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Medication Reconciliation at Discharge: A Rapid Review

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Conflict of Interest Statement

All authors in by the Evidence Development and Standards branch at Health Quality Ontario are impartial. There are no competing interests or conflicts of interest to declare.

Rapid Review Methodology

Rapid reviews are completed in 2–4-week time frames. Clinical questions are developed by the Evidence Development and Standards branch at Health Quality Ontario, in consultation with experts, end users, and/or applicants in the topic area. A systematic literature search is then conducted to identify relevant systematic reviews, health technology assessments, and meta-analyses. The methods prioritize systematic reviews, which, if found, are rated by AMSTAR to determine the methodological quality of the review. If the systematic review has evaluated the included primary studies using the GRADE Working Group criteria (http://www.gradeworkinggroup.org/index.htm), the results are reported and the rapid review process is complete. If the systematic review has not evaluated the primary studies using GRADE, the primary studies in the systematic review are retrieved and the GRADE criteria are applied to 2 outcomes. If no systematic review is found, then RCTs or observational studies are included, and their risk of bias is assessed. All rapid reviews are developed and finalized in consultation with experts.

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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. The Evidence Development and Standards branch works with expert advisory panels, clinical experts, scientific collaborators, and field evaluation partners to conduct evidence-based reviews that evaluate the effectiveness and cost-effectiveness of health interventions in Ontario.

Based on the evidence provided by Evidence Development and Standards and its partners, the Ontario Health Technology Advisory Committee—a standing advisory subcommittee of the Health Quality Ontario 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.

Health Quality Ontario's research is published as part of the *Ontario Health Technology Assessment Series,* which is indexed in MEDLINE/PubMed, Excerpta Medica/Embase, and the Centre for Reviews and Dissemination database. Corresponding Ontario Health Technology Advisory Committee recommendations and other associated reports are also published on the Health Quality Ontario website. Visit http://www.hqontario.ca for more information.

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To conduct its rapid reviews, Evidence Development and Standards and its research partners review the available scientific literature, making every effort to consider all relevant national and international research; collaborate with partners across relevant government branches; consult with expert advisory panels, clinical and other external experts, and developers of health technologies; and solicit any necessary supplemental information.

In addition, Evidence Development and Standards 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 may be included to assist in making timely and relevant decisions to optimize patient outcomes.

Disclaimer

This rapid review is the work of the Evidence Development and Standards branch at Health Quality Ontario, and is developed from analysis, interpretation, and comparison of published scientific research. It also incorporates, when available, Ontario data and information provided by experts. As this is a rapid review, it may not reflect all the available scientific research and is not intended as an exhaustive analysis. Health Quality Ontario assumes no responsibility for omissions or incomplete analysis resulting from its rapid reviews. In addition, it is possible that other relevant scientific findings may have been reported since completion of the review. This report is current as of the date of the literature search specified in the Research Methods section. Health Quality Ontario makes no representation that the literature search captured every publication that was or could be applicable to the subject matter of the report. This rapid review may be superseded by an updated publication on the same topic. Please check the Health Quality Ontario website for a list of all publications: http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations.

Table of Contents

List of Abbreviations

ADE	Adverse Drug Events
AMSTAR	Assessment of Multiple Systematic Reviews
BPMH	Best Possible Medication History
GRADE	Grading of Recommendations Assessment, Development, and Evaluation
PADE	Possible Adverse Drug Events
RCT	Randomized controlled trial

Background

As legislated in Ontario's *Excellent Care for All Act*, Health Quality Ontario's mandate includes the provision of objective, evidence-informed advice about health care funding mechanisms, incentives, and opportunities to improve quality and efficiency in the health care system. As part of its Quality-Based Procedures (QBP) initiative, Health Quality Ontario works with multidisciplinary expert panels (composed of leading clinicians, scientists, and administrators) to develop evidence-based practice recommendations and define episodes of care for selected disease areas or procedures. Health Quality Ontario's recommendations are intended to inform the Ministry of Health and Long-Term Care's Health System Funding Strategy.

For more information on Health Quality Ontario's Quality-Based Procedures initiative, visit www.hqontario.ca.

Objective of Analysis

The objective of this analysis is to determine the effectiveness of medication reconciliation on hospital readmission rates, emergency department visits, and clinically significant unintended drug discrepancies by comparing those patients who received medication reconciliation at predetermined care transition points to those who did not.

