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Application of the Ontario Diabetes Economic Model (ODEM) to Determine the Cost-effectiveness and Budget Impact of Selected Type 2 Diabetes Interventions in Ontario

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About the Medical Advisory Secretariat

The Medical Advisory Secretariat is part of the Ontario Ministry of Health and Long-Term Care. The mandate of the Medical Advisory Secretariat is to provide evidence-based policy advice on the coordinated uptake of health services and new health technologies in Ontario to the Ministry of Health and Long-Term Care and to the healthcare system. The aim is to ensure that residents of Ontario have access to the best available new health technologies that will improve patient outcomes.

The Medical Advisory Secretariat also provides a secretariat function and evidence-based health technology policy analysis for review by the Ontario Health Technology Advisory Committee (OHTAC).

The Medical Advisory Secretariat conducts systematic reviews of scientific evidence and consultations with experts in the health care services community to produce the *Ontario Health Technology Assessment Series*.

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To conduct its comprehensive analyses, the Medical Advisory Secretariat systematically reviews available scientific literature, collaborates with partners across relevant government branches, and consults with clinical and other external experts and manufacturers, and solicits any necessary advice to gather information. The Medical Advisory Secretariat makes every effort to ensure that all relevant research, nationally and internationally, is included in the systematic literature reviews conducted.

The information gathered is the foundation of the evidence to determine if a technology is effective and safe for use in a particular clinical population or setting. Information is collected to understand how a new technology fits within current practice and treatment alternatives. Details of the technology's diffusion into current practice and input from practising medical experts and industry add important information to the review of the provision and delivery of the health technology in Ontario. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social and legal issues relating to the technology assist policy makers to make timely and relevant decisions to optimize patient outcomes.

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Background

In June 2008, the Medical Advisory Secretariat began work on the Diabetes Strategy Evidence Project, an evidence-based review of the literature surrounding strategies for successful management and treatment of diabetes. This project came about when the Health System Strategy Division at the Ministry of Health and Long-Term Care subsequently asked the secretariat to provide an evidentiary platform for the Ministry's newly released Diabetes Strategy.

After an initial review of the strategy and consultation with experts, the secretariat identified five key areas in which evidence was needed. Evidence-based analyses have been prepared for each of these five areas: insulin pumps, behavioural interventions, bariatric surgery, home telemonitoring, and community based care. For each area, an economic analysis was completed where appropriate and is described in a separate report.

To review these titles within the Diabetes Strategy Evidence series, please visit the Medical Advisory Secretariat Web site, http://www.health.gov.on.ca/english/providers/program/mas/mas_about.html,

1. Diabetes Strategy Evidence Platform: Summary of Evidence-Based Analyses
2. Continuous Subcutaneous Insulin Infusion Pumps for Type 1 and Type 2 Adult Diabetics: An Evidence-Based Analysis
3. Behavioural Interventions for Type 2 Diabetes: An Evidence-Based Analysis
4. Bariatric Surgery for People with Diabetes and Morbid Obesity: An Evidence-Based Summary
5. Community-Based Care for the Management of Type 2 Diabetes: An Evidence-Based Analysis
6. Home Telemonitoring for Type 2 Diabetes: An Evidence-Based Analysis
7. Application of the Ontario Diabetes Economic Model (ODEM) to Determine the Cost-effectiveness and Budget Impact of Selected Type 2 Diabetes Interventions in Ontario

Purpose

The Programs for Assessment of Technology in Health (PATH) was commissioned by the Medical Advisory Secretariat (MAS) to predict the long-term costs and effects of strategies for successful management and treatment of type 2 diabetes, as well as their cost-effectiveness. This report summarizes the economic analyses of the following strategies: multi-disciplinary diabetes programs, continuous subcutaneous insulin infusion (CSII) pumps, behavioural interventions, and bariatric surgery. This economic analysis was conducted by PATH for the Secretariat of the Ontario Ministry of Health.

An assessment of type 2 diabetes interventions requires an evaluation of both short- and long-term costs and effectiveness. Early management of diabetes can help delay and even prevent complications that can have large impacts on patients' quality of life and healthcare costs. Reductions in future complications may also offset 'up-front' medical resources invested in intensive disease management.

The objective of this economic analysis was to compare the lifetime costs, effects, and cost-effectiveness of the following treatments for type II diabetes using the Ontario Diabetes Economic Model (ODEM):

1) Primary care multidisciplinary diabetes program versus no program in adults with type 2 diabetes.

