rural living left many rural-living men and women waiting until 'they could no longer function' to seek physician's help." (31) The ability to engage in work was described as both the threshold for seeking care and a main barrier to doing so. For participants who worked as farmers, time away from the farm was a large burden. (31) Other rural patients reported having low expectations of health care and trying not to rely too heavily on health services. (30, 34) Many expressed a preference for self-reliance and self-sufficiency to fill care gaps caused by living in a rural setting. (30, 34-35) For this reason, patients may not consider their rural area to be underserviced, and they may understand the challenges health professionals typically face in rural practice. (30-36, 38, 40, 41) Many rural dwellers with chronic diseases reported feeling gratitude for the health care providers and services that were available. (30, 35) This feeling may extend to a reported reluctance to burden the health care system, as a kind of civic responsibility, and not feeling entitled to extensive care, as described by Caldwell in her study of women with heart disease. (34) Rural culture can carry an obligation to "make do" with available resources and solve one's problems independently: for example, creating one's own exercise program "to meet what they understood to be the rehabilitation requirements when a referral was not possible." (35)

Although *self-reliance* may inhibit care seeking, it was also a highly valued source of strength and personal control for rural dwellers with chronic conditions and helped mitigate the experience of inadequate access to services. (30-32, 34, 35, 37, 40) It helped individuals feel a sense of control and diminished vulnerability, and it fostered active self-management of chronic conditions. (33, 35) Self-management of conditions such as diabetes can be daily hard work, and patients reported a sense of "taking charge" of their condition and situation. (33)

A sense of *community belonging* in rural culture can diminish the experience of vulnerability related to living in a rural area, as well as the experience of vulnerability in urban settings, but it can also leave rural patients more vulnerable to stigma. Rural patients reported feeling "relationally" closer to their neighbours: "Many described how neighbours 'know' and 'look out for' each other. The neighbors seemed to readily come to the aid of the participants when illness struck." (31) Community relationships were described as a source of support and information. (34) The community belonging of health providers also enhanced the trust and rapport necessary for good therapeutic relationships. (39) However, a close-knit community also made it difficult for individuals to admit their health-related dependencies to others, which may have contributed to stigma for certain diseases, such as diabetes in a rural African American community (33) or in a Baffin Island community. (39) Nonbiomedical, culturally based beliefs about etiology (e.g., diabetes as transmitted by transfusion or sexual activity) can further contribute to stigma. (39) Some rural dwellers were consequently reluctant to talk about their conditions or seek help in an obvious way. (33) As part of integrating services into rural communities, health information may need to be reconciled and conveyed within frameworks coherent with local culture and belief systems. (39)

Limitations

Qualitative research provides theoretical and contextual insights into the experiences of limited numbers of people in specific settings. While qualitative insights are robust and often enlightening for understanding experiences and planning services in other settings, the findings of the studies reviewed here—and of this synthesis—do not strictly generalize to the Ontario (or any specific) population. Findings were limited to the conditions included in the body of literature synthesized (i.e., coronary artery disease, myocardial infarction, diabetes, COPD). Other conditions were included in the search strategy, but no relevant literature was found relating to the rural experience of patients living with these conditions (atrial fibrillation, chronic conditions [not further specified], chronic wounds, congestive heart failure, multiple morbidities, and stroke). This report may not capture experiences of other common chronic conditions (e.g., mental health conditions, addictions, osteoarthritis, dementia).

Conclusions

By focusing on patients' experience of vulnerability, this study corroborates previous knowledge and concerns related to health care access in rural and remote areas (such as distance, transportation, weather conditions, shortage of health care professionals, and limited availability of health care services), highlighting how unhealthy behaviours and reduced willingness to seek care can increase patients' susceptibility to external risks and vulnerability. Patients' perspectives also highlighted the potential of rural culture to both exacerbate and mitigate access issues. Rural culture can nourish feelings of marginalization from the health care system and foster reticence to seek care. However, community belonging, personalization of relationships with health care professionals, and self-reliance may be useful means of coping with deficiencies and gaps in the rural health care system.

Glossary

Rural and remote areas	Small towns and villages with fewer than 1,000 inhabitants and a population density that ranges from 150 to 400 individuals per square kilometre. (1)
Vulnerability	A concept linked to the idea of risk and defenselessness due to the exposure to contingencies and stress, and difficulty coping with them. Therefore, there are 2 sides of vulnerability: an *external* side, which is the risks, shocks, and stress to which an individual is exposed, and an *internal* side, which is defenselessness related to a lack of means of coping without damaging loss.
Vulnerable populations	Social groups with an increased relative risk of or susceptibility to adverse health outcomes. This differential vulnerability or risk is evidenced by increased comparative morbidity, premature mortality, and diminished quality of life.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

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Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health (PATH) Research Institute, St. Joseph's Healthcare Hamilton
Nick Kates	Senior Medical Advisor	Health Quality Ontario – QI McMaster University Hamilton Family Health Team
Murray Krahn	Director	Toronto Health Economics and Technology Assessment (THETA) Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
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Michael Schull	Deputy CEO & Senior Scientist	Institute for Clinical Evaluative Sciences
Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Mega Filter: Ovid MEDLINE

1. Interviews+
2. (theme$ or thematic).mp.
3. qualitative.af.
4. Nursing Methodology Research/
5. questionnaire$.mp.
6. ethnological research.mp.
7. ethnograph$.mp.
8. ethnonursing.af.
9. phenomenol$.af.
10. (grounded adj (theor$ or study or studies or research or analys?s)).af.
11. (life stor$ or women* stor$).mp.
12. (emic or etic or hermeneutic$ or heuristic$ or semiotic$).af. or (data adj1 saturat$).tw. or participant observ$.tw.
13. (social construct$ or (postmodern$ or post- structural$) or (post structural$ or poststructural$) or post modern$ or post-modern$ or feminis$ or interpret$).mp.
14. (action research or cooperative inquir$ or co operative inquir$ or co- operative inquir$).mp.
15. (humanistic or existential or experiential or paradigm$).mp.
16. (field adj (study or studies or research)).tw.
17. human science.tw.
18. biographical method.tw.
19. theoretical sampl$.af.
20. ((purpos$ adj4 sampl$) or (focus adj group$)).af.
21. (account or accounts or unstructured or open-ended or open ended or text$ or narrative$).mp.
22. (life world or life-world or conversation analys?s or personal experience$ or theoretical saturation).mp
23. (lived or life adj experience$.mp
24. cluster sampl$.mp.
25. observational method$.af.
26. content analysis.af.
27. (constant adj (comparative or comparison)).af.
28. ((discourse$ or discurs$) adj3 analys?s).tw.
29. narrative analys?s.af.
30. heidegger$.tw.
31. colaizzi$.tw.
32. spiegelberg$.tw.
33. (van adj manen$).tw.
34. (van adj kaam$).tw.
35. (merleau adj ponty$).tw
36. .husserl$.tw
37. foucault$.tw.
38. (corbin$ adj2 strauss$).tw
39. glaser$.tw.

NOT

40. p =.ti,ab.
41. p<.ti,ab.
42. p>.ti,ab.
43. p =.ti,ab.
44. p<.ti,ab.
45. p>.ti,ab.
46. p-value.ti,ab.
47. retrospective.ti,ab.
48. regression.ti,ab.
49. statistical.ti,ab.

Mega Filter: EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL)

1. Interviews+
2. MH audiorecording
3. MH Grounded theory
4. MH Qualitative Studies
5. MH Research, Nursing
6. MH Questionnaires+
7. MH Focus Groups (12639)
8. MH Discourse Analysis (1176)
9. MH Content Analysis (11245)
10. MH Ethnographic Research (2958)
11. MH Ethnological Research (1901)
12. MH Ethnonursing Research (123)
13. MH Constant Comparative Method (3633)
14. MH Qualitative Validity+ (850)
15. MH Purposive Sample (10730)
16. MH Observational Methods+ (10164)
17. MH Field Studies (1151)
18. MH theoretical sample (861)
19. MH Phenomenology (1561)
20. MH Phenomenological Research (5751)
21. MH Life Experiences+ (8637)
22. MH Cluster Sample+ (1418)
23. Ethnonursing (179)
24. ethnograph* (4630)
25. phenomenol* (8164)
26. grounded N1 theor* (6532)
27. grounded N1 study (601)
28. grounded N1 studies (22)
29. grounded N1 research (117)
30. grounded N1 analys?s (131)
31. life stor* (349)
32. women's stor* (90)
33. emic or etic or hermeneutic$ or heuristic$ or semiotic$ (2305)
34. data N1 saturat* (96)
35. participant observ* (3417)

36. social construct* or postmodern* or post-structural* or post structural* or poststructural* or post modern* or post-modern* or feminis* or interpret* (25187)
37. action research or cooperative inquir* or co operative inquir* or co-operative inquir* (2381)
38. humanistic or existential or experiential or paradigm* (11017)
39. field N1 stud* (1269)
40. field N1 research (306)
41. human science (132)
42. biographical method (4)
43. theoretical sampl* (983)
44. purpos* N4 sampl* (11299)
45. focus N1 group* (13775)
46. account or accounts or unstructured or open-ended or open ended or text* or narrative* (37137)
47. life world or life-world or conversation analys?s or personal experience* or theoretical saturation (2042)
48. lived experience* (2170)
49. life experience* (6236)
50. cluster sampl* (1411)
51. theme* or thematic (25504)
52. observational method* (6607)
53. questionnaire* (126686)
54. content analysis (12252)
55. discourse* N3 analys?s (1341)
56. discurs* N3 analys?s (35)
57. constant N1 comparative (3904)
58. constant N1 comparison (366)
59. narrative analys?s (312)
60. Heidegger* (387)
61. Colaizzi* (387)
62. Spiegelberg* (0)
63. van N1 manen* (261)
64. van N1 kaam* (34)
65. merleau N1 ponty* (78)
66. husserl* (106)
67. Foucault* (253)
68. Corbin* N2 strauss* (50)
69. strauss* N2 corbin* (88)
70. glaser* (302)

NOT

71. TI statistical OR AB statistical
72. TI regression OR AB regression
73. TI retrospective OR AB retrospective
74. TI p-value OR AB p-value
75. TI p< OR AB p<
76. TI p< OR AB p<
77. TI p= OR AB p=

Mega Filter: ISI Web of Science, Social Science Citation Index

1. TS=interview*

2. TS=(theme*)
3. TS=(thematic analysis)
4. TS=qualitative
5. TS=nursing research methodology
6. TS=questionnaire
7. TS=(ethnograph*)
8. TS= (ethnonursing)
9. TS=(ethnological research)
10. TS=(phenomenol*)
11. TS=(grounded theor*) OR TS=(grounded stud*) OR TS=(grounded research) OR TS=(grounded analys?s)
12. TS=(life stor*) OR TS=(women's stor*)
13. TS=(emic) OR TS=(etic) OR TS=(hermeneutic) OR TS=(heuristic) OR TS=(semiotic) OR TS=(data saturat*) OR TS=(participant observ*)
14. TS=(social construct*) OR TS=(postmodern*) OR TS=(post structural*) OR TS=(feminis*) OR TS=(interpret*)
15. TS=(action research) OR TS=(co-operative inquir*)
16. TS=(humanistic) OR TS=(existential) OR TS=(experiential) OR TS=(paradigm*)
17. TS=(field stud*) OR TS=(field research)
18. TS=(human science)
19. TS=(biographical method*)
20. TS=(theoretical sampl*)
21. TS=(purposive sampl*)
22. TS=(open-ended account*) OR TS=(unstructured account) OR TS=(narrative*) OR TS=(text*)
23. TS=(life world) OR TS=(conversation analys?s) OR TS=(theoretical saturation)
24. TS=(lived experience*) OR TS=(life experience*)
25. TS=(cluster sampl*)
26. TS=observational method*
27. TS=(content analysis)
28. TS=(constant comparative)
29. TS=(discourse analys?s) or TS =(discurs* analys?s)
30. TS=(narrative analys?s)
31. TS=(heidegger*)
32. TS=(colaizzi*)
33. TS=(spiegelberg*)
34. TS=(van manen*)
35. TS=(van kaam*)
36. TS=(merleau ponty*)
37. TS=(husserl*)
38. TS=(foucault*)
39. TS=(42)(42)(42)[42]
40. TS=(42)(42)(42)[42]
41. TS=(glaser*)

NOT

42. TS=(p-value)
43. TS=(retrospective)
44. TS=(regression)
45. TS=(statistical)

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Patient Experiences of Depression and Anxiety with Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis

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About Health Quality Ontario

Health Quality Ontario (HQO) is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. HQO works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in CINAHL, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the *Ontario Health Technology Advisory Committee* and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings may have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: *http://www.hqontario.ca/en/mas/mas_ohtas_mn.html*.