Clinical Need and Target Population

Medication errors are frequent, costly, and potentially harmful. (1) Up to 67% of patients have unintended medication discrepancies at hospital admission (2) and these discrepancies remain common at discharge. (3;4) Transitional care is a key focus of error reduction (5) as more than 40% of medication errors take place when patients move between different stages and settings of care. (6) Specifically, for those patients transitioning from hospital to home, medications discrepancies have been linked to increased re-hospitalization rates. (3)

Technology/Technique

Medication reconciliation involves a systematic and comprehensive review of all the medications a patient is taking to ensure that medications being added, changed or discontinued are carefully assessed and documented. It is intended to ensure accurate communication and documentation consistently across transitions of care. (7)

Medication reconciliation is a three-step process that should be uniform across care transition points:

1. Create an accurate Best Possible Medication History (BPMH) of the patient's medication (prescribed and non-prescribed), which includes documenting the name, dosage, route, and frequency using one or more sources of information (e.g., general practitioner medical records, patient's own supply, pharmacy records, patient/family interview);

2. Use the BPMH to create admission orders or compare medication history against admission, transfer, or discharge medication orders, and resolve any discrepancies;
3. Document and communicate to the patient, family/caregiver, and the next provider of care any changes in medication orders. (8;9)

Regulatory Status

Over 1,100 health care organizations participate in Accreditation Canada programs every year. Medication reconciliation was introduced into the Accreditation Canada program in 2005. (9;10) This program assesses and validates compliance that contributes to improving quality and safety, and mitigates risk through Required Organizational Practices (ROPs). ROPs are evidence-based practices. Two ROPs exist for medication reconciliation, these are*:* Medication Reconciliation at Admission and Medication Reconciliation at Transfer or Discharge. (9;10) These ROPs are detailed steps (explained above) that are to be followed when performing medication reconciliation.

For those organizations that participate in Accreditation Canada programs, at the service level, compliance rates for Medication Reconciliation at Admission improved from 47% in 2010 to 60% in 2011, and Medication Reconciliation at Transfer or Discharge improved from 36% in 2010 to 50% in 2011. (10)

Rapid Review

Research Question

What is the effectiveness of medication reconciliation at discharge compared to no medication reconciliation on patient outcomes?

Research Methods

Literature Search

Search Strategy

A literature search was performed on November 14, 2013, using Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid Embase, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), and EBM Reviews for studies published from January 1, 2008, to November 14, 2013. (Appendix 1 provides details of the search strategies.) 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 publications
- published between January 1, 2008, and November 14, 2013
- systematic reviews, meta-analyses, health technology assessments
- patients being discharged from acute hospital to home

Exclusion Criteria

- Patients being discharged from hospital to another facility (e.g., long-term-care home)
- Studies focusing on an electronic system for medication reconciliation
- Studies that did not include a control group

Outcomes of Interest

- 30-day hospital readmission
- Emergency department visits
- Clinically significant unintended medication discrepancies
    - This includes Adverse Drug Events (ADE) and Potential Adverse Drug Events (PADE)

Expert Panel

In December 2013, an Expert Advisory Panel on Post-Acute, Community-Based Care for CHF Patients was struck. Members of the community-based panels included family physicians, physician specialists, community health care administrators, and allied health professionals.

The role of the expert advisory panel was to provide advice on primary CHF patient groupings; to review the evidence, guidance, and publications related to defined CHF patient populations; to identify and prioritize interventions and areas of community-based care; and to advise on the development of a care pathway model. The role of panel members was to provide advice on the scope of the project, the methods used, and the findings. However, the statements, conclusions, and views expressed in this report do not necessarily represent the views of the expert panel members.

Quality of Evidence

The Assessment of Multiple Systematic Reviews (AMSTAR) measurement tool was used to assess the methodological quality of systematic reviews. (11)

The quality of the body of evidence for each outcome was examined according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) Working Group criteria. (12) The overall quality was determined to be high, moderate, low, or very low 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: the large magnitude of effect, the dose response gradient, and any residual confounding factors. (12) For more detailed information, please refer to the latest series of GRADE articles. (12)

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

High	High confidence in the effect estimate—the true effect lies close to the estimate of the effect.
Moderate	Moderate confidence in the effect estimate—the true effect is likely to be close to the estimate of the effect, but may be substantially different.
Low	Low confidence in the effect estimate—the true effect may be substantially different from the estimate of the effect.
Very Low	Very low confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect.