2) CSII pumps versus multiple daily injection (MDI) of insulin in insulin-dependent adults with type 2 diabetes
3) Behavioural interventions versus no intervention in adults with type 2 diabetes
4) Bariatric surgery versus no surgery in morbidly obese adults with type 2 diabetes

Clinical Need: Target Population and Condition

Diabetes (i.e. diabetes mellitus) is a highly prevalent chronic metabolic disorder that interferes with the body's ability to produce or effectively use insulin. The majority (90%) of diabetes patients have type 2 diabetes. (1) Based on the United Kingdom Prospective Diabetes Study (UKPDS), intensive blood glucose and blood pressure control significantly reduce the risk of microvascular and macrovascular complications in type 2 diabetics. While many studies have documented that patients often do not meet the glycemic control targets specified by national and international guidelines, factors associated with glycemic control are less well studied, one of which is the provider(s) of care.

Multidisciplinary approaches to care may be particularly important for diabetes management. According guidelines from the Canadian Diabetes Association (CDA), the diabetes health care team should be multi- and interdisciplinary. Presently in Ontario, the core diabetes health care team consists of at least a family physician and/or diabetes specialist, and diabetes educators (registered nurse and registered dietician). Increasing the role played by allied health care professionals in diabetes care and their collaboration with physicians may represent a more cost-effective option for diabetes management. Several systematic reviews and meta-analyses have examined multidisciplinary care programs, but these have either been limited to a specific component of multidisciplinary care (e.g. intensified education programs), or were conducted as part of a broader disease management program, of which not all were multidisciplinary in nature. Most reviews also do not clearly define the intervention(s) of interest, making the evaluation of such multidisciplinary community programs challenging.

Methods

DISCLAIMER: The Medical Advisory Secretariat uses a standardized costing method for its economic analyses of interventions. The main cost categories and the associated methods from the province's perspective are as follows:

Hospital: Ontario Case Costing Initiative cost data are used for in-hospital stay, emergency visit and day procedure costs for the designated International Classification of Diseases (ICD) diagnosis codes and Canadian Classification of Health Interventions procedure codes. Adjustments may be required to reflect accuracy in estimated costs of the diagnoses and procedures under consideration. Due to the difficulties of estimating indirect costs in hospitals associated with a particular diagnosis or procedure, the secretariat normally defaults to considering direct treatment costs only.

Nonhospital: These include physician services costs obtained from the Ontario Schedule of Benefits, laboratory fees from the Ontario Schedule of Laboratory Fees, drug costs from the Ontario Drug Benefit Formulary, and device costs from the perspective of local health care institutions whenever possible or its manufacturer.

Discounting: For cost-effectiveness analyses, a discount rate of 5% is applied as recommended by economic guidelines.

Downstream costs: All numbers reported are based on assumptions on population trends (i.e. incidence, prevalence and mortality rates), time horizon, resource utilization, patient compliance, healthcare patterns, market trends (i.e. rates of intervention uptake or trends in current programs in place in the Province), and estimates on funding and prices. These may or may not be realized by the system or individual institutions and are often based on evidence from the medical literature, standard listing references and educated hypotheses from expert panels. In cases where a deviation from this standard is used, an explanation is offered as to the reasons, the assumptions, and the revised approach. The economic analysis represents ***an estimate only***, based on the assumptions and costing methods that have been explicitly stated above. These estimates will change if different assumptions and costing methods are applied to the analysis.

Research Questions

1. Are the selected study interventions cost-effective in improving glycemic control in adults with type 2 diabetes?
2. What are the lifetime costs, effects, health events, and cost-effectiveness of these interventions in adults with type 2 diabetes?

Ontario Diabetes Economic Model

The recently developed UKPDS Outcomes Model is a computer simulation that uses a system of equations to predict the occurrence and timing of seven diabetes-related complications (i.e. fatal or non-fatal MI (myocardial infarction), other ischaemic heart disease, stroke, heart failure, amputation, renal failure and blindness) and death, to calculate life expectancy and quality-adjusted life expectancy for patients with Type 2 diabetes. To account for event-related dependencies, the model makes use of time-varying risk factors (e.g. blood pressure and HbA1c), which also facilitates its application to patient groups at different stages of the disease. The UKPDS Outcomes Model is based on data from over 5,000

patients with over 53,000 years of patient follow-up. To apply the model to other geographic areas (such as Ontario), however, it requires needs adaptation. Specifically, international differences may exist in: the incidence and prevalence of diabetes, baseline demographics, diabetes risk factors, overall mortality or mortality from diabetes-related complications, costs (e.g. treatment and management of complications), and the cost and effects of treatment programs. Accordingly, the UKPDS Outcomes Model was populated with Ontario-specific data for use in the province.