Abstract

Background

Depression and anxiety are highly prevalent in patients with chronic disease, but remain undertreated despite significant negative consequences on patient health. A number of clinical groups have developed recommendations for depression screening practices in the chronic disease population.

Objectives

The objective of this analysis was to review empirical qualitative research on the experiences of patients with chronic disease (e.g., COPD, diabetes, heart disease, stroke) and comorbid depression or anxiety, and to highlight the implications of the screening and management of anxiety and/or depression on chronic disease outcomes.

Review Methods

We performed literature searches for studies published from January 2002 to May 2012. We applied a qualitative mega-filter to nine condition-specific search filters. Titles and abstracts were reviewed by two reviewers and, for the studies that met the eligibility criteria, full-text articles were obtained. Qualitative meta-synthesis was used to integrate findings across relevant published primary research studies. Qualitative meta-synthesis produced a synthesis of evidence that both retained the original meaning of the authors and offered a new, integrative interpretation of the phenomenon through a process of comparing and contrasting findings across studies.

Results

The findings of 20 primary qualitative studies were synthesized. Patients tended to experience their chronic conditions and anxiety or depression as either independent or inter-related (i.e., the chronic disease lead to depression/anxiety, the depression/anxiety lead to the chronic disease, or the two conditions exacerbated each other). Potential barriers to screening for depression or anxiety were also identified.

Limitations

A wider array of issues might have been captured if the analysis had focused on broader psychological responses to the chronic disease experience. However, given the objective to highlight implications for screening for anxiety or depression, the more narrow focus seemed most relevant.

Conclusions

Chronic disease and anxiety or depression can be independent or inter-related. Patients may be reluctant to acknowledge depression or anxiety as a separate condition, or may not recognize that the conditions are separate because of overlapping physical symptoms. More qualitative research is needed to specifically address screening for depression or anxiety.

Plain Language Summary

Depression is a common complication of chronic disease. It may worsen the disease, and it may also affect the self-management of the disease. Screening for depression earlier, and then treating it, may reduce distress and improve symptoms of the chronic disease, leading to better quality of life.

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List of Abbreviations

CI	Confidence interval(s)
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COPD	Chronic obstructive pulmonary disease
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, version IV
GAD	Generalized anxiety disorder
HQO	Health Quality Ontario
MDD	Major depressive disorder
OHTAC	Ontario Health Technology Advisory Committee
SSCI	Social Sciences Citation Index
WHO	World Health Organization

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

To review empirical qualitative research on the experiences of patients with chronic disease (i.e., chronic obstructive pulmonary disease (COPD), diabetes, heart disease, stroke) and comorbid depression or anxiety, and to highlight the implications of screening on the management of anxiety and/or depression.

Clinical Need and Target Population

Depression

Depression is recognized by the World Health Organization (WHO) as the leading cause of disability in the world, and the fourth leading contributor to the global burden of disease. (1) Projections by WHO suggest that, by 2020, depression will be the second leading public health concern, behind only cardiovascular disease. (2) Despite this, depression continues to be under-recognized and undertreated. (2)

Depressive illness can have a variety of presentations that can vary in both severity and chronicity. (3) According to criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), (4) major depressive disorder (MDD)—which consists of an episode of at least 2 weeks in which an individual has 5 of 9 specific depressive symptoms—is the most severe form of depression. One of these symptoms must be depressed mood or anhedonia (loss of interest or pleasure). (3) Also, these symptoms must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning, a requirement that emphasizes the marked disability resulting from depressive illness.

Anxiety

Anxiety disorders are usually characterized by excessive fear and subsequent avoidance, typically in response to a specified object or situation and in the absence of true danger. (5, 6) Anxiety, like all emotions, has cognitive, neurobiological, and behavioural components. Although it is often comorbid with depressive mood, anxiety is a distinct emotion. (6) Anxiety becomes alarming and burdensome when it increases or persists to such a degree that the individual can no longer function effectively in everyday life. At this stage, anxiety can have negative consequences for the individual. Anxiety exists on a continuum from normal to pathological, and a number of anxiety disorders exist, such as panic disorder, phobic anxiety, generalized anxiety disorder (GAD), anxiety reactions, and chronic anxiety. (6)

Prevalence

Patients in the primary care setting often suffer from depression and anxiety. The 1994/1995 National Population Health Survey, a Canadian longitudinal study that included household residents in all provinces, reported a 1-year prevalence for major depressive disorder (MDD) of about 6% among Canadians aged 18 and older. (7) Point prevalence estimates of major depression range from 4.8% to 8.6% in primary care settings in the United States. (3) Anxiety disorders have a high prevalence as well, with a 12-month rate of 17.2% and lifetime rates of about 25% in the United States. (8)

Patten and colleagues (9) found in a large, prospective Canadian community-based study that subjects with chronic medical disorders had a higher risk of developing major depression that those without such disorders. A total of 4% (CI: 3.3-4.7) of those with one or more medical conditions versus 2.8% (CI: 2.2-3.4) of those without medical conditions developed major depression over a 2-year period. (9)

The 2005 Canadian Community Health Survey, cycle 3.1, measured the prevalence rates of comorbid mood disorders among individuals with various chronic physical conditions in Ontario. (10) The highest

prevalence (15.5%) was seen in those suffering from the effects of stroke, followed by cardiovascular disease (9.8%) and diabetes mellitus (9.3%). (10)

The estimated prevalence of anxiety and/or depression varies by the type and severity of chronic illness, and the setting and methodology for screening and diagnosis. However, rates are consistently higher across most chronic diseases compared to the general population, especially for people with stroke, cardiovascular disease, and diabetes.

Qualitative Evidence

Qualitative empirical studies can offer important information about how patients experience their conditions. This synthesis of qualitative literature offers insights into patients' perspectives on chronic disease and comorbid anxiety or depression, their needs, and how interventions such as screening might affect their experiences. The experiences of clinicians are also examined, where relevant.

Technology/Technique

Screening Instruments

Screening is defined as the systematic testing of asymptomatic individuals to detect a potential disease or condition. (11) The purpose of screening is to prevent or delay the development of advanced disease in the subset with preclinical disease through early detection and treatment. (11)

Screening for depression and/or anxiety identifies patients suffering from these conditions, allowing them to access care earlier in the course of their illness. Despite the potential benefits of screening, it is infrequently conducted and primary care physicians fail to identify an estimated 30% to 50% of patients suffering from depression. (3)

Several depression screening tools, called instruments, are currently available for use in the primary care setting. The tools differ primarily by the time frame to which they are applied, the time to administer the tools, and the discernment of levels of depression. (12) These tools have been designed to be administered in a variety of ways by a variety of health care providers. These instruments are composed of standardized questions that assess the number and severity of a patient's depression symptoms. The finding of a positive screen requires further diagnostic questioning by the clinician to establish an appropriate diagnosis and initiate a treatment plan and follow-up. (13)

Depression Screening for Adults With Chronic Diseases

Given the higher prevalence of depression among adults with chronic diseases, a number of clinical groups have developed recommendations on depression screening practices. There are guidelines on depression screening for the general population, as well as disease specific guidelines for those with diabetes, COPD, stroke, and coronary artery disease.

Evidence-Based Analysis

Research Question

What are the experiences of patients living with COPD, diabetes, heart disease, and stroke with comorbid depression or anxiety?

Research Methods

Literature Search

Search Strategy

We performed literature searches for studies published from January 1, 2002, to May 2012, on May 3, 2012, using OVID MEDLINE and EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL), and on May 4, 2012, using ISI Web of Science Social Sciences Citation Index (SSCI). We developed a qualitative mega-filter by combining existing published qualitative filters. (14-16) The filters were compared and redundant search terms were deleted. We added exclusionary terms to the search filter that were likely to identify quantitative research and would reduce the number of false positives. We then applied the qualitative mega-filter to 9 condition-specific search filters (atrial fibrillation, diabetes, chronic conditions, chronic obstructive pulmonary disease, chronic wounds, coronary artery disease, heart failure, multiple morbidities, and stroke). Appendix 1 provides details of the search strategy. Titles and abstracts were reviewed by two reviewers and, for those studies meeting the eligibility criteria, full-text articles were obtained.

Inclusion Criteria

English language full-reports

- published between January 2002 and May 2012
- including adults (age ≥ 18) from Canada, Europe, Australia, New Zealand, and the United States
- primary qualitative empirical research (using any descriptive or interpretive qualitative methodology, including the qualitative component of mixed-methods studies) and secondary syntheses of primary qualitative empirical research
- studies addressing any aspect of the experience of comorbid anxiety or depression and chronic disease

Exclusion Criteria

- studies addressing topics other than the experience of comorbid anxiety or depression and chronic disease
- studies labelled "qualitative" but not using a qualitative descriptive or interpretive methodology (e.g., case studies, experiments, or observational analyses using qualitative categorical variables)
- quantitative research (i.e., using statistical hypothesis testing, using primarily quantitative data or analyses, or expressing results in quantitative or statistical terms)
- studies that did not pose an empirical research objective or question, or involve primary or secondary analysis of empirical data

Outcomes of Interest

- qualitative descriptions or interpretations (narrative or theoretical) of personal or social experiences of comorbid anxiety or depression.

Analytical Methods

We analyzed published qualitative research using techniques of integrative qualitative meta-synthesis. (17-19) Qualitative meta-synthesis, also known as qualitative research integration, is an integrative technique that summarizes research over a number of studies, with the intent of combining findings from multiple studies. Qualitative meta-synthesis has 2 objectives: first, summarizing the aggregate of a result should reflect the range of findings that exist while retaining the original meaning of the authors; second, through a process of comparing and contrasting findings across studies, a new integrative interpretation of the phenomenon should be produced. (20)

Predefined topic and research questions guided research collection, data extraction, and analysis. Topics were defined in stages, as available relevant literature was identified and the corresponding evidence-based analyses proceeded. First, we retrieved all qualitative research relevant to the conditions under analysis. Then, specific topics were chosen and a final search of the dataset was performed to retrieve papers relevant to these questions. This report examines the experience of comorbid anxiety or depression and chronic disease.

Data extraction focused on, and was limited to, findings relevant to this research topic. Qualitative findings are the "data-driven and integrated discoveries, judgments, and/or pronouncements researchers offer about the phenomena, events, or cases under investigation." (17) In addition to the researchers' findings, we also extracted original data excerpts (e.g., participant quotes, stories, or incidents) embedded in the findings, to help illustrate specific findings and, when useful, to facilitate the communication of our own meta-synthetic findings.

