Selected reviews of Economic Evaluations relating to Diabetes and Obesity

The cost, quality of life impact, and cost-utility of bariatric surgery in a managed care population

McEwen L N, Coelho R B, Baumann L M, Bilik D, Nota-Kirby B, Herman W H; *Obesity Surgery* 2010; 20(7): 919-928

**Study Question:** Although obesity is expensive and bariatric surgery is effective, the costs of bariatric surgery are high. Recent studies have described the impact of bariatric surgery on health care costs, quality of life, and have assessed cost-effectiveness, but most have employed simulation models. The aim of this study was to assess the cost, quality of life impact, and the cost-utility of bariatric surgery in a managed care population between 2001 and 2005. In order to do this, empiric data were used from a single managed care health plan, and seven Bariatric Surgery Centres of Excellence.

**Patient Group:** 221 adult patients in a managed care population who underwent bariatric surgery between 2001 and 2005. There were a number of inclusion/exclusion criteria. The analysis was based on medical claims data for all patients and survey data for 122 survey respondents (55% response rate). Patients were generally middle-aged (mean age at surgery, 42 yrs), female (88%), and white (86%). Sixty-four percent underwent open and 33% underwent laparoscopic Roux-en-Y procedures.

**Key Results:** One year after surgery, mean body mass index fell from 51 to 31 kg/m(2) in women and from 59 to 35 kg/m(2) in men, with substantial improvements in comorbidities. Postsurgical mortality and morbidity were low. Total per member per month costs increased in the six months before bariatric surgery, were lower in the 12 months after bariatric surgery, but increased somewhat over the next 12 months. The average cost of bariatric surgery was US$11,144. The average cost of laparoscopic surgery was US$10,393 compared with US$11,705 for open surgery. When presurgical quality of life was assessed prospectively, average health utility scores improved by 0.14 one year after surgery. In analyses that took a lifetime time horizon, projected future costs based on age and obesity, and discounted costs and health utilities at 3% per year, the cost-utility ratio for bariatric surgery versus no surgery was approximately US$1,400 per QALY gained. In sensitivity analyses, bariatric surgery was more cost-effective in women, non-whites, more obese patients, and when performed laparoscopically. Based on these findings, the authors conclude that, although not cost-saving, bariatric surgery represents very good value for money. Its long-term cost-effectiveness appears to depend on the natural history and cost of late postsurgical complications and the natural history and cost of untreated morbid obesity.

A population model evaluating the costs and benefits associated with different oral treatment strategies in people with type 2 diabetes

McEwan P, Evans M, Bergenheim K; *Diabetes, Obesity and Metabolism* 2010; 12 (7): 623-630

**Study Question:** The objective of this study is to quantify the overall costs and benefits, expressed in terms of quality-adjusted life years (QALYs) of therapy escalation via oral treatment strategies with
different adverse event profiles as a function of target hemoglobin A1c (HbA1c) achievement, as defined by the most recent National Institute for Health and Clinical Excellence (NICE) guidance. A previously published model was adapted to run as a non-terminating simulation model. The model was designed to evaluate the cost utility of treatment strategies in a population of type 2 diabetes mellitus patients. Model outputs include incidence of micro- and macrovascular complications, hypoglycaemia and diabetes-specific and all-cause mortality.

**Patient Group:** Patients with type 2 diabetes

**Key Results:** The predicted number of patients receiving oral therapies over the 10-year period (2006 to 2015), with a prevalent population of 8060 predicted in 2006 is expected to increase by 4.5% by 2015. The total number of vascular-related (micro and macro) events varies little across four treatment strategies. The treatment strategies are: Strategy 1 (first line therapy - metformin (MF), second line therapy – MF + sulphonylureas (SU) and third line therapy – MF + SU + thiazolidinediones (TZD); Strategy 2 (first line therapy - MF, second line therapy – MF + TZD and third line therapy – MF + TZD + SU; Strategy 3 (first line therapy - MF, second line therapy – MF + dipeptidyl peptidase (DPP-4) inhibitors and third line therapy – MF + DPP-4 + SU and Strategy 4 (first line therapy - MF, second line therapy – MF + SU and third line therapy – MF + SU + DPP-4. Where discordance exists between treatment strategies, it is primarily restricted to the number of hypoglycaemic events, total discounted costs and quality-adjusted life years (QALYs). The number of total hypoglycaemic events predicted over a 10-year period varied from 55,551 with strategy 1, 20,895 with strategy 2, 4982 with strategy 3 to 36,417 with strategy 4. Overall discounted QALYs were highest with treatment strategy 3 (61,978) and lowest with strategy 1 (61,002); differences in 10-year discounted QALYs were driven primarily by hypoglycaemia and weight gain. Factoring in both costs and QALYs gave a cost per QALY of £609, £793, £756 and £611 for treatment strategies 1, 2, 3 and 4, respectively. The authors concluded that a treatment strategy involving the sequential addition of SU and TZD to first-line MF therapy is associated with the lowest cost and lowest gain across a population, whereas addition of TZD and SU sequentially to first-line MF therapy resulted in the highest cost and incrementally less QALY gain when compared with treatment strategies involving the addition of a DPP-4 inhibitor and SU to first-line MF (irrespective of the treatment sequence) that were associated with both less cost and greatest QALY gain.