In brief, more than 734,000 patients with diabetes were identified in the Ontario Diabetes Database (ODD) and followed for up to 10 years. Various administrative databases were linked to this population in order to measure the prevalence and incidence of complications, healthcare resource utilization (i.e. inpatient and outpatient hospitalizations, outpatient visits, prescription drugs, emergency room visits, and home care), and death. Unit costs were collected and assigned to each of the different health care sectors. Complication-specific costs were divided into two time periods:

1) Immediate costs that accrue within the year in which a complication first occurs; and
2) Long-term costs that reflect ongoing costs in subsequent years associated with the management of the complication (including subsequent events of the same type).

Hospital inpatient and non-inpatient event and state costs were estimated for each of the seven complications. The perspective taken for estimating costs was that of the Ontario Ministry of Health and Long-term Care. All healthcare costs used in the model were based on direct costs as it was not possible to measure productivity costs or other patient costs from the data available. The ODEM was then used to conduct the cost-effectiveness analyses.

Results of Cost-Effectiveness Analysis

1. Multi-Disciplinary Diabetes Programs

Objective

The objective was to compare the lifetime costs, effects and cost-effectiveness of the following:

- Usual care (before program)
- Primary care multi-disciplinary management program: 1 year program, FTE diabetes liaison nurse, access to dietician (if needed), workshop with key opinion leaders in Ontario, workshop with physicians and nurses from GHC, patient education through newsletters, brochures, education day, electronic medical records (EMR), diabetes tracker program, audit and feedback

The patient cohort was all patients with diabetes from the Sault Ste Marie Group Health Centre (n = 401). The study characteristics have been described elsewhere.(10)

Upfront Costs

The total program costs were estimated at $240,000.(10) On a per patient basis (n = 401), the cost was $664 with diabetes-related medication costs averaging $230/patient and program costs averaging $434/patient. Costs were assumed to last one year.

Effectiveness

Table 1 describes the effectiveness of the Sault Ste Marie primary care multi-disciplinary management program in adults with type 2 diabetes. For further description of the effectiveness analysis, refer to the O'Reilly et al. 2007 publication in the Canadian Journal of Diabetes (MAS did not conduct the systematic review on multi-disciplinary diabetes programs). The effect of a current model of care for diabetes management in Sault Ste Marie Health Centre was measured by PATH and this effect was analyzed through ODEM. The study specifics have been described elsewhere.(10) Effects were assumed to last for a period of one year.

Table 1. Effectiveness of Sault Ste Marie multi-disciplinary diabetes management program in adults with type 2 diabetes.

Time-varying Risk Factor	Before (SE)	After (SE)	Change (95% CI)	P-value
HbA1c	8.14% (0.10)	7.12% (0.07)	-1.02% (-1.25; -0.79)	<0.001*
Systolic BP (mmHg)	138.68 (0.98)	137.36 (0.95)	-1.32 (-3.42; 0.78)	0.219
Total cholesterol	5.43 (0.06)	4.97 (0.05)	-0.47 (-0.58; -0.35)	<0.001*
HDL cholesterol	1.14 (0.02)	1.20 (0.02)	0.06 (0.03; 0.09)	<0.001*
Smoking status = yes	19.4% (2.6)	13.8% (1.8)	-5.6% (-11.6; 0.01)	0.070

Results

Table 2 describes the basecase results of the Sault Ste Marie primary care multi-disciplinary diabetes management program in adults with type 2 diabetes. Table 3 describes the complications avoided with the Sault Ste Marie multi-disciplinary diabetes management program in adults with type 2 diabetes.

Table 2. Basecase results of the Sault Ste Marie multi-disciplinary diabetes management program in adults with type 2 diabetes.

	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$7,742	$45,882	$53,624	8.632	11.321
Pre- Program	$0	$46,074	$46,074	8.243	10.898
Incremental	$7,742	($192)	$7,551	0.390	0.423
ICUR/ICER				$19,869	$17,857

Table 3. Complications avoided with Sault Ste Marie multi-disciplinary diabetes management program in adults with type 2 diabetes.