Through a staged coding process similar to that used in grounded theory (e.g., (21, 22)), we broke the studies' findings into their component parts (e.g., key themes, categories, concepts), which we then gathered across studies to regroup and relate to each other thematically. This process allowed us to organize and reflect upon the full range of interpretative insights across this body of research. (17, 23) These categorical groupings provided the foundation from which we synthesized interpretations of the social and personal phenomena addressed by the topic of comorbid anxiety or depression and chronic disease. A "constant comparative" and iterative approach was used, in which we repeatedly compared preliminary categories to the research findings, to raw data excerpts, and co-investigators' interpretations of the same studies, as well as to the original OHTAC-defined topic, the emerging evidence-based analyses of clinical evaluations of related technologies, and feedback from OHTAC deliberations and expert panels on issues emerging in relation to the topic.

Quality of Evidence

For valid epistemological reasons, the field of qualitative research lacks consensus on the importance, methods, and standards of critical appraisal. (24) Qualitative health researchers conventionally under-report procedural details, (25) and the quality of findings tends to rest less on methodological processes than on the conceptual prowess of the researchers. (24) Theoretically sophisticated findings are promoted as markers of study quality for making valuable theoretical contributions to social science academic disciplines. (26) However, theoretical sophistication is not necessary for contributing potentially valuable information to a synthesis of multiple studies, nor to inform questions posed by the interdisciplinary and interprofessional field of health technology assessment. Qualitative meta-synthesis researchers typically do not exclude qualitative research on the basis of independently appraised quality. This approach is common to multiple types of interpretive qualitative synthesis. (20, 27-29)

For this review, we relied on the academic peer review and publication process to eliminate scientifically unsound studies according to current standards. Beyond this, we included all topically relevant, accessible research studies using any qualitative interpretive or descriptive methodology. We appraised the value of the research findings solely in terms of their relevance to our research questions and the presence of data that supported the authors' findings.

Results of Systematic Review

Applying the qualitative research filter to the HQO search strategy for all chronic disease topics yielded 49,676 citations published between January 1, 2002, and May 2, 2012 (including some duplicates). Articles were excluded based on information in the title and abstract. Two reviewers reviewed all titles and abstracts to refine the database to qualitative research relevant to any of the chronic diseases (N=1937). Figure 1 shows the breakdown of when and for what reason citations were excluded from the analysis.

From the database of relevant studies, titles and abstracts were searched for their relevance to depression or anxiety, including a keyword search for "anxi*" and "depress*". Twenty-four citations were retrieved. Based on full-text review, 9 were excluded because they did not relate to experiences of anxiety or depression. Five additional studies were identified from systematic reviews and reference lists of retrieved papers.

A total of twenty papers met the inclusion criteria for this analysis.

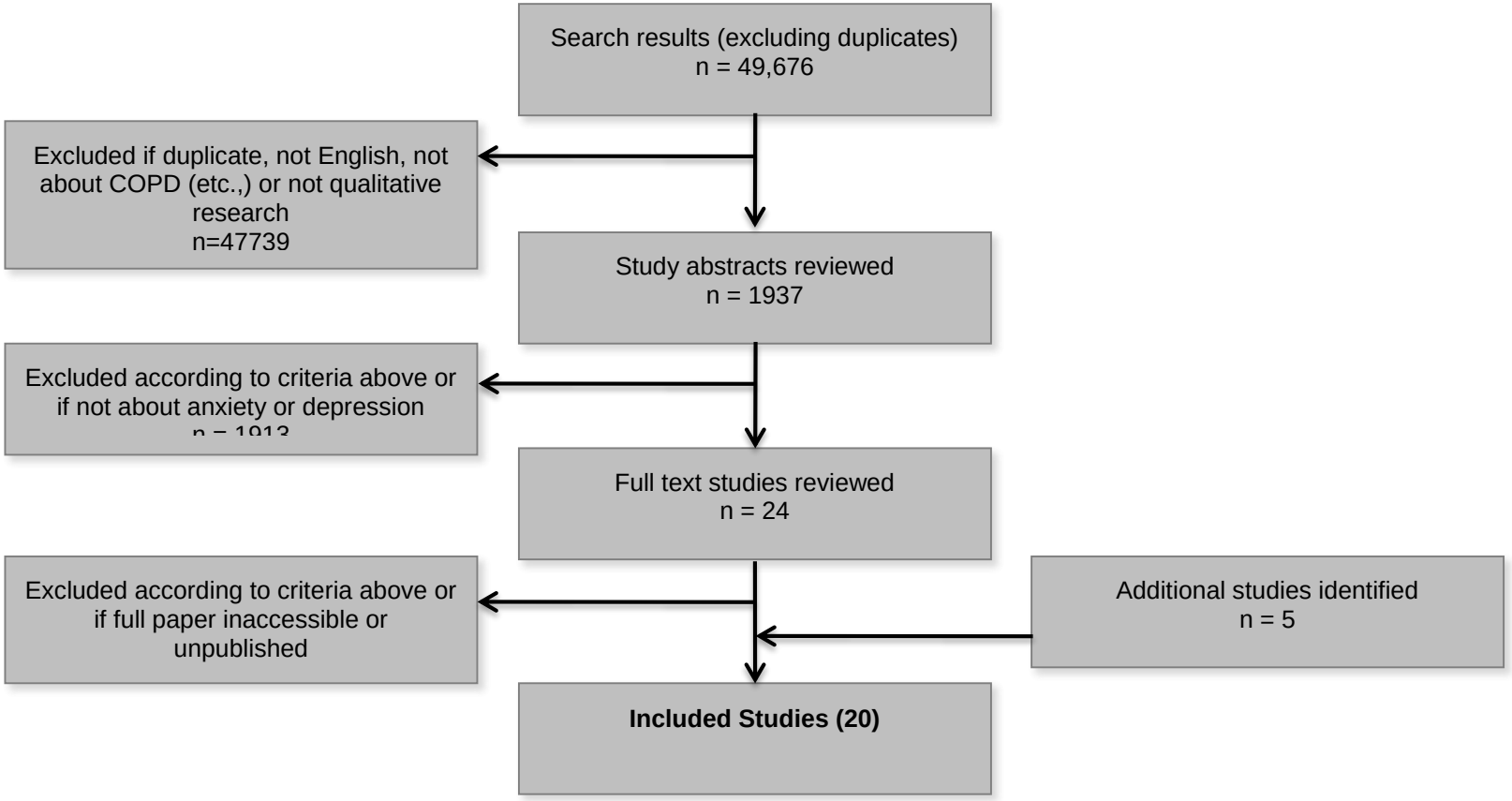

Figure 1: Citation Flow Chart

Table 1: Body of Evidence Examined According to Condition

Chronic Disease	Comorbid Disease		
	Anxiety	Depression	Anxiety and Depression
COPD	2	0	1
Diabetes	0	5	1
Heart Failure	0	3	2
Stroke	0	3	1
Various	0	1	1

For each included study, the study design was identified and is summarized below in Table 2.

Table 2: Body of Evidence Examined According to Study Design

Study Design	Number of Eligible Studies
Qualitative Studies	
Content Analysis	6
Ethnography	1
Grounded Theory/Constant Comparative Analysis	6
Framework Analysis	1
Other	3
Qualitative (otherwise unspecified)	3
Total	**20**

For each included study, the study location was identified and is summarized below in Table 3.

Table 3: Body of Evidence Examined According to Study Context

Study Context	Number of Eligible Studies
Australia and New Zealand	3
Europe	8
Canada (Ontario)	1
United States	8
Total	**20**

Results

A central theme that emerged from this body of research was the relationship between the chronic conditions and depression or anxiety (see Figure 2 for an illustration of perceived relationships between depression/anxiety and chronic disease). In the synthesized research, patients reported experiencing their chronic conditions and these mental health states in two main ways: 1) as two co-incidental problems, or 2) as independent conditions, with no relationship between the chronic disease and their depression or anxiety. Where patients did experience a relationship between their chronic condition and depression or anxiety, some believed they experienced a progression from chronic disease to depression or anxiety (Figure 2, pathway 1). Others described experiencing the reverse, with the depression or anxiety leading to the chronic disease (Figure 2, pathway 2). While most research reports identified one or two types of experiences (pathway 1 or 2), (30-36) a minority of reports identified both types of experienced relationships, a cyclical relationship we describe as pathway 3 (Figure 2). (37-39) As a whole, this body of qualitative research sheds light on the various patient experiences of the relationships between their physical and mental health, and the cyclical reasoning used to make sense of these. From this evidence, some potential barriers to screening for depression or anxiety can also be identified.

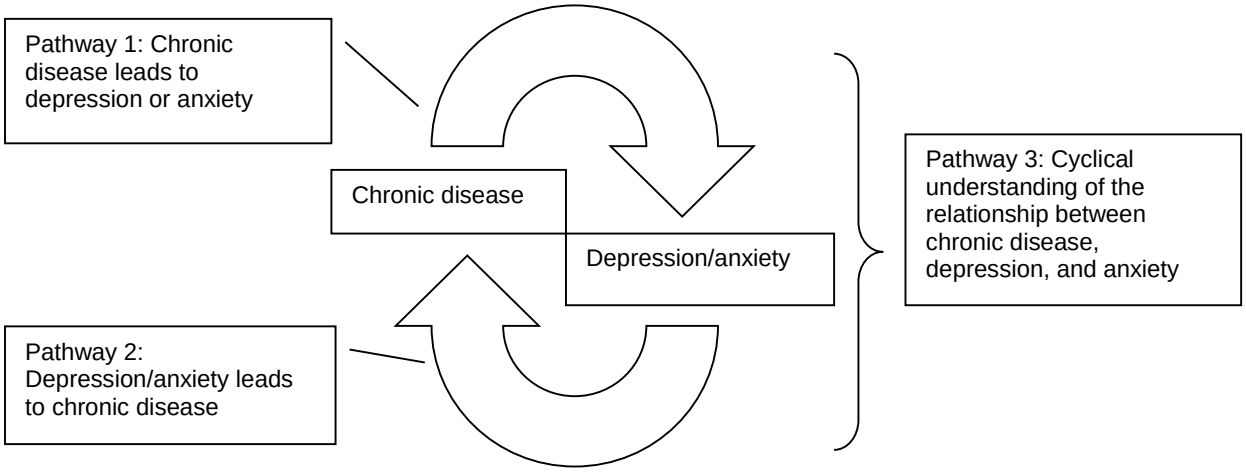

Figure 2: Patient-Experienced Pathways Between Depression/Anxiety and Chronic Disease

Patient-Experienced Pathway 1: Chronic Disease Leads to Depression or Anxiety

The majority of papers found that patients tended to experience depression or anxiety as a consequence of being diagnosed with a chronic disease. (30-37, 39) Multiple consequences of a chronic disease diagnosis can contribute to depression or anxiety: the loss of a sense of self, anxiety and uncertainty about the future, loss of relationships and social isolation, and feelings of guilt.