**Long-term health and economic impact of preventing and reducing overweight and obesity in adolescence**


**Study Question:** To estimate the impact of a 1% reduction in both overweight and obese adolescents aged 16-17 on lifetime medical costs and quality adjusted life years (QALYs) using a modelling approach based on the 2000 National Medical Expenditure Survey.

**Patient Group:** Overweight and obese adolescents aged 16-17. Cost estimates were based on 14,143 observations from the 2000 National Medical Expenditure Panel Survey (MEPS)

**Key Results:** Among the 8.1m persons in the study cohort, the number of expected obese adults decreases by nearly 53,000, and the numbers of overweight and nonoverweight adults increased by around 27,000 and 26,000 respectively. Total lifetime medical costs after age 40 were expected to decrease by US$586.3m ($US73 per capita) and total quality adjusted life years (QALYs) to increase by over 47,000. The results were sensitive mainly to body mass index progression probability estimates but not to cost or health related quality of life estimates. In the worst case scenario,
Gestational diabetes mellitus screening and diagnosis: a prospective randomised controlled trial comparing costs of one-step and two-step methods

Study Question: The objective of this study was to conduct a cost minimisation analysis of three methods of gestational diabetes mellitus (GDM) screening and diagnosis.

Patient Group: 1594 pregnant women presenting for gestational diabetes mellitus (GDM) screening.

Key Results: The cost of the Glycol drink was Can$1.60 per 75-g bottle, i.e. Can$1.07 for 50-g glucose screen (GS), Can$1.60 for 75-g OGTT and Can$2.13 for 100-g oral glucose tolerance test (OGTT). The Glucola drink was measured for 50-g GS and the unused portions were used for subsequent tests. The cost of a single blood draw, including consumable tubing, needles and blood technician time, was Can$10.00 per sample. Laboratory analysis of a glucose sample cost Can$1.50. Thus, the total sampling costs were Can$12.57 for 50-g GS, Can$36.10 for the three-sample, 75-g OGTT and Can$48.13 for the four-sample, 100-g OGTT. Among women in the two-step method groups diagnosed with gestational diabetes mellitus (GDM), 39% of the GR1 and 61% of the GR2 groups were diagnosed at the first step by GS = or > 10.3 mmol/l, according to the Canadian Diabetes Association recommendations, contributing to a lower total cost in these groups. The total costs per woman screened were as follows: GR1, Can$91.61; GR2, Can$89.03; GR3, Can$108.38. The GDM prevalence was similar (3.7%, 3.7% and 3.6%, respectively). The higher costs of GR3 were related to more blood draws and the time required for all women to undergo the 2-hour OGTT. The authors’ concluded that careful consideration should be given to an internationally recommended method of universal screening for GDM which minimises the burden and cost for individual women and the healthcare system, yet provides diagnostic efficacy. The two-step method (GS +/- OGTT) accomplished this better than the one-step method (75-g OGTT).

Diabetic retinopathy screening: a systematic review of the economic evidence

Study Question: To review the evidence and issues highlighted in economic evaluation studies of diabetic retinopathy screening policy and practice and suggest areas for further research. This was done through a review of the literature.

Patient Group: Studies of diabetic retinopathy screening policy for eligible for inclusion. Articles were excluded if they were: non-English language studies published before 1998; were not economics papers; and alluded to the term ‘cost’, referring to the potentially negative psychosocial consequences of diabetic retinopathy screening.