Complication	Events Avoided per 1,000 population
Ischemic Heart Disease	20.5
Myocardial Infarction	54.9
Heart Failure	11.5
Stroke	18.9
Amputation	17.7
Blindness	8.3
Renal Failure	1.1

2. CSII Pumps

Objective

The objective was to compare the lifetime costs, effects and cost-effectiveness of the following:

- Usual care (MDI): First year treatment education, annual blood glucose test strip supplies, annual insulin supplies
- CSII pumps: Pump (replaced every 8 years), first year treatment education, annual pump supplies, annual insulin supplies

The patient cohort baseline characteristics were assumed to be the same as the Sault Ste Marie Group Health Centre:

- All patients: n = 401
- Aged 65+ only: n = 177

Upfront Costs

The upfront costs associated with MDI are described in Table 4 and Table 5 describes the upfront costs associated with CSII pumps. Most costs were incurred annually throughout the lifetime of the model and obtained from the Ministry of Health and Long Term Care Diabetes Strategy (3) and from personal communication with a clinical nurse specialist at a major Toronto hospital. Insulin dosage was obtained from the literature (11;12) and costed using the Ontario Drugs Benefit Formulary. (13)

Table 4. Upfront costs of MDI

		Costs	
Category	**Frequency**	**All Patients**	**Aged ≥65**
Treatment Education	first year	$245	$245
Insulin	annually	$5061	$1,205
Blood Glucose Test Strips	annually	$1531	$365
Lancets	annually	$151	$37

Assumed 42%(14) (Statistics Canada) diabetic patients are 65 or older and therefore reimbursed by the Ontario Ministry of Health.

Table 5. Upfront costs of CSII pumps.

Category	Frequency	Cost
CSII Pump	every 8 years	$6,300
Treatment Education	first year	$394
Pump Supplies (strips, batteries, etc)	annually	$2,400
Insulin	annually	$1,364

Effectiveness

The effectiveness of MDI and CSII pumps in insulin dependent adults with type 2 diabetes are described in the Table 6. For further description of the effectiveness analysis refer to the MAS systematic review on CSII pumps. Effects were assumed to be sustained over the lifetime period of the model.

Table 6. Effectiveness of MDI and CSII pumps in adults with type 2 diabetes.

	Baseline HbA_{1c}	Change in HbA_{1c}	HbA_{1c} on treatment
CSII	8.10%	-0.98%	7.12%
MDI	8.10%	-0.84%	7.26%
CSII – MDI		-0.14%	

Results

Table 7 describes the basecase results of CSII pumps in adults with type 2 diabetes. Table 8 describes the results of CSII pumps in 65+ adults with type 2 diabetes. Table 9 describes the complications avoided with CSII pumps in adults with type 2 diabetes.

Table 7. Basecase results of CSII pumps in adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$46,501	$30,114	$76,615	6.648	8.771
Pre- Program	$6,579	$30,198	$36,776	6.627	8.749
Incremental	$39,923	($84)	$39,840	0.021	0.022
ICUR/ICER				$1,880,271	$1,787,507

Table 8. Results of CSII pumps in 65+ adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$30,638	$22,827	$53,436	3.940	5.258
Pre- Program	$9,604	$22,916	$32,520	3.923	5.240
Incremental	$21,055	($89)	$20,916	0.017	0.018
ICUR/ICER				$1,255,830	$1,174,752

Table 9. Complications avoided with CSII pumps in adults with type 2 diabetes.

	1st Events Avoided per 1,000 population	
Complication	All	Aged ≥65
Ischemic Heart Disease	1.0	0.9
Myocardial Infarction	2.8	3.1
Heart Failure	2.3	2.4
Stroke	1.8	2.3
Amputation	1.0	0.6
Blindness	1.4	1.6
Renal Failure	(0.04)	0.1

3. Behavioural Interventions

Objective

The objective was to compare the lifetime costs, effects and cost-effectiveness of the following:

- Usual care (no behavioural intervention)
- Behavioural interventions - various interventions aimed at promoting the development of self-care skills or outcomes in the patient

The patient cohort baseline characteristics were assumed to be the same as the Sault Ste Marie Group Health Centre.

Upfront Costs

The upfront costs were obtained from the literature and are described in Table 10. Costs were assumed to last for the duration of the intervention, either 6 weeks for the pooled intervention or over 12 months for the long-term intervention and those studies with baseline HbA_{1c} >9.0.

Table 10. Upfront cost of behavioural interventions.

Program	Cost
6 weeks, 2.5 hrs/week - Pooled intervention cost	$302.45 (15)
52 hours over 12 months - Long intervention cost - HbA1c >= 9.0 sub-group cost	$464.56(16)

Effectiveness

The effectiveness of behavioural interventions in adults with type 2 diabetes is described in Table 11. For a more detailed description of the effectiveness analysis refer to the MAS systematic review on behavioural interventions. Effects were assumed to last one year.