Loss of self pervades experiences of chronic disease. Many patients expressed sadness and distress at the changes to their lives as a result of the chronic disease. They felt "trapped in a different life" (31) because the limitations of the disease, such as fatigue and a lack of energy, (31, 40-42) kept them from pursuing their normal activities. Functional limitations also lead to feelings of frustration and sadness. (30) Conversely, patients noted a reduction in symptoms of depression when they felt that they were able to participate in and contribute to daily life, and if they were able to regain certain functions (e.g., regain a driver's licence or return to work). (31)

Chronic disease can socially isolate people. The experience of chronic disease often resulted in reduced contact with friends and family and sometimes the loss of relationships. (30-32, 36) Contact with friends might be limited because of friends' fears about the condition, (32) the patients' lack of energy, (32, 33) or a reluctance to engage with friends because days were uneventful and "there's nothing to talk about." (32)

Some patients reported that they avoided social situations because of their chronic disease. With COPD, patients worried that exertion would lead to breathlessness, possibly triggering a panic attack. (37) Stroke survivors reported uncertainty in social settings because of sensitivity to noise and feelings of confusion. (31) Willgoss et al (37) reported that symptoms of anxiety such as sweating and incontinence in COPD patients led to social isolation and that some patients were "effectively housebound."

Anxiety and uncertainty about the future often accompanies chronic disease. Patients described concern about the prognosis of their chronic disease and uncertainty about their future, often experienced as anxiety and depression. (33, 35, 37, 39) Some patients reported relatively sudden episodes of panic, such as waking up at night and being unable to sleep because they were worrying about their chronic disease while others described a more subtle and constant feeling of uncertainty. (33, 35) Patients attributed their uncertainty to the fact that their chronic disease was incurable (39), that the course of the disease was unpredictable, (35) and that they had fears about death. (33)

Feelings of guilt concerning the chronic illness can heighten feelings of depression. Some patients reported feeling that they were to blame for the development of their chronic condition. (30) Patients who had experienced a stroke described "paying the price" for a variety of factors such as drinking and stress. (30) Patients also experienced guilt for not feeling grateful for being alive. (40)

Patient-Experienced Pathway 2: Depression or Anxiety Lead to Chronic Disease

While most qualitative studies find that patients interpret their chronic condition as contributing to depression or anxiety (30-37, 39), fewer studies find patients expressed the belief that anxiety or depression led to their chronic disease. (33, 38, 39) For example, patients may attribute their heart disease to depression having caused a "heavy heart," (39) or heart attacks to high blood pressure triggered by "high emotions," (39) or diabetes to high blood sugar caused by constant worry. (33)

Patient-Experienced Pathway 3: Chronic Disease and Depression or Anxiety Each Worsen the Other

Sometimes, the relationship between the depression or anxiety and the chronic disease could be described as cyclical. Most notably, patients with COPD described a breathlessness/anxiety/breathlessness cycle, where patients perceived breathlessness as a sign of an impending panic attack, while the panic in turn exacerbated the feeling of breathlessness. (37, 38) Bogner et al (39) highlighted the interconnectedness of depression and heart failure, with one patient suggesting that the only way to deal with heart problems was to seek treatment for depression. The relationships between social isolation and depression or anxiety can be perceived as cyclical because symptoms of the latter may prevent patients from engaging in social activities, which in turn leads to increased distress.

Ultimately, the majority of papers addressing anxiety or depression in patients with chronic disease focused on the causal pathway from chronic disease to anxiety or depression. (30-36) Some addressed the opposite pathway, and others highlighted the recurring relationship between the two. (37-39)

Patient-Experienced (Non) Pathway 4: Chronic Disease and Depression or Anxiety are Independent

Some studies found that patients experience chronic disease and anxiety or depression as coincidental. (33, 35, 43) Depression might be pre-existing, with chronic disease simply adding to the patient's burden. (35) Anxiety and depression sometimes arose because of unrelated issues such as financial difficulties, (43) family problems, (35) health issues unrelated to the chronic disease, (35) or grief over the loss of a loved one. (33, 35)

Barriers to Screening

Because screening for anxiety and depression is a technology under assessment for the optimal management of patients with chronic disease, we also reviewed these qualitative studies for findings potentially relevant to the practice of screening. A few reports provided insight into barriers to screening for anxiety or depression in patients with chronic disease. (33, 34, 44) A major barrier to identifying anxiety or depression is that there is often overlap between the physical symptoms of the chronic disease, such as fatigue in heart failure (35) or heart palpitations in COPD. (37) Common symptoms can make it difficult for both clinicians and patients to recognize anxiety or depression as a separate disease and not simply a manifestation of the chronic disease. (43)

Some papers described a normalization of symptoms of anxiety or depression by both patients and clinicians. (33, 44) Clinicians tend to highlight the common link between chronic disease and feelings of anxiety or depression, which in turn can make it difficult for the patient to recognize them as separate conditions and not just an "inevitable" and expected part of the chronic disease experience. (44) In fact, some patients felt that a formal diagnosis of depression underplayed the experience of the chronic disease. (33)

Finally, patients may be reluctant to acknowledge a formal diagnosis of anxiety or depression because of the stigma associated with mental illness. (33, 34, 44, 45) One patient's concerns about taking anti-depressant medication illustrates the reluctance to accept a mental health problem (versus a chronic disease): "I said that is being *loco*, taking medicines for depression. I'm not depressed... depression is a mental problem... I don't have that, I have diabetes. I have other problems, but not a mental problem." (34) Clinicians also raised the issue of stigma, and reluctance to diagnose and label patients as a result. (44)

Limitations

We focused our review on papers that addressed diagnosis of comorbid anxiety or depression with chronic disease. It is possible that a wider array of issues might have been captured if we had focused on broader psychological responses to the chronic disease experience. However, given our OHTAC-related objective to highlight the implications of screening for anxiety or depression, the more narrow focus seemed most relevant for this report.

Conclusions

The relationship between the chronic conditions and depression or anxiety can be experienced as independent or inter-related (with either one causing the other). The majority of papers find that patients tend to experience depression or anxiety as a consequence of being diagnosed with a chronic disease, some studies highlight the experience from anxiety or depression to chronic disease, and others describe a cyclical relationship between the two. Some patients with chronic disease sense no relationship between their chronic disease and mental health conditions.

Patients may be reluctant to acknowledge depression or anxiety as a separate condition. Clinicians' tendency to highlight the link between chronic disease and depression or anxiety can lead to the normalization of these experiences and make it more difficult for patients to recognize anxiety or depression as separate conditions. The overlapping physical symptoms of chronic disease and depression or anxiety also make formal diagnosis difficult.

More qualitative research is needed to specifically address screening for depression or anxiety, and the effect of depression or anxiety (and their treatments) on the chronic disease and its outcomes.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
Shirlee Sharkey (chair)	President & CEO	Saint Elizabeth Health Care
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Appendices

Appendix 1: Literature Search Strategies

Mega Filter: OVID MEDLINE

1. Interviews+
2. (theme$ or thematic).mp.
3. qualitative.af.
4. Nursing Methodology Research/
5. questionnaire$.mp.
6. ethnological research.mp.
7. ethnograph$.mp.
8. ethnonursing.af.
9. phenomenol$.af.
10. (grounded adj (theor$ or study or studies or research or analys?s)).af.
11. (life stor$ or women* stor$).mp.
12. (emic or etic or hermeneutic$ or heuristic$ or semiotic$).af. or (data adj1 saturat$).tw. or participant observ$.tw.
13. (social construct$ or (postmodern$ or post- structural$) or (post structural$ or poststructural$) or post modern$ or post-modern$ or feminis$ or interpret$).mp.
14. (action research or cooperative inquir$ or co operative inquir$ or co- operative inquir$).mp.
15. (humanistic or existential or experiential or paradigm$).mp.
16. (field adj (study or studies or research)).tw.
17. human science.tw.
18. biographical method.tw.
19. theoretical sampl$.af.
20. ((purpos$ adj4 sampl$) or (focus adj group$)).af.
21. (account or accounts or unstructured or open-ended or open ended or text$ or narrative$).mp.
22. (life world or life-world or conversation analys?s or personal experience$ or theoretical saturation).mp
23. (lived or life adj experience$.mp
24. cluster sampl$.mp.
25. observational method$.af.
26. content analysis.af.
27. (constant adj (comparative or comparison)).af.
28. ((discourse$ or discurs$) adj3 analys?s).tw.
29. narrative analys?s.af.
30. heidegger$.tw.
31. colaizzi$.tw.
32. spiegelberg$.tw.
33. (van adj manen$).tw.

34. (van adj kaam$).tw.
35. (merleau adj ponty$).tw
36. .husserl$.tw
37. foucault$.tw.
38. (corbin$ adj2 strauss$).tw
39. glaser$.tw.

NOT

40. p =.ti,ab.
41. p<.ti,ab.
42. p>.ti,ab.
43. p =.ti,ab.
44. p<.ti,ab.
45. p>.ti,ab.
46. p-value.ti,ab.
47. retrospective.ti,ab.
48. regression.ti,ab.
49. statistical.ti,ab.

Mega Filter: EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL)

1. Interviews+
2. MH audiorecording
3. MH Grounded theory
4. MH Qualitative Studies
5. MH Research, Nursing
6. MH Questionnaires+
7. MH Focus Groups (12639)
8. MH Discourse Analysis (1176)
9. MH Content Analysis (11245)
10. MH Ethnographic Research (2958)
11. MH Ethnological Research (1901)
12. MH Ethnonursing Research (123)
13. MH Constant Comparative Method (3633)
14. MH Qualitative Validity+ (850)
15. MH Purposive Sample (10730)
16. MH Observational Methods+ (10164)
17. MH Field Studies (1151)
18. MH theoretical sample (861)
19. MH Phenomenology (1561)
20. MH Phenomenological Research (5751)
21. MH Life Experiences+ (8637)
22. MH Cluster Sample+ (1418)
23. Ethnonursing (179)
24. ethnograph* (4630)

25. phenomenol* (8164)
26. grounded N1 theor* (6532)
27. grounded N1 study (601)
28. grounded N1 studies (22)
29. grounded N1 research (117)
30. grounded N1 analys?s (131)
31. life stor* (349)
32. women's stor* (90)
33. emic or etic or hermeneutic$ or heuristic$ or semiotic$ (2305)
34. data N1 saturat* (96)
35. participant observ* (3417)
36. social construct* or postmodern* or post-structural* or post structural* or poststructural* or post modern* or post-modern* or feminis* or interpret* (25187)
37. action research or cooperative inquir* or co operative inquir* or co-operative inquir* (2381)
38. humanistic or existential or experiential or paradigm* (11017)
39. field N1 stud* (1269)
40. field N1 research (306)
41. human science (132)
42. biographical method (4)
43. theoretical sampl* (983)
44. purpos* N4 sampl* (11299)
45. focus N1 group* (13775)
46. account or accounts or unstructured or open-ended or open ended or text* or narrative* (37137)
47. life world or life-world or conversation analys?s or personal experience* or theoretical saturation (2042)
48. lived experience* (2170)
49. life experience* (6236)
50. cluster sampl* (1411)
51. theme* or thematic (25504)
52. observational method* (6607)
53. questionnaire* (126686)
54. content analysis (12252)
55. discourse* N3 analys?s (1341)
56. discurs* N3 analys?s (35)
57. constant N1 comparative (3904)
58. constant N1 comparison (366)
59. narrative analys?s (312)
60. Heidegger* (387)
61. Colaizzi* (387)
62. Spiegelberg* (0)
63. van N1 manen* (261)
64. van N1 kaam* (34)
65. merleau N1 ponty* (78)
66. husserl* (106)

67. Foucault* (253)
68. Corbin* N2 strauss* (50)
69. strauss* N2 corbin* (88)
70. glaser* (302)

NOT

71. TI statistical OR AB statistical
72. TI regression OR AB regression
73. TI retrospective OR AB retrospective
74. TI p-value OR AB p-value
75. TI p< OR AB p<
76. TI p< OR AB p<
77. TI p= OR AB p=