Results of Rapid Review

The database search yielded 109 citations published between January 1, 2008, and November 14, 2013, (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.

One systematic review met the inclusion criteria. The reference lists of the included studies and health technology assessment websites were hand-searched to identify other relevant studies, but none were found that met the inclusion criteria.

The systematic review by Kwan et al (13) examined medication reconciliation on discrepancies with the potential to harm ("clinically significant discrepancies") and hospital utilization after discharge, specifically emergency department visits and hospital readmission within 30 days of discharge. This systematic review scored highly on the AMSTAR scale with a score of 8 out of a possible 11. Some limitations included no assessment of publication bias, no list provided of excluded studies and not searching of grey literature. Three systematic reviews were also reviewed but not utilized for this review because they did not directly address the question for this review, added no extra articles that were not already included within the systematic review utilized and were not the most recent.

Table 1 provides the characteristics of the 5 RCTs and 2 observational studies that were extracted from Kwan et al (13) because they included medication reconciliation as an intervention and took place at discharge from acute care.

Table 1: Summary of Studies Examining Medication Reconciliation on Patient Outcomes

Author, Year	Setting (Country)	Population	Study Design (Sample Size)	Person performing Medication Reconciliation	Additional Interventions	Outcomes	Results[a]
Parry et al, 2009 (14)	Any unit (except for psychiatric) in 2 community-based hospitals (USA)	Patients 65 and older[b]	RCT (98) Intervention group (49) Control group (49)	Transitional coaches	Patient education, timely clinic follow-up, home visit, transition coach, patient-centered discharge instructions	30-day hospital readmission	Intervention patients had lower hospital readmission rates than control patients at 30 days (2.3% vs. 9.5%, *P* = 0.20)
Dedhia et al, 2009 (15)	Medical unit in academic medical centre, community teaching hospital and urban community hospital (USA)	Patients 65 and older[b]	Prospective before-and-after study (185)	Physician followed by a Pharmacist (for review)	Safe STEPS intervention, including admission assessment, communication with PCP, and multidisciplinary discharge meeting	30-day hospital readmission Emergency department visits within 30 days of discharge	The intervention period had a lower rate of hospital readmission (22% vs. 14%, OR, 0.59; 95% CI, 0.34–0.97) and fewer visits to the emergency department (21% vs. 14%, OR, 0.61; 95% CI, 0.36–1.03; *P* = 0.06) compared to the control period.
Jack et al, 2009 (16)	Medical unit in academic medical centre (USA)	Patients aged 18 and older	RCT (738) Intervention group (370) Control group (368)	Nurse discharge advocate	Post-hospitalization care plan and post-discharge telephone call	30-day hospital readmission Emergency department visits within	Intervention participants had a lower rate of readmission than usual care participants (IRR, 0.720; 95% CI, 0.445-1.164; *P* = 0.090) Intervention participants had a lower rate of emergency

Author, Year	Setting (Country)	Population	Study Design (Sample Size)	Person performing Medication Reconciliation	Additional Interventions	Outcomes	Results[a]
						30 days of discharge	department visits than did usual care participants (IRR=0.674; 95% CI, 0.476-0.955; *P* = 0.014) Intervention participants had a lower rate of hospital utilization than did usual care participants (IRR, 0.695; 95% CI, 0.515-0.937; *P* = 0.009)[c]
Koehler et al, 2009 (17)	Medical unit in academic medical centre (USA)	Patients age ≥70 years with ≥5 medications, ≥3 chronic comorbid conditions, with ≥1 requiring assistance with ADL[b]	RCT (41) Intervention group (20) Control group (21)	Pharmacist	Counselling by pharmacist, post-discharge telephone call, discharge letter to PCP	30-day hospital readmission Emergency department visits within 30 days of discharge	Intervention group readmission/ED visit rates were reduced at 30 days compared to the control group (10.0% vs. 38.1%, *P* = 0.04)
Schnipper et al, 2006 (18)	Medical unit in academic medical centre (USA)	Patients admitted to the medical unit	RCT (176) Intervention group (92) Control group (84)	Pharmacist	None	30-day hospital readmission ED visits within 30 days of discharge	The rate of preventable, medication-related ED visits or hospital readmissions was 1% in the intervention group and 8% in those assigned to usual care (*P* = 0.03)
						Clinically significant discrepancies (ADE, PADE)	PADEs had occurred in 1 patient in the intervention group and 8 in the usual-care group (1% vs. 11%; *P* = 0.01; unadjusted odds ratio, 0.10; 95% CI, 0.013-0.86) The groups did not differ significantly with respect to total ADEs (*P* > 0.99), total