Key Results: A total of 29 electronic databases were searched for English-language studies published between 1998 and 2008. Internet searches were also undertaken and papers included in the review were hand searched for additional references. Search terms were reported. Potentially relevant articles were obtained and reviewed in full by one public health specialist and a health economist reviewed papers to ensure consistency. The 10-item Drummond checklist was used to assess the
quality of the studies included in the review. Meta-analysis was not possible because of the diversity in research methods and interventions used. A total of 416 papers were identified of which 21 fulfilled the inclusion criteria. Of the 21 articles covering 15 studies, 12 were cost-effectiveness studies, one was a cost analysis, one was a cost-minimization study, one was a cost-utility study and six were reviews; 11 used economic modeling techniques and/or computer simulation. The modelling studies were generally well conducted, scoring well on the Drummond checklist. One did not measure costs and consequences accurately and two did not value costs credibly. Four papers did not discount costs and/or consequences for differential timing, one did not conduct incremental analysis and two papers did not adequately conduct sensitivity analysis to account for uncertainty. Three papers assessed the cost-effectiveness of a technology that has not yet been fully established as effective. The authors stated that the economic evaluation literature on diabetic retinopathy screening has focused on four key questions: the overall cost-effectiveness of ophthalmic care; the cost-effectiveness of systematic vs. opportunistic screening; how screening should be organized and delivered; and how often people should be screened. Systematic screening for diabetic retinopathy is cost-effective in terms of sight years preserved compared with no screening. Digital photography with telemedicine links has the potential to deliver cost-effective, accessible screening to rural, remote and hard-to-reach populations. Variation in compliance rates, age of onset of diabetes, glycaemic control and screening sensitivities influence the cost-effectiveness of screening programmes and are important sources of uncertainty in relation to the issue of optimal screening intervals. There is controversy in relation to the economic evidence on optimal screening intervals. The authors stated that a limitation of the review is the reliance on evidence from economic modelling studies rather than primary research. Further primary research is needed to address the issue of optimal screening interval and the effect of changing the interval on compliance and the reassurance given to patients by annual screening.

**Event rates, hospital utilization, and costs associated with major complications of diabetes: A multicountry comparative analysis**


**Study Question:** The purpose of this study was to estimate acute and long-term resource use associated with five major complications of diabetes, on the basis of patient-level information from the Action in Diabetes and Vascular Disease (ADVANCE) study.

**Patient Group:** All patients included in this analysis were participants in the Action in Diabetes and Vascular Disease (ADVANCE) study. Patients were eligible for the trial if they had been diagnosed with type 2 diabetes mellitus at the age of 30 years or older, were aged 55 years or older at entry to the study, and had a history of major macrovascular disease or at least one other risk factor for macrovascular disease.

**Key Results:** Some regional differences were observed in the baseline characteristics of the population. Compared with participants from Established Market Economies participants in the other regions were younger and more likely to be female. Blood pressure was substantially higher among Eastern European patients, who had a mean blood pressure at entry of 150/85 mm Hg. Body mass index was on average significantly lower among Asian patients. A total of 10,955 hospitalizations were recorded during the study follow-up (median duration of follow-up was 5.0 years). The average numbers (standard deviation [SD]) of hospitalizations per participant during the trial by region were: Asia 0.7 (1.2); Eastern Europe 0.9 (1.6); Established Market Economies 1.3 (1.9). Estimated regional costs associated with the different types of complications, on the basis of the
estimated numbers of total bed-days from the Action in Diabetes and Vascular Disease (ADVANCE) study, combined with WHO-CHOICE estimates of hospital per diem costs. Overall estimated annual hospital costs for patients with none of the specified events or event histories ranged from Int$76 in Asia to Int$296 in Established Market Economies. All complications included in this analysis led to significant increases in hospital costs. Coronary events, cerebrovascular events, and heart failure were the most costly, at more than Int$1,800, Int$3,000, and Int$4,000 in Asia, Eastern Europe, and Established Market Economies, respectively. Patients with a history of complications continued to have higher hospital use and costs in subsequent years relative to those without any history of complications. In a sensitivity analysis assuming that costs were incurred in secondary-level rather than tertiary-level hospitals, costs were approximately 30% lower than those reported in the main analysis. The estimated annual costs associated with nonfatal coronary events were Int$1,871 (95% confidence interval 1,260-2,857) for China, Int$2,655 (1,734-3,975) for Russia, and Int$3,947 (2,535-5,842) for the UK. The provided cost calculator enables estimation of hospital use and costs for any country in the ADVANCE study, assuming any specified hospital level, and expressed in either international dollars or local currency units. The authors concluded that major complications of diabetes significantly increase hospital use and costs across various settings and are likely to impose a high economic burden on health care systems. International dollars (Int$) represent a hypothetical currency that allows for the same quantities of goods or services to be purchased regardless of country, standardized on purchasing power in the United States.

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