Table 11. Effectiveness of behavioural interventions in adults with type 2 diabetes.

Complication	Change in HbA_{1c}
All programs (pooled)	20.5
Intervention length ≥1 year	54.9
Baseline HbA_{1c} ≥9.0	11.5

Results

Tables 12 and 13 describe the basecase and 1-year results, respectively, of behavioural interventions in adults with type 2 diabetes. Table 14 describes the baseline $HbA_{1c} \geq 9.0$ results of behavioural interventions in adults with type 2 diabetes. Table 15 describes the complications avoided with behavioural interventions in adults with type 2 diabetes.

Table 12. Basecase results of behavioural interventions in adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$302	$30,996	$31,299	6.488	8.609
Pre- Program	$0	$31,013	$31,013	6.480	8.601
Incremental	$302	($17)	$285	0.008	0.008
ICUR/ICER				$36,226	$36,054

Table 13. One-year follow-up results of behavioural interventions in adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$465	$30,979	$31,444	6.494	8.617
Pre- Program	$0	$31,013	$31,013	6.480	8.601
Incremental	$465	($34)	$351	0.015	0.016
ICUR/ICER				$29,177	$27,561

Table 14. Baseline HbA_{1c} ≥ 9.0 results of behavioural interventions in adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$465	$33,092	$33,557	5.541	7.454
Pre- Program	$0	$33,174	$33,174	5.520	7.412
Incremental	$465	($82)	$383	0.021	0.043
ICUR/ICER				$18,911	$18,308

Table 15. Complications avoided with behavioural interventions in adults with type 2 diabetes.

	Events Avoided per 1,000 population		
Complication	Pooled	1-Year	HbA_{1c} ≥9.0
Ischemic Heart Disease	0.6	0.5	1.1
Myocardial Infarction	0.7	1.3	2.3
Heart Failure	0.8	1.1	2.2
Stroke	0.5	0.6	1.8
Amputation	0.5	0.6	0.9
Blindness	0.7	1.0	1.6
Renal Failure	0.1	0.2	(0.1)

4. Bariatric Surgery

Objective

The objective was to compare the lifetime costs, effects and cost-effectiveness of the following:

- Usual care (no surgery)
- Bariatric surgery (surgery plus follow-up care)

The patient cohort baseline characteristics were obtained from the literature and are described in Table 16. (17)

Table 16. Baseline risk factors for morbidly obese population.

Time-Varying Risk Factor	Female	Male
HbA_{1c} %	8.3	8.5
Total Cholesterol (mmol/L)	5.3	4.7
HDL (mmol/L)	1.3	1.1
Systolic Blood Pressure (mmHg)	148	148
BMI (kg/m^2)	40	40

Upfront Cost

The resources associated with bariatric surgery were obtained from personal communication with the Ministry of Health and Long-Term Care (October 2008). The average cost of bariatric surgery was calculated to be $13,646. This included pre and post surgery consults with dietician, social worker and psychologist costed from the Ministry of Health and Long-Term Care website, hospitalization stay costed from Ontario Case Costing Initiative website (18) and professional fees costed from the Ontario Schedule of Benefits. (19) They were assumed to be a one time cost.

Effectiveness

The effectiveness of bariatric surgery in morbidly obese adults with type 2 diabetes is described in Table 17. For further details of the effectiveness analysis refer to the MAS systematic review on bariatric surgery. The drop in HbA_{1c} was assumed to be sustained over the lifetime period of the model.

Table 17. Effectiveness of bariatric surgery in morbidly obese adults with type 2 diabetes.

Time-Varying Risk Factor	Change
HbA_{1c} %	-2.70
Total Cholesterol (mmol/L)	-0.49
HDL (mmol/L)	-0.01
Systolic Blood Pressure (mmHg)	-13.94
BMI (kg/m^2)	-2.70

Results

Table 18 describes the basecase results of bariatric surgery in morbidly obese adults with type 2 diabetes, while Table 19 details the complications avoid by these patients through the use of the surgery.

Table 18. Basecase results of bariatric surgery in morbidly obese adults with type 2 diabetes.