Author, Year	Setting (Country)	Population	Study Design (Sample Size)	Person performing Medication Reconciliation	Additional Interventions	Outcomes	Results[a]
							health care utilization (*P* > 0.99)
Walker et al, 2009 (19)	Medical unit in academic centre (USA)	≥1 of the following: ≥5 medications, ≥1 targeted medications, medication requiring monitoring, ≥2 changes to regimen, dementia or confusion, or inability to manage medications[b]	Prospective quasi-experimental study (358)	Pharmacist or pharmacy resident	None	30-day hospital readmission ED visits within 30 days of discharge Clinically significant discrepancies (PADE)	Readmission rates did not differ significantly between groups at 30 days (22.1% vs. 18%; *P* = 0.17), nor did ED visits (2.8% vs. 2.2%; *P* = 0.60) Medication discrepancies at discharge were identified in 33.5% of intervention patients and in 59.6% of control patients (*P* < 0.001)
Kripalani et al, 2012 (20)	Medical and Cardiology units in 2 academic medical centres (USA)	Patients admitted into the medical and cardiology units	RCT (851) Intervention group (423) Control group (428)	Pharmacist	Inpatient pharmacist counselling, low-literacy adherence aids, post-discharge telephone calls	Clinically significant discrepancies (PADE)	The mean number of PADE was similar in the intervention and usual care groups (0.87 vs. 0.95 per patient). Although the treatment effect favored the intervention, this difference was not statistically significant (unadjusted IRR, 0.92; 95% CI, 0.77-1.10)

Abbreviations: ADL, activities of daily life; ED, emergency department; RCT, randomized controlled trial; STEPS, Safe and Successful Transition of Elderly Patients; ADE, adverse drug event; CI, confidence interval; IRR, incidence rate ratio; OR, odds ratio; PADE, potential adverse drug events; PCP, primary care physician.
[a]Green font, statistically significant results; blue font, a trend towards significant results; red font, no statistically significant results.
[b]Defined as high-risk patients.
[c]Defined as the sum of emergency department visits plus rehospitalizations. An emergency department visit that leads to a rehospitalization is counted only as a rehospitalization.

It is difficult to isolate factors that contribute to a successful discharge plan. However, there are some common factors that may contribute to a successful intervention. First, most (5 of 7) of the interventions studied relied heavily on pharmacists, with 4 studies finding lower readmission, emergency, or medication discrepancies rates. Second, some studies (4 of 7) included what they defined as a high-risk sample, with 3 finding lower readmission, emergency, or medication discrepancies rates.

Limitations

Some limitations arise when drawing conclusions about medication reconciliation as an intervention. Five of the 7 individual studies bundled medication reconciliation with other interventions aimed at improving care coordination at hospital discharge, but the specific effect of medication reconciliation within a multifaceted approach may not be apparent.

Conclusions

Based on low to moderate quality evidence, results of medication reconciliation on patient outcomes are mixed. Three individual studies (2 RCTs and 1 observational) found no difference in hospital readmission rates within 30 days of discharge between intervention and control groups. However, 3 studies (2 RCTs and 1 observational) found a statistically significant reduction in hospital readmission rates within 30 days in the intervention group compared to the control group. Two observational studies found no difference in emergency department visits within 30 days of discharge between the intervention and control group, and 3 RCT studies found a statistically significant reduction in emergency department visits within 30 days of discharge between the intervention and control groups. Two RCT studies found clinically significant difference in medication discrepancies (PADE or ADE) between intervention and control groups. On the other hand, 2 studies (1 RCT and 1 observational) found a statistically significant reduction in medication discrepancies (PADE or ADE) between the intervention and control groups.

It is not possible to make conclusions about the effect of medication reconciliation on patient outcomes as there is limited evidence on medication reconciliation in isolation of other care coordination interventions.