Mega Filter: ISI Web of Science, Social Science Citation Index

1. TS=interview*
2. TS=(theme*)
3. TS=(thematic analysis)
4. TS=qualitative
5. TS=nursing research methodology
6. TS=questionnaire
7. TS=(ethnograph*)
8. TS= (ethnonursing)
9. TS=(ethnological research)
10. TS=(phenomenol*)
11. TS=(grounded theor*) OR TS=(grounded stud*) OR TS=(grounded research) OR TS=(grounded analys?s)
12. TS=(life stor*) OR TS=(women's stor*)
13. TS=(emic) OR TS=(etic) OR TS=(hermeneutic) OR TS=(heuristic) OR TS=(semiotic) OR TS=(data saturat*) OR TS=(participant observ*)
14. TS=(social construct*) OR TS=(postmodern*) OR TS=(post structural*) OR TS=(feminis*) OR TS=(interpret*)
15. TS=(action research) OR TS=(co-operative inquir*)
16. TS=(humanistic) OR TS=(existential) OR TS=(experiential) OR TS=(paradigm*)
17. TS=(field stud*) OR TS=(field research)
18. TS=(human science)
19. TS=(biographical method*)
20. TS=(theoretical sampl*)
21. TS=(purposive sampl*)
22. TS=(open-ended account*) OR TS=(unstructured account) OR TS=(narrative*) OR TS=(text*)
23. TS=(life world) OR TS=(conversation analys?s) OR TS=(theoretical saturation)
24. TS=(lived experience*) OR TS=(life experience*)
25. TS=(cluster sampl*)
26. TS=observational method*
27. TS=(content analysis)
28. TS=(constant comparative)
29. TS=(discourse analys?s) or TS =(discurs* analys?s)

30. TS=(narrative analys?s)
31. TS=(heidegger*)
32. TS=(colaizzi*)
33. TS=(spiegelberg*)
34. TS=(van manen*)
35. TS=(van kaam*)
36. TS=(merleau ponty*)
37. TS=(husserl*)
38. TS=(foucault*)
39. TS=(corbin*)
40. TS=(strauss*)
41. TS=(glaser*)

NOT

42. TS=(p-value)
43. TS=(retrospective)
44. TS=(regression)
45. TS=(statistical)

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Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

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All reports in the *Ontario Health Technology Assessment Series* are impartial. There are no competing interests or conflicts of interest to declare.

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All reports in the *Ontario Health Technology Assessment Series* are subject to external expert peer review. Additionally, Health Quality Ontario (HQO) posts draft reports and recommendations on its website for public comment before publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

About Health Quality Ontario

Health Quality Ontario is an arms-length agency of the Ontario government. It is a partner and leader in transforming Ontario's health care system so that it can deliver a better experience of care, better outcomes for Ontarians, and better value for money.

Health Quality Ontario strives to promote health care that is supported by the best available scientific evidence. Health Quality Ontario works with clinical experts, scientific collaborators and field evaluation partners to develop and publish research that evaluates the effectiveness and cost-effectiveness of health technologies and services in Ontario.

Based on the research conducted by HQO and its partners, the Ontario Health Technology Advisory Committee (OHTAC) — a standing advisory sub-committee of the HQO Board — makes recommendations about the uptake, diffusion, distribution, or removal of health interventions to Ontario's Ministry of Health and Long-Term Care, clinicians, health system leaders, and policy-makers.

This research is published as part of Ontario Health Technology Assessment Series, which is indexed in EBSCO Cumulative Index to Nursing and Allied Health Literature, EMBASE, MEDLINE, and the Centre for Reviews and Dissemination. Corresponding OHTAC recommendations and other associated reports are also published on the HQO website. Visit http://www.hqontario.ca for more information.

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To conduct its comprehensive analyses, HQO and/or its research partners reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, HQO collects and analyzes information about how a health intervention fits within current practice and existing treatment alternatives. Details about the diffusion of the intervention into current health care practices in Ontario add an important dimension to the review. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social, and legal issues relating to the intervention assist in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals and organizations wishing to comment on reports and recommendations before publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This report was prepared by HQO or one of its research partners for the OHTAC and developed from analysis, interpretation, and comparison of scientific research. It also incorporates, when available, Ontario data and information provided by experts and applicants to HQO. It is possible that relevant scientific findings could have been reported since completion of the review. This report is current to the date of the literature review specified in the methods section, if available. This analysis may be superseded by an updated publication on the same topic. Please check the HQO website for a list of all publications: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

Abstract

Background

Specialized community-based care (SCBC) endeavours to help patients manage chronic diseases by formalizing the link between primary care providers and other community providers with specialized training. Many types of health care providers and community-based programs are employed in SCBC. Patient-centred care focuses on patients' psychosocial experience of health and illness to ensure that patients' care plans are modelled on their individual values, preferences, spirituality, and expressed needs.

Objectives

To synthesize qualitative research on patient and provider experiences of SCBC interventions and health care delivery models, using the core principles of patient-centredness.

Data Sources

This report synthesizes 29 primary qualitative studies on the topic of SCBC interventions for patients with chronic conditions. Included studies were published between 2002 and 2012, and followed adult patients in North America, Europe, Australia, and New Zealand.

Review Methods

Qualitative meta-synthesis was used to integrate findings across primary research studies.

Results

Three core themes emerged from the analysis:

- patients' health beliefs affect their participation in SCBC interventions;
- patients' experiences with community-based care differ from their experiences with hospital-based care;
- patients and providers value the role of nurses differently in community-based chronic disease care.

Limitations

Qualitative research findings are not intended to generalize directly to populations, although meta-synthesis across several qualitative studies builds an increasingly robust understanding that is more likely to be transferable. The diversity of interventions that fall under SCBC and the cross-interventional focus of many of the studies mean that findings might not be generalizable to all forms of SCBC or its specific components.

Conclusions

Patients with chronic diseases who participated in SCBC interventions reported greater satisfaction when SCBC helped them better understand their diagnosis, facilitated increased socialization, provided them

with a role in managing their own care, and assisted them in overcoming psychological and social barriers.

Plain Language Summary

More and more, to reduce bed shortages in hospitals, health care systems are providing programs called specialized community-based care (SCBC) to patients with chronic diseases. These SCBC programs allow patients with chronic diseases to be managed in the community by linking their family physicians with other community-based health care providers who have specialized training. This report looks at the experiences of patients and health care providers who take part in SCBC programs, focusing on psychological and social factors. This kind of lens is called patient-centred. Three themes came up in our analysis:

- patients' health beliefs affect how they take part in SCBC interventions;
- patients' experiences with care in the community differ from their experiences with care in the hospital;
- patients and providers value the role of nurses differently.

The results of this analysis could help those who provide SCBC programs to better meet patients' needs.

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List of Abbreviations

CHF	Congestive heart failure
COPD	Chronic obstructive pulmonary disease
HQO	Health Quality Ontario
OHTAC	Ontario Health Technology Advisory Committee
SCBC	Specialized community-based care

Background

In July 2011, the Evidence Development and Standards (EDS) branch of Health Quality Ontario (HQO) began developing an evidentiary framework for avoidable hospitalizations. The focus was on adults with at least 1 of the following high-burden chronic conditions: chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), atrial fibrillation, heart failure, stroke, diabetes, and chronic wounds. This project emerged from a request by the Ministry of Health and Long-Term Care for an evidentiary platform on strategies to reduce avoidable hospitalizations.

After an initial review of research on chronic disease management and hospitalization rates, consultation with experts, and presentation to the Ontario Health Technology Advisory Committee (OHTAC), the review was refocused on optimizing chronic disease management in the outpatient (community) setting to reflect the reality that much of chronic disease management occurs in the community. Inadequate or ineffective care in the outpatient setting is an important factor in adverse outcomes (including hospitalizations) for these populations. While this did not substantially alter the scope or topics for the review, it did focus the reviews on outpatient care. HQO identified the following topics for analysis: discharge planning, in-home care, continuity of care, advanced access scheduling, screening for depression/anxiety, self-management support interventions, specialized nursing practice, and electronic tools for health information exchange. Evidence-based analyses were prepared for each of these topics. In addition, this synthesis incorporates previous EDS work, including Aging in the Community (2008) and a review of recent (within the previous 5 years) EDS health technology assessments, to identify technologies that can improve chronic disease management.

HQO partnered with the Programs for Assessment of Technology in Health (PATH) Research Institute and the Toronto Health Economics and Technology Assessment (THETA) Collaborative to evaluate the cost-effectiveness of the selected interventions in Ontario populations with at least 1 of the identified chronic conditions. The economic models used administrative data to identify disease cohorts, incorporate the effect of each intervention, and estimate costs and savings where costing data were available and estimates of effect were significant. For more information on the economic analysis, please contact either Murray Krahn at murray.krahn@theta.utoronto.ca or Ron Goeree at goereer@mcmaster.ca.

HQO also partnered with the Centre for Health Economics and Policy Analysis (CHEPA) to conduct a series of reviews of the qualitative literature on “patient centredness” and “vulnerability” as these concepts relate to the included chronic conditions and interventions under review. For more information on the qualitative reviews, please contact Mita Giacomini at giacomin@mcmaster.ca.

The Optimizing Chronic Disease Management in the Outpatient (Community) Setting mega-analysis series is made up of the following reports, which can be publicly accessed at http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations.

- Optimizing Chronic Disease Management in the Outpatient (Community) Setting: An Evidentiary Framework
- Discharge Planning in Chronic Conditions: An Evidence-Based Analysis
- In-Home Care for Optimizing Chronic Disease Management in the Community: An Evidence-Based Analysis
- Continuity of Care: An Evidence-Based Analysis
- Advanced (Open) Access Scheduling for Patients With Chronic Diseases: An Evidence-Based Analysis
- Screening and Management of Depression for Adults With Chronic Diseases: An Evidence-Based Analysis
- Self-Management Support Interventions for Persons With Chronic Diseases: An Evidence-Based Analysis
- Specialized Nursing Practice for Chronic Disease Management in the Primary Care Setting: An Evidence-Based Analysis
- Electronic Tools for Health Information Exchange: An Evidence-Based Analysis
- Health Technologies for the Improvement of Chronic Disease Management: A Review of the Medical Advisory Secretariat Evidence-Based Analyses Between 2006 and 2011
- Optimizing Chronic Disease Management Mega-Analysis: Economic Evaluation
- How Diet Modification Challenges Are Magnified in Vulnerable or Marginalized People With Diabetes and Heart Disease: A Systematic Review and Qualitative Meta-Synthesis
- Chronic Disease Patients’ Experiences With Accessing Health Care in Rural and Remote Areas: A Systematic Review and Qualitative Meta-Synthesis
- Patient Experiences of Depression and Anxiety With Chronic Disease: A Systematic Review and Qualitative Meta-Synthesis
- Experiences of Patient-Centredness With Specialized Community-Based Care: A Systematic Review and Qualitative Meta-Synthesis

Objective of Analysis

To synthesize qualitative research on patient and provider experiences of specialized community-based care (SCBC) interventions and health care delivery models, using the lens of patient-centredness.