All Patients	Program Costs	Diabetes & Complication Costs	Total Costs	QALYs	LYs
Program	$13,646	$28,714	$42,360	7.092	9.248
Pre- Program	$0	$33,172	$33,172	6.506	8.670
Incremental	$13,646	($4,448)	$9,188	0.585	0.585
ICUR/ICER				$15,697	$15,894

Table 19. Complications avoided with bariatric surgery in morbidly obese adults with type 2 diabetes.

Complication	Events Avoided per 1,000 population
Ischemic Heart Disease	16.1
Myocardial Infarction	80.8
Heart Failure	181.8
Stroke	52.3
Amputation	17.5
Blindness	24.4
Renal Failure	0.1

Summary of Diabetes Programs Based on ODEM

Table 20 summarizes the various diabetes treatment and management programs based on the ODEM analysis over a 40 year time horizon. Table 21 describes the population and health system impact based on the ODEM analysis in a 40 year time horizon and the various assumptions to calculate the eligible population for each intervention.

Table 20. Summary of diabetes programs based on ODEM.

Incremental Costs, QALYS, CE and Events per 1,000	Multi-disciplinary Diabetes Program	Insulin Pumps	Behavioural Interventions	Bariatric Surgery
Δ HbA_{1c}	-1.02%	-0.14%	-0.44%	-2.70%
Δ Costs	$7,551	$39,840	$285	$9,188
Δ QALYs	0.390	0.021	0.008	0.585
$/QALY gained	$19,869/QALY	$1.9M/QALY	$36,226/QALY	$15,697/QALY
Δ IHD	20.5	1.0	0.6	16.1
Δ MI	54.9	2.8	0.7	80.8
Δ Heart Failure	11.5	2.3	0.8	181.8
Δ Stroke	18.9	1.8	0.5	52.3
Δ Amputation	17.7	1.0	0.5	17.5
Δ Blindness	8.3	1.4	0.7	24.4
Δ Renal Failure	1.1	(0.04)	0.1	0.1

Table 21. Summary of health system impact based on ODEM.

Incremental Costs, QALYS, CE and Events per 1,000	Multi-disciplinary Diabetes Program[1]	Insulin Pumps[2]	Behavioural Interventions[1]	Bariatric Surgery[3]
Δ HbA_{1c}	-1.02%	-0.14%	-0.44%	-2.70%
Δ Costs	$5.623	$8.010	$0.212	$1.573
Δ QALYs	290,424	4,222	5,957	100,196
$/QALY gained	$19,869/QALY	$1.9M/QALY	$36,226/QALY	$15,697/QALY
Δ IHD	15,265	201	446	2,757
Δ MI	40,882	562	521	13,839
Δ Heart Failure	8,563	462	595	31,137
Δ Stroke	14,074	361	372	8,957
Δ Amputation	13,180	201	372	2,997
Δ Blindness	6,180	281	521	4,179
Δ Renal Failure	819	-8	74	17

[1]All type 2 diabetes = 744,677(20); [2] Insulin dependent type 2 diabetes = 201,062(21);
[3] Morbidly obese with type 2 diabetes = 171,275 (17)

Limitations

There were several limitations with the economic analyses. The effect of multi-disciplinary program was based on patient-level data reflecting a more accurate estimate of the projected outcomes as opposed to the other interventions in which summary estimates were obtained from the literature. Caution should be exercised when comparing projections across interventions. Furthermore, the multi-disciplinary program was based in Sault Ste. Marie and may not be generalizable to the whole of Ontario.

Baseline characteristics of the patient cohorts in the individual analyses (except for bariatric surgery) were assumed to be the same as the patient cohort of the multi-disciplinary program as patient level data were available for that analysis. This may conflict with the baseline characteristics of the patient populations examined in the trials meta-analyzed for each intervention. Whenever possible the baseline characteristics of the trial population were used as in the case of bariatric surgery since the data for this unique patient population were reported accurately in the literature but for all other interventions it was assumed to be the same as multi-disciplinary program due to the availability of the data.

Costs and resource utilization used in the analyses will vary based on the assumptions made. Literature and expert opinion were sought to validate numbers used in the analyses.

Projections for the budgetary impact analyses were based on the prevalent number of cases for each intervention. Compliance and other reasons that may affect this prevalence number were not factored into the calculation.

Conclusions

1. Based on the MAS review of clinical effectiveness, multi-disciplinary programs, behavioural interventions, and bariatric surgery would be considered cost-effective for the treatment and management of adults with type 2 diabetes.
2. Insulin pumps are not cost-effective, either for age 65+ sub-group or for 'all patients' in general.
3. The determination of relative cost-effectiveness would require a head-to-head field evaluation.

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