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Health Quality Ontario's Expert Advisory Panel on Post-Acute, Community-Based Care for CHF Patients

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Sherry Grace	York University University Health Network	Associate Professor
Kory Kingsbury	Cardiac Care Network	Chief Executive Officer

Appendices

Appendix 1: Literature Search Strategies

Search date: November 14, 2013
Databases searched: OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, All EBM Databases (see below)

Q: What is the effectiveness of medication reconciliation at transitions of care (i.e., discharge from hospital) compared to no medication reconciliation on hospital readmission and adverse drug events?
Limits: January 1, 2008, to November 14, 2013
Filters: Meta-analyses, systematic reviews, health technology assessments

Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to October 2013>, EBM Reviews - ACP Journal Club <1991 to November 2013>, EBM Reviews - Database of Abstracts of Reviews of Effects <4th Quarter 2013>, EBM Reviews - Cochrane Central Register of Controlled Trials <October 2013>, EBM Reviews - Cochrane Methodology Register <3rd Quarter 2012>, EBM Reviews - Health Technology Assessment <4th Quarter 2013>, EBM Reviews - NHS Economic Evaluation Database <4th Quarter 2013>, Ovid MEDLINE(R) <1946 to November Week 3 2013>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <November 27, 2013>.

Search Strategy:

#	Searches	Results
1	exp Patient Discharge/	19905
2	exp Aftercare/ or exp Convalescence/	10298
3	"Continuity of Patient Care"/ or exp "Recovery of Function"/	49399
4	((patient* adj2 discharge*) or after?care or post medical discharge* or post?discharge* or convalescen*).ti,ab.	37828
5	or/1-4	107305
6	exp Stroke/	89117
7	exp brain ischemia/ or exp intracranial hemorrhages/	132313
8	(stroke or poststroke or tia or transient ischemic attack or ((cerebral vascular or cerebrovascular) adj (accident* or infarct*)) or CVA or cerebrovascular apoplexy or brain infarct* or (brain adj2 isch?emia) or (cerebral adj2 isch?emia) or (intracranial adj2 h?emorrhag*) or (brain adj2 h?emorrhag*)).ti,ab.	199794
9	or/6-8	287112
10	exp Heart Failure/	93122
11	(((cardia? or heart) adj (decompensation or failure or incompetence or insufficiency)) or cardiac stand still or ((coronary or myocardial) adj (failure or insufficiency))).ti,ab.	135687
12	or/10-11	162171
13	exp Pulmonary Disease, Chronic Obstructive/	26665
14	exp Emphysema/	11098
15	(copd or coad or chronic airflow obstruction* or (chronic adj2 bronchitis) or emphysema).ti,ab.	59959
16	(chronic obstructive adj2 (lung* or pulmonary or airway* or airflow* or respiratory or bronchopulmonary) adj (disease* or disorder*)).ti,ab.	37701
17	or/13-16	84745
18	exp Pneumonia/	78260

19	(pneumoni* or peripneumoni* or pleuropneumoni* or lobitis or ((pulmon* or lung*) adj inflammation*)).ti,ab.	147195
20	or/18-19	174702
21	or/5,9,12,17,20	778857
22	exp Medication Reconciliation/	282
23	exp Medication Errors/	11392
24	exp "Drug Utilization Review"/	3231
25	exp Drug Monitoring/	15716
26	exp Pharmaceutical Services/	51222
27	(((medication* or medicine* or drug or drugs or pharmacist* or pharmacy or pharmacies or formulary or formularies or prescription* or prescrib*) adj3 (reconcil* or review* or discrepanc* or discontinuit* or assess* or audit*)) or (med* reconcil* or medrec* or med rec or stopp criteria* or beer's criteria)).ti,ab.	31691
28	or/22-27	103340
29	21 and 28	4660
30	Meta Analysis.pt.	52731
31	Meta-Analysis/ use mesz or exp Technology Assessment, Biomedical/ use mesz	61456
32	(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.	210621
33	(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.	210621
34	or/30-33	226141
35	29 and 34	230
36	limit 35 to (english language and yr="2008 -Current") [Limit not valid in CDSR,ACP Journal Club,DARE,CCTR,CLCMR; records were retained]	129
37	remove duplicates from 36	109

Appendix 2: Evidence Quality Assessment

Table A1: AMSTAR Scores of Included Systematic Reviews

Author, Year	AMSTAR Score[a]	(1) Provided Study Design	(2) Duplicate Study Selection	(3) Broad Literature Search	(4) Considered Status of Publication	(5) Listed Excluded Studies	(6) Provided Characteristics of Studies	(7) Assessed Scientific Quality	(8) Considered Quality in Report	(9) Methods to Combine Appropriate	(10) Assessed Publication Bias	(11) Stated Conflict of Interest
Kwan et al, 2013 (13)	8	✓	✓	✓[b]	✗	✗	✓	✓	✓	✓[c]	✗	✓

Abbreviation: AMSTAR, Assessment of Multiple Systematic Reviews.