Clinical Need and Target Population

Chronic Disease

As described in the 2012 Health Quality Ontario (HQO) report *Specialized Community-Based Care: An Evidence-Based Analysis*, "Chronic diseases have a large impact on the Ontario population. An estimated 1 in 3 Ontarians has a chronic disease, and among those over 65 years of age, 80% have at least 1 chronic disease and 70% have 2 or more chronic diseases. Chronic diseases include heart failure, diabetes, cancer, COPD, and arthritis. In 2002, the World Health Organization estimated that medical treatment for chronic diseases and the resulting lost productivity would cost $80 million in Canada annually." (1)

Patient-Centredness

The concept of *patient-centredness* originated in general practice and primary care in the 1970s as a reaction to the prevailing biomedical model of care, which focused on the biologic manifestations of disease rather than on the patient's psychosocial experience of health and illness. (2) The term *patient-centred* was coined in 1988. (3) The ideal of patient-centredness entails modelling patients' care plans on their values, preferences, spirituality, and expressed needs. (2-4) The concept of patient-centredness draws attention to and critiques the patient-provider relationship, promoting nonpaternalistic, nonauthoritarian relationships in which patients' autonomy is sufficiently empowered so they can participate actively in their own care, and ensuring that their relationships with others (family, supports) are recognized by health care providers. (4-6) To enable this, relevant information should be shared between providers and patients, and decision-making should be collaborative.

Qualitative research has been advocated as the method of choice for investigating both the nonmedical and individualized illness experience, and the experiences of providers in patient-provider relationships. (2) The core principles of patient-centredness that have emerged from the qualitative literature are as follows:

- recognizing the cultural, social, and psychological (nonmedical) dimensions of illness;
- requiring an understanding of patients' unique experiences;
- promoting a nonpaternalistic, nonauthoritarian relationship between patient and provider;
- ensuring agreement on goals and treatment, and a bond of caring and sympathy between providers and patients;
- acknowledging providers as persons, necessitating self-awareness of their emotional and cultural responses;

Technique

This meta-synthesis uses the definition of SCBC provided in the 2012 HQO report on SBSC: care "that manages chronic illness through formalized links between primary and specialized care." (1) Specialized community-based care seeks to improve the effectiveness and efficiency of chronic disease care using interdisciplinary care teams such as primary care physicians, specialists, nurses, dietitians, pharmacists, social workers, caregivers, patients, and physiotherapists. Many terms have been used to describe programs that include the essential elements of SCBC, including intermediate care, shared care, integrated care, chronic disease management, interdisciplinary primary care, collaborative care, guided care, and care-and-case management.

Table 1: Frequently Reported Components of Specialized Community-Based Care

Components	Description
Disease-specific education	Education about the signs, symptoms, and etiology of a chronic condition
Medication education/review	Education about the side effects of medication, the relationship of medication to chronic disease management, and the importance of medication adherence
Medication titration	Assistance with appropriate dosing of specific medications
Diet counselling	Counselling on disease-specific diets
Physical activity counselling	Counselling on physical activity
Lifestyle counselling	Counselling on lifestyle choices, such as smoking cessation and alcohol intake
Self-care support behaviour	Encouragement for patients to monitor weight, symptoms, and medications
Self-care tools	Patient diaries for recording weight, diet, or symptoms
Evidence-based guidelines	Clinical practice guidelines based on evidence
Regular follow-up	Regular follow-up visits between the beginning and end of the treatment phase

Source: Health Quality Ontario. (1)

Evidence-Based Analysis

Research Question

What are the findings of the qualitative research on patient and provider experiences of specialized community-based care (SCBC) interventions and health care delivery models, using the lens of patient-centredness?

Research Methods

Literature Search

Search Strategy

A literature search was performed on May 3, 2012, using Ovid MEDLINE and EBSCO Cumulative Index to Nursing and Allied Health Literature, and on May 4, 2012, using Thomson Reuters Web of Knowledge, Social Sciences Citation Index, for studies published from January 1, 2002, until May 31, 2012. We developed a qualitative mega-filter by combining existing published qualitative filters. (7-10) The filters were compared, and redundant search terms were deleted. We added exclusionary terms to the search filter that were likely to identify quantitative research and would reduce the number of false-positive results. We then applied the qualitative mega-filter to 9 condition-specific search filters (atrial fibrillation, diabetes, chronic conditions, COPD, chronic wounds, coronary artery disease, CHF, multiple morbidities, and stroke). Appendix 1 provides details of the search strategy. Titles and abstracts were reviewed by 2 reviewers and, for those studies meeting the eligibility criteria, full-text articles were obtained.

This search identified all the qualitative research on the chronic diseases listed above. Databases were hand searched to identify studies that were related to patient-centredness, according to the research-based definition. Titles and abstracts were reviewed, and those that related to the core principles of patient-centredness were included. The following terms and concepts were used to identify publications associated with patient-centredness or patient-centeredness: *patient-focused; people-/person-/client-/consumer-/family-centred, biopsychosocial model; health advocacy/promotion, health literacy; patient empowerment, patient autonomy, shared decision-making;* and *collaborative care*, among others.

Finally, the studies on chronic diseases and patient-centredness were hand searched to identify those that were relevant to SCBC. Eligible interventions included components of SCBC identified by the 2012 HQO report (1) (Table 1) and interventions described as SCBC or using related terminology (e.g., shared care, interdisciplinary primary care, chronic disease management).

Inclusion Criteria

English-language full reports

- published between January 1, 2002, and May 31, 2012;
- primary qualitative empirical research (using any descriptive or interpretive qualitative methodology, including the qualitative component of mixed-methods studies) and secondary syntheses of primary qualitative empirical research;
- participating patients engaged in an SCBC program or a program with components related to the definitions of SCBC;
- research with an approach consistent with the core principles of patient-centred care.

Exclusion Criteria

- studies addressing topics other than the experience of a patient or provider engaging in an SCBC program or a program with related components;
- studies labelled "qualitative" that did not use a qualitative descriptive or interpretive methodology (e.g., case studies, experiments, or observational analyses using qualitative categorical variables);
- quantitative research (i.e., using statistical hypothesis testing, using primarily quantitative data or analyses, or expressing results in quantitative or statistical terms);
- studies that did not pose an empirical research objective or question, or involve primary or secondary analysis of empirical data.

Qualitative Analysis

We analyzed published qualitative research using techniques of integrative qualitative meta-synthesis (9, 11-13). Qualitative meta-synthesis, also known as qualitative research integration, is an integrative technique that summarizes research over several studies with the intent of combining findings from multiple papers. Qualitative meta-synthesis has 2 objectives: first, summarizing the aggregate of a result should reflect the range of findings that exist while retaining the original meaning of the authors; second, through a process of comparing and contrasting findings across studies, a new integrative interpretation of the phenomenon should be produced. (14)

Predefined topic and research questions guided research collection, data extraction, and analysis. Topics were defined in stages, as available relevant literature was identified and the corresponding evidence-based analyses proceeded. All qualitative research relevant to the conditions under analysis was retrieved. In consultation with HQO, a theoretical sensitivity to patient centeredness and vulnerability was used to further refine the dataset. Finally, specific topics were chosen and a final search was performed to retrieve papers relevant to these questions. This analysis included papers that addressed experiences of patients with chronic conditions and their providers in the context of receiving SCBC interventions.

Data extraction focused on, and was limited to, findings relevant to this research topic. Qualitative findings are the "data-driven and integrated discoveries, judgments, or pronouncements researchers offer about the phenomena, events, or cases under investigation." (9) In addition to the researchers' findings, original data excerpts (participant quotes, stories, or incidents) embedded in the findings were also extracted to help illustrate specific findings and, when useful, to facilitate communication of meta-synthesis findings.

Through a staged coding process similar to that of grounded theory, (15-16) studies' findings were broken into their component parts (key themes, categories, concepts) and then gathered across studies to regroup

and relate to each other thematically. This process allowed for organization and reflection on the full range of interpretative insights across the body of research. (9, 17) These categorical groupings provided the foundation from which interpretations of the social and personal phenomena relevant to patients' experience were synthesized. A "constant comparative" and iterative approach was used, in which preliminary categories were repeatedly compared with research findings, raw data excerpts, and co-investigators' interpretations of the same studies, as well as to the original Ontario Health Technology Assessment Committee (OHTAC)–defined topic, emerging evidence-based analyses of clinical evaluations of related technologies, (1) and feedback from OHTAC deliberations and expert panels on issues emerging in relation to the topic.

Quality of Evidence

For valid epistemologic reasons, the field of qualitative research lacks consensus on the importance of, and methods and standards for, critical appraisal. (18) Qualitative health researchers conventionally underreport procedural details, (12) and the quality of findings tends to rest more on the conceptual prowess of the researchers than on methodologic processes. (18) Theoretically sophisticated findings are promoted as a marker of study quality for making valuable theoretical contributions to social science academic disciplines. (19) However, theoretical sophistication is not necessary for contributing potentially valuable information to a synthesis of multiple studies, or to inform questions posed by the interdisciplinary and interprofessional field of health technology assessment. Qualitative meta-synthesis researchers typically do not exclude qualitative research on the basis of independently appraised quality. This approach is common to multiple types of interpretive qualitative synthesis. (9-10, 14, 18-22)

For this review, the academic peer review and publication process was used to eliminate scientifically unsound studies according to current standards. Beyond this, all topically relevant, accessible studies using any qualitative, interpretive, or descriptive methodology were included. The value of the research findings was appraised solely in terms of their relevance to our research questions and of data that supported the authors' findings.

Results of Evidence-Based Analysis

The database search yielded 826 citations published between January 1, 2002, and May 2012 (with duplicates removed). Articles were excluded on the basis of information in the title and abstract. Two reviewers reviewed all titles and abstracts to refine the database to qualitative research relevant to any of the chronic diseases. Figure 1 shows the breakdown of when and for what reason citations were excluded from the analysis.

Twenty-nine studies met the inclusion criteria. The reference lists of the included studies were hand searched to identify any additional potentially relevant studies, but no additional citations were included.