[a]Maximum possible score is 11. Details of AMSTAR score are described in Shea et al. (11)

[b]This information is provided in Kwan et al. *Supplement: Medication Reconciliation During Transitions of Care as a Patient Safety Strategy*. http://annals.org/article.aspx?articleid=1656444&resultClick=3.

[c]The article explicitly states that the populations included in the review are heterogeneous populations and only meta-analysis was performed on three similar RCTs.

Table A2: GRADE Evidence Profile for Comparison of Medication Reconciliation on Patient Outcomes in Randomized Controlled Trials

Number of Studies (Design)	Risk of Bias[a]	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
30-day hospital readmission							
4 (RCTs)	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
30-day emergency visit							
3 (RCTs)	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	No serious limitations	Undetected	None	⊕⊕⊕ Moderate
Clinically significant unintended discrepancies							
2 (RCTs)	No serious limitations	Serious limitations (–1)[b]	Serious limitations (–1)[c]	No serious limitations	Undetected	None	⊕⊕⊕ Moderate

Abbreviations: GRADE, Grading of Recommendations Assessment, Development, and Evaluation; RCT, randomized controlled trial.

[a] See table A4 for risk of bias details.

[b] Heterogeneity unexplained by the differing disease severity of populations.

[c] Medication Reconciliation was tested with multiple other interventions in most studies, so it is impossible to isolate this intervention.

Table A3: GRADE Evidence Profile for Comparison of Medication Reconciliation on Patient Outcomes in Observational Studies

Number of Studies (Design)	Risk of Bias[a]	Inconsistency	Indirectness	Imprecision	Publication Bias	Upgrade Considerations	Quality
30-day hospital readmission							
2 (observational)	No serious limitations	No serious limitations	Serious limitations (–1)[b]	No serious limitations	Undetected	None	⊕⊕ Low
30-day emergency visit							
2 (observational)	No serious limitations	No serious limitations	Serious limitations (–1)[b]	No serious limitations	Undetected	None	⊕⊕ Low
Clinically significant unintended discrepancies							
1 (observational)	No serious limitations	No serious limitations	No serious limitations	No serious limitations	Undetected	None	⊕⊕ Low

[a] See Table A5 for risk of bias details.
[b] Medication Reconciliation was tested with multiple other interventions in most studies, so it is impossible to isolate this intervention.

Table A4: Risk of Bias Among Randomized Controlled Trials for the Comparison of Medication Reconciliation on Patient Outcomes

Author, Year	Allocation Concealment	Blinding	Complete Accounting of Patients and Outcome Events	Selective Reporting Bias	Other Limitations
Parry et al, 2009 (14)	No limitations	Limitations[a]	No limitations	No limitations	No limitations
Jack et al, 2009 (16)	No limitations	No limitations	No limitations	No limitations	No limitations
Koehler et al, 2009 (17)	No limitations	No limitations	No limitations	No limitations	No limitations
Schnipper et al, 2006 (18)	No limitations	Limitations[b]	No limitations	No limitations	No limitations
Kripalani et al, 2012 (20)	No limitations	Limitations[c]	No limitations	No limitations	No limitations

[a]The participants were not blinded to whether they were in the intervention or control group.
[b]Patients and pharmacists were not blinded to what group (intervention or control) participants were assigned to.
[c]One unblinded research coordinator from each site administered the randomization.

Table A5: Risk of Bias Among Observational Trials for the Comparison of Medication Reconciliation on Patient Outcomes

Author, Year	Appropriate Eligibility Criteria	Appropriate Measurement of Exposure	Appropriate Measurement of Outcome	Adequate Control for Confounding	Complete Follow-Up
Dedhia et al, 2009 (15)	No limitations	No limitations	No limitations	Limitations[a]	No limitations
Walker et al, 2009 (19)	No limitations	No limitations	No limitations	No limitations	No limitations

[a] No statement of the variables controlled for in the analysis.

References

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