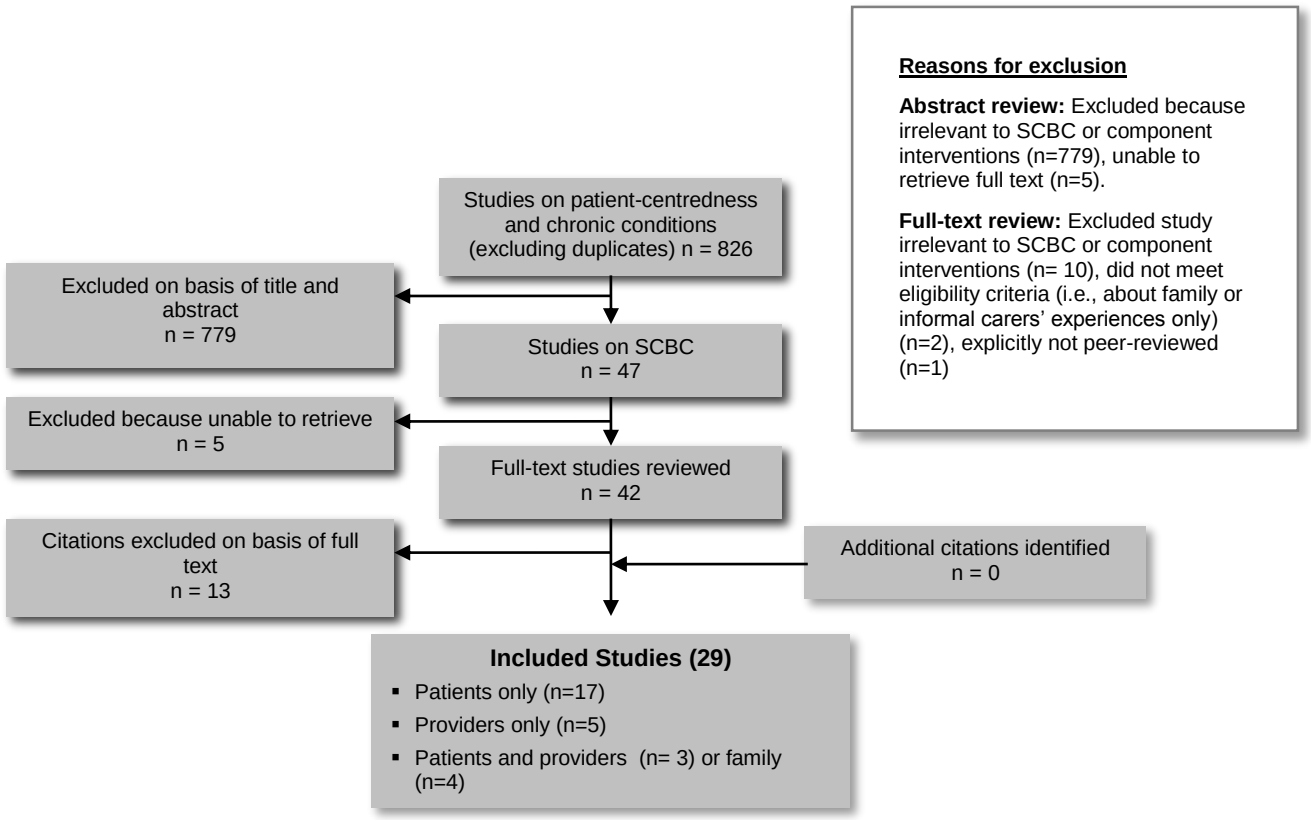

Figure 1: Citation Flow Chart

Description of Studies

The included studies were diverse in their research focus and questions. Of the studies that directly related to SCBC interventions and patient-centredness, 7 examined patients' or providers' perceptions of care delivered at nurse-led, shared care clinics. (23-29) Many of these clinics were disease specific—for example, CHF clinics, (26) COPD clinics, (23, 30) and diabetes clinics. (24-25, 27-28, 31) Most clinics were based at primary care centres, but some, such as a patient rehabilitation centre, (32), a leg ulcer clinic, (33) and a CHF clinic, (34) were based at secondary care facilities.

Some studies asked patients and providers to compare their experience of a new model of care with the care they had previously received in a community setting. (24-25, 28, 33, 35-37) These included comparing new models of shared care to the care they previously received (patients), or to care delivered in either primary or secondary health care settings (providers). (24-25, 28) In 2 instances, studies considered the patient in moving from specialty care to primary care clinics. (36-37)

Two studies examined patients' and providers' experiences of telehome care interventions, but because these interventions were diverse in the type of technology used and degree of patient involvement in the care, generalizations about telehome care from those studies was avoided. (38-39) Two studies examined patients' experiences of a physical activity intervention. (32, 40)

The remaining studies were indirectly related to SCBC and patient-centredness. These studies tended to have broader research questions that examined patients' and providers' perceptions of chronic conditions, and it was through these findings that the studies described specific components of SCBC (e.g., diet or lifestyle counselling). (41-44) In a similar vein, several studies specifically examined patients' perceptions of the health information they received during care. These were included in our analysis because those patients reported on SCBC-type interventions. (45-47)

Three core themes emerged from the qualitative research on the management of chronic conditions through SCBC:

- patients' health beliefs affect their participation in SCBC interventions;
- patients' experiences with community-based care differ from their experiences with hospital-based care;
- patients and providers value the role of nurses differently in community-based chronic disease care.

Patients' Health Beliefs Affect Their Participation

Recruitment into SCBC programs—or the therapies associated with some interventions (e.g., activity-based rehabilitation)—suggested that patients do not know as much about their chronic diseases as providers presume. For patients whose reports indicated a more comprehensive knowledge of their condition, manifestations of their condition appeared to affect their perceptions of competence in social functioning; this, in turn, influenced their willingness to participate in or access SCBC interventions. Patients reported that social support provided as part of SCBC interventions was helpful in improving their understanding of their condition or ameliorating the psychosocial barriers to accessing those services.

Patients' Knowledge of Their Conditions

Some patients reported that limits to their understanding of their diagnosis were made apparent by the SCBC interventions they were expected to undergo, whether they were activity-based rehabilitation (48) or a strict medication regimen. (45) Some patients reported that they learned more about their condition and the factors that led to it from SCBC-based providers than they did from the diagnosing clinicians, because the SCBC-based providers spent time discussing their condition in a way that was personalized to their current life experience. (26, 32) Some patients reported that poor knowledge about their condition was because they were given limited information when they received their diagnosis (32, 45) or because they were reluctant to seek further information at the time of diagnosis. (43, 45)

Communication Between Providers and Patients

Other patients—particularly those with communication impairments acquired as a result of their condition (e.g., aphasia)—reported feeling psychologically isolated by their speech difficulties and felt particularly reliant on the format of the SCBC program, because it affected their perception of how able or competent they were to participate. (35, 43, 46, 49) Patients also reported perceptions of condition-based physical and psychosocial limitations with several conditions, (e.g., CHF, COPD, and stroke) noting that these limitations affected their willingness to participate in SCBC interventions because of the physical and psychosocial demands of the interventions or opportunities to access them. (27, 32, 34, 42-43, 47, 50) However, patients were not unanimous about which interventions were positive or negative in these respects. Although social support via contacts outside the patients' homes was highly valued by many, (32, 34, 41, 43, 50) others said they valued having providers come to their home for individualized care. (38, 43) A common theme across both groups was the value participants placed on acquisition of self-care management skills, regardless of where the care was provided.

Information and Self-Management

Diet, physical activity, and lifestyle counselling could be viewed with suspicion if they are not in a format patients can understand, (35, 49) given at a time patients can process information, (41, 46-47) or explained and situated in a way that is relevant to patients' personal situation and disease. (23, 26, 35, 47) In lieu of written information, some patients preferred personalized verbal exchange. (35) Conflicting health information from various providers or the media (e.g., which foods one should eat) generated skepticism among patients about the value of such information. (25, 45, 47)

Patients' Experiences With Community-Based Care Versus Hospital-Based Care

The studies focused on the perceptions and experiences of patients with chronic diseases as they related to participation in SCBC interventions. Although SCBC interventions are not based in hospitals, patients with chronic diseases frequently have experience with hospital-based care, either because they receive their diagnosis there or because they visit the hospital during acute episodes of their disease. Study authors quoted patients who compared their experiences in hospital to their experiences with SCBC interventions.

Negative Dimensions of Hospital Care

Many patients reported associating the severity of their illness with the setting of their care; for example, they reported interpreting their transfer of care to a hospital inpatient program or a hospital-based specialist as an indication that their disease had progressed. (36-37, 51) Both patients (33, 37, 48) and providers (23) characterized hospital care as focused on disease state and not individualized to unique patients. Some patients reported that hospital-based care made them feel like a "number" (33) or a "case," (36-37) or a nuisance to care providers. (48) Some patients reported that the feature of home care that most positively contrasted with hospital care was lack of privacy during hospital stays. (40) However, some patients also reported feeling alone and lacking support when discharged from hospital to home, reflecting diminished access to care providers. (35)

Value of Relationships With Providers

Patients who preferred community-based care indicated that they appreciated the repeated and longer access to knowledgeable providers, in contrast to hospital-based care. (24, 26-27, 30, 43, 49) Patients reported that SCBC gave them access to longer appointments with providers, particularly nursing staff, enabling them to build a rapport with their providers and form responsive relationships that might not have been possible in a hospital. (24, 27, 35, 43) Trust in their care providers led patients to feel that they could tell their stories and have them heard. (24, 35, 43) This helped some patients feel that they could take a more active role in their own care (i.e., self-management), contributing to treatment planning that reflected their specific care needs or life goals. (27, 30, 33, 38, 49, 52)

Specialized Community-Based Care and Socialization

Patients participating in programs that got them out of their homes and into the community (e.g., peer support groups, exercise and rehabilitation programs, regular specialty clinic visits), or that brought providers into their homes, reported that the resulting social support reduced their sense of isolation and increased their confidence. (32-34, 40-41) Some patients—particularly those in neighbourhoods characterized as socioeconomically deprived—reported the important role of community networks in informing patients about new SCBC services. (48) Patients who attended rehabilitation for their chronic diseases often commented that the presence of other patients and providers was crucial to their motivation. (32) Such socialization opportunities were sometimes valued even when patients did not believe that the program itself improved their underlying physical condition. (40)

Patients and Providers Value the Role of Nurses Differently

Several studies had findings specific to patients' and providers' perceptions of the role of nurses in nurse-led shared care and disease-specific clinics, located either in primary care settings or in interdisciplinary primary care practices. (23-26, 28, 30-31, 33, 37, 49, 51, 53-54) Of these 13 studies, 7 included patients' perspectives, (24, 26-28, 37, 49, 54) 5 included nurses' perspectives, (23, 26, 30, 49, 53) and 2 captured general practitioners' perspectives. (25, 51) These studies all point to the perceived value of the role of nurses in supporting patients' self-management, in personalizing patient care, and in referring patients to specialists when needed.

Nurses' Support of Patients' Self-Management

One dimension of the nurses' role that was highlighted by study findings central to SCBC interventions for chronic diseases was their support for patients' self-management. (23, 26-27, 30-31, 49) Patients saw nurses as key supports for self-management, (26, 31) and nurses themselves reported supporting patients' self-management as an integral part of their role. (26-27) Self-management support included teaching the communication and social skills required for self-management (27) and promoting patients' feelings of autonomy. (31) More generally, patients reported that nurses provided basic social support (27) and information on specific chronic diseases and activities to prevent complications. (26)

However, not all nurses' approaches to supporting self-management were reported as equal by patients. Several studies found that nurses lacked skills or failed to facilitate self-management. (23, 29, 53) This included the failure to tend to the patient as an individual (23) and to incorporate patients' perspectives into self-management counselling. (29) In such instances, the result was a one-size-fits-all approach to self-management that focused on provision of generalized medical information. (23, 29, 53) Findings from 2 studies supported the use of mentors and senior nursing staff to help nurses adopt an individualized and holistic approach to counselling. (29, 53)

Nurses' Rapport With Patients and Personalized Approach to Care

According to the ethos of patient-centred care, an important enabler of personalized approaches to care is the rapport developed between patient and provider. Many nurses reported seeing their role as one of building rapport, naming this as a key step in better understanding their patients' disease and providing guidance and health information tailored to their patients' condition and life experiences. (26-27, 30, 49) Key elements of building rapport reported by both patients and nurses were sustained and focused time with patients (30) and repeated visits with the same provider. (27, 37) Physicians reported awareness that time constraints limited how long they could spend with each patient, making it difficult for them to establish the same degree of rapport with their patients as nurses did. (25, 51) Patients similarly reported that physicians were more difficult to access and spend time with than nursing staff. (28, 54) Some nurses reported awareness of this and described an element of their role as improving communication between patients and their general practitioners. (25, 49)

Another important aspect of nurses' therapeutic role was providing referrals to other health care providers as needed or requested. (24, 31, 37, 49, 53) Nurses' ability to do this appropriately was facilitated by the rapport they established with their patients as a result of knowing the patient's needs and social context. (31, 49, 53)

Patient-Perceived Limits to Nurses' Expertise

While some patients reported perceiving nurses as having greater expertise than they were allowed to exercise under the supervision of a physician (for example, changing medication prescriptions), (28) others were aware of the limits to nurses' expertise. (24, 31, 33, 37) Patients reported expecting nurses to make referrals to other practitioners when the limits of the nurse's knowledge or scope of practice were reached. (24, 28, 31, 33, 37) In this way, patients reported that nurses' referral role contributed to their

sense of security (31) and confidence in nursing care. (37) Some patients reported taking comfort in the perception that the nurse's practice was overseen by a physician; this suggested to them that the physician was still involved in their care. (24) However, nurses in 1 study of a shared-care diabetes clinic reported struggling to have their expertise recognized by physicians in the clinic, and pointed to the local and health system barriers that made fully shared care in those contexts difficult. (25)

Limitations

Qualitative studies are designed to contribute new insights into poorly understood social phenomena. Findings are not intended to generalize directly to populations, although meta-synthesis across several qualitative studies does build an increasingly robust understanding that is more likely to be transferable.

The diversity of interventions that fall under SCBC (i.e., the multiple components listed in Table 1) mean that findings might not be generalizable to all forms of SCBC or its components. The qualitative studies reviewed here addressed (in either their research question or findings) most interventions that comprise SCBC (i.e., disease-specific education, medication education and review, medication titration, diet counselling, physical activity counselling, lifestyle counselling, and self-care support). However, given the broad focus of many of the studies, there were no specific results about each type of intervention (e.g., diet counselling versus self-care support). Other aspects of SCBC, such as self-care tools, evidence-based guidelines, and regular follow-up, were not covered as discrete topics of investigation in the evidence reviewed. Had we expanded our focus to include patients' experiences with chronic conditions without specific interventional foci, we might have captured more evidence on specific interventions. However, such an approach would have generated a volume of research for review that would have exceeded the resources available. Consequently, the focus on SCBC was deemed appropriate for this evidence-based review.

The studies that were selected focused on the perceptions and experiences of patients with chronic diseases as these relate to their participation in SCBC-type interventions and the experiences of providers employed in those interventions. However, with respect to patients' experiences, many of the studies captured this broadly, not just as it applied to the program in question. Some of these experiences (e.g., physician care contrasted with nursing care) were not formally incorporated into the conclusions, nor were they the explicit focus of this review, but when patient experiences spoke to and illuminated features of SCBC interventions that were relevant to this review, they were included in the results.

Not all patients shared the same experiences of SCBC or had the same expectations of patient-centred care. This review sensitized information for planning and evaluating patient-centred SCBC, but findings should be placed into context of the setting and services.

Conclusions

This synthesis of 29 primary qualitative studies on the experiences of patients with chronic conditions and their providers in SCBC programs and using the analytical lens of patient-centred care revealed 3 themes:

- patients' health beliefs affect their participation in SCBC interventions;
- patients' experiences with community-based care differ from their experiences with hospital-based care;
- patients and providers value the role of nurses differently in community-based chronic disease care.

Patients with chronic diseases who participated in SCBC interventions reported greater satisfaction when SCBC helped them better understand their diagnosis, facilitated increased socialization, provided them with a role in managing their own care, and assisted them in overcoming psychological and social barriers.

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Expert Panel for Health Quality Ontario: Optimizing Chronic Disease Management in the Community (Outpatient) Setting

Name	Title	Organization
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Theresa Agnew	Executive Director	Nurse Practitioners' Association of Ontario
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Arlene Bierman	Ontario Women's Health Council Chair in Women's Health	Department of Medicine, Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto
Susan Bronskill	Scientist	Institute for Clinical Evaluative Sciences
Catherine Demers	Associate Professor	Division of Cardiology, Department of Medicine, McMaster University
Alba Dicenso	Professor	School of Nursing, McMaster University
Mita Giacomini	Professor	Centre of Health Economics & Policy Analysis, Department of Clinical Epidemiology & Biostatistics
Ron Goeree	Director	Programs for Assessment of Technology in Health Research Institute, St. Joseph's Healthcare Hamilton
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Murray Krahn	Director	Toronto Health Economics and Technology Assessment Collaborative, University of Toronto
Wendy Levinson	Sir John and Lady Eaton Professor and Chair	Department of Medicine, University of Toronto
Raymond Pong	Senior Research Fellow and Professor	Centre for Rural and Northern Health Research and Northern Ontario School of Medicine, Laurentian University
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Moira Stewart	Director	Centre for Studies in Family Medicine, University of Western Ontario
Walter Wodchis	Associate Professor	Institute of Health Management Policy and Evaluation, University of Toronto

Appendices

Appendix 1: Literature Search Strategies

Mega Filter: Ovid MEDLINE

1. Interviews+
2. (theme$ or thematic).mp.
3. qualitative.af.
4. Nursing Methodology Research/
5. questionnaire$.mp.
6. ethnological research.mp.
7. ethnograph$.mp.
8. ethnonursing.af.
9. phenomenol$.af.
10. (grounded adj (theor$ or study or studies or research or analys?s)).af.
11. (life stor$ or women* stor$).mp.
12. (emic or etic or hermeneutic$ or heuristic$ or semiotic$).af. or (data adj1 saturat$).tw. or participant observ$.tw.
13. (social construct$ or (postmodern$ or post- structural$) or (post structural$ or poststructural$) or post modern$ or post-modern$ or feminis$ or interpret$).mp.
14. (action research or cooperative inquir$ or co operative inquir$ or co- operative inquir$).mp.
15. (humanistic or existential or experiential or paradigm$).mp.
16. (field adj (study or studies or research)).tw.
17. human science.tw.
18. biographical method.tw.
19. theoretical sampl$.af.
20. ((purpos$ adj4 sampl$) or (focus adj group$)).af.
21. (account or accounts or unstructured or open-ended or open ended or text$ or narrative$).mp.
22. (life world or life-world or conversation analys?s or personal experience$ or theoretical saturation).mp
23. (lived or life adj experience$.mp
24. cluster sampl$.mp.
25. observational method$.af.
26. content analysis.af.
27. (constant adj (comparative or comparison)).af.
28. ((discourse$ or discurs$) adj3 analys?s).tw.
29. narrative analys?s.af.
30. heidegger$.tw.
31. colaizzi$.tw.
32. spiegelberg$.tw.
33. (van adj manen$).tw.
34. (van adj kaam$).tw.
35. (merleau adj ponty$).tw
36. .husserl$.tw
37. foucault$.tw.
38. (corbin$ adj2 strauss$).tw
39. glaser$.tw.

NOT

40. p =.ti,ab.
41. p<.ti,ab.
42. p>.ti,ab.
43. p =.ti,ab.
44. p<.ti,ab.
45. p>.ti,ab.
46. p-value.ti,ab.
47. retrospective.ti,ab.
48. regression.ti,ab.
49. statistical.ti,ab.

Mega Filter: EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL)

1. Interviews+
2. MH audiorecording
3. MH Grounded theory
4. MH Qualitative Studies
5. MH Research, Nursing
6. MH Questionnaires+
7. MH Focus Groups (12639)
8. MH Discourse Analysis (1176)
9. MH Content Analysis (11245)
10. MH Ethnographic Research (2958)
11. MH Ethnological Research (1901)
12. MH Ethnonursing Research (123)
13. MH Constant Comparative Method (3633)
14. MH Qualitative Validity+ (850)
15. MH Purposive Sample (10730)
16. MH Observational Methods+ (10164)
17. MH Field Studies (1151)
18. MH theoretical sample (861)
19. MH Phenomenology (1561)
20. MH Phenomenological Research (5751)
21. MH Life Experiences+ (8637)
22. MH Cluster Sample+ (1418)
23. Ethnonursing (179)
24. ethnograph* (4630)
25. phenomenol* (8164)
26. grounded N1 theor* (6532)
27. grounded N1 study (601)
28. grounded N1 studies (22)
29. grounded N1 research (117)
30. grounded N1 analys?s (131)
31. life stor* (349)
32. women's stor* (90)
33. emic or etic or hermeneutic$ or heuristic$ or semiotic$ (2305)
34. data N1 saturat* (96)
35. participant observ* (3417)
36. social construct* or postmodern* or post-structural* or post structural* or poststructural* or post

modern* or post-modern* or feminis* or interpret* (25187)

37. action research or cooperative inquir* or co operative inquir* or co-operative inquir* (2381)
38. humanistic or existential or experiential or paradigm* (11017)
39. field N1 stud* (1269)
40. field N1 research (306)
41. human science (132)
42. biographical method (4)
43. theoretical sampl* (983)
44. purpos* N4 sampl* (11299)
45. focus N1 group* (13775)
46. account or accounts or unstructured or open-ended or open ended or text* or narrative* (37137)
47. life world or life-world or conversation analys?s or personal experience* or theoretical saturation (2042)
48. lived experience* (2170)
49. life experience* (6236)
50. cluster sampl* (1411)
51. theme* or thematic (25504)
52. observational method* (6607)
53. questionnaire* (126686)
54. content analysis (12252)
55. discourse* N3 analys?s (1341)
56. discurs* N3 analys?s (35)
57. constant N1 comparative (3904)
58. constant N1 comparison (366)
59. narrative analys?s (312)
60. Heidegger* (387)
61. Colaizzi* (387)
62. Spiegelberg* (0)
63. van N1 manen* (261)
64. van N1 kaam* (34)
65. merleau N1 ponty* (78)
66. husserl* (106)
67. Foucault* (253)
68. Corbin* N2 strauss* (50)
69. strauss* N2 corbin* (88)
70. glaser* (302)

NOT

71. TI statistical OR AB statistical
72. TI regression OR AB regression
73. TI retrospective OR AB retrospective
74. TI p-value OR AB p-value
75. TI p< OR AB p<
76. TI p< OR AB p<
77. TI p= OR AB p=

Mega Filter: Thomson Reuters Web of Knowledge, Social Science Citation Index

1. TS=interview*
2. TS=(theme*)
3. TS=(thematic analysis)
4. TS=qualitative
5. TS=nursing research methodology
6. TS=questionnaire
7. TS=(ethnograph*)
8. TS= (ethnonursing)
9. TS=(ethnological research)
10. TS=(phenomenol*)
11. TS=(grounded theor*) OR TS=(grounded stud*) OR TS=(grounded research) OR TS=(grounded analys?s)
12. TS=(life stor*) OR TS=(women's stor*)
13. TS=(emic) OR TS=(etic) OR TS=(hermeneutic) OR TS=(heuristic) OR TS=(semiotic) OR TS=(data saturat*) OR TS=(participant observ*)
14. TS=(social construct*) OR TS=(postmodern*) OR TS=(post structural*) OR TS=(feminis*) OR TS=(interpret*)
15. TS=(action research) OR TS=(co-operative inquir*)
16. TS=(humanistic) OR TS=(existential) OR TS=(experiential) OR TS=(paradigm*)
17. TS=(field stud*) OR TS=(field research)
18. TS=(human science)
19. TS=(biographical method*)
20. TS=(theoretical sampl*)
21. TS=(purposive sampl*)
22. TS=(open-ended account*) OR TS=(unstructured account) OR TS=(narrative*) OR TS=(text*)
23. TS=(life world) OR TS=(conversation analys?s) OR TS=(theoretical saturation)
24. TS=(lived experience*) OR TS=(life experience*)
25. TS=(cluster sampl*)
26. TS=observational method*
27. TS=(content analysis)
28. TS=(constant comparative)
29. TS=(discourse analys?s) or TS =(discurs* analys?s)
30. TS=(narrative analys?s)
31. TS=(heidegger*)
32. TS=(colaizzi*)
33. TS=(spiegelberg*)
34. TS=(van manen*)
35. TS=(van kaam*)
36. TS=(merleau ponty*)
37. TS=(husserl*)
38. TS=(foucault*)
39. TS=(corbin*)
40. TS=(strauss*)
41. TS=(glaser*)

NOT

42. TS=(p-value)
43. TS=(retrospective)
44. TS=(regression)
45. TS=(statistical)

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