

The Public Health Implications of the Cost-Effectiveness of Bariatric Surgery for Diabetes

Bariatric surgery is one of the major breakthroughs in diabetes care to have emerged since the discovery of insulin. In the 15 years since the first observational study, clinical trials and observational studies of bariatric surgery in diabetic patients have confirmed the beneficial effects of surgery (1). Since 2000, guidelines from the National Institutes of Health (NIH) have recommended bariatric surgery as an option for obesity treatment in adults with a BMI ≥ 35 kg/m² and a serious comorbid condition (2). In 2009, the Centers for Medicare & Medicaid Services officially announced it would cover bariatric surgery for beneficiaries with morbid obesity and type 2 diabetes. While bariatric surgery can be beneficial, it is an expensive intervention costing at least \$13,000 in the first year (3). In light of its high costs and potential benefits, understanding the cost-effectiveness of bariatric surgery for diabetes is critical for policy discussions regarding any ongoing or additional public health investment in bariatric surgery. The cost-effectiveness of bariatric surgery for diabetes has been evaluated in prior studies, but these studies have been limited by simplistic diabetes models (4–6) with parameter inputs derived from individual trials (5). Only one previous study of Roux-en-Y gastric bypass has accounted for the future complications of diabetes (7,8), and only one study has been conducted from the perspective of the U.S. (7).

In this issue of *Diabetes Care*, Hoerger et al. (9) address many of these deficits in the existing literature and report on the most rigorously conducted cost-effectiveness analysis of bariatric surgery for diabetes to date. Using the Centers for Disease Control-Research Triangle Institute (CDC-RTI) Diabetes Cost-Effectiveness Model, the authors modeled the potential lifetime effects of bariatric surgery on diabetes by estimating rates of diabetes remission and relapse, as well as diabetes complications, deaths, costs, and quality-adjusted life-years (QALYs). The authors separately evaluated two forms of bariatric surgery, gastric bypass and gas-

tric banding, which differ in surgical approach, clinical benefits, and adverse consequences. They also accounted for the well-known differences in diabetes remission from surgery based on duration of diabetes and type of surgery.

The authors found that bariatric surgery, based on currently available data, is cost-effective over the lifetimes of severely obese patients with diabetes. Bypass surgery had incremental cost-effectiveness ratios (ICERs) of \$7,000/QALY and \$12,000/QALY for severely obese patients with newly diagnosed and established diabetes; banding surgery had slightly higher ICERs of \$11,000/QALY and \$13,000/QALY for the two respective diabetic groups. The ICERs for both surgeries are very favorable since values below the \$200,000/QALY threshold in the U.S. are now considered cost-effective (10). Other diabetes treatments, such as intensive glycemic and lipid control in comparison to conventional risk factor control, have previously been found to have ICERs of \$41,384/QALY and \$51,889/QALY (11).

While these results are extremely promising for bariatric surgery, the validity of this analysis and others like it depends on the quality of the research in bariatric surgery. Unfortunately, bariatric surgery studies (12) are plagued by inadequate patient retention and short durations of follow-up. The accepted standard for patient retention in both published studies and clinical practice is 50%, which is far below the norm for clinical studies in other areas of medicine. These low retention rates are highly problematic because they have the potential to introduce strong selection bias. Patient attrition after bariatric surgery is very likely related to satisfaction with the surgery and its effects. Thus, reported results from bariatric surgery likely overestimate rates of diabetes remission and improvement and underestimate costs. In conjunction with the practice of allowing low retention rates, follow-up time for the majority of bariatric surgery studies is less than 2 years (12). This short duration of fol-

low-up is thought to be appropriate for most surgical research since complications usually occur within a few years of surgery. However, bariatric surgery can also cause lifelong side-effects such as nutritional deficiencies, dumping syndrome, cholelithiasis, and long-term operative complications, which may be underrepresented in short-term studies (13,14). The need for studies of the long-term effects of bariatric surgery is well-known, and efforts are being made to address it. In 2005, the Longitudinal Assessment of Bariatric Surgery project was launched under direction of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). In addition, both the American Society for Bariatric Surgery and the American College of Surgeons are actively collecting data from their approved bariatric surgery centers (15,16). At present, long-term data on bariatric surgery are limited to the Swedish Obesity Study and a few small trials.

Despite the limitations of bariatric surgery literature, this analysis provides a strong argument for the economic value of bariatric surgery as a treatment for diabetes in the U.S. If bariatric surgery is indeed a cost-effective treatment for diabetes in the U.S., can bariatric surgery practically be provided to everyone who would benefit from it? Should bariatric surgery be strongly advocated for these patients?

One fundamental issue that may hinder the widespread adoption of bariatric surgery for diabetes is that it may simply be considered too expensive in the face of current health care budget concerns. The study by Hoerger et al. shows that bariatric surgery for diabetes is cost-effective over the lifetime of the patient, which means that adoption of bariatric surgery will increase health care costs. These cost concerns are undoubtedly shared by individual payers who have been reluctant to adopt widespread coverage of the procedure (17). The payer perspective is important for bariatric surgery because the majority of the costs oc-

cur in the first year after surgery, whereas the benefits occur over the patient's lifetime. Increasing coverage for bariatric surgery for the treatment of diabetes will require convincing payers that bariatric surgery for diabetes will be at least cost-effective, if not cost-saving, in the short-term. Studies from European countries with nationalized health care systems have found that bariatric surgery is cost-effective from a 5-year societal perspective, but these findings are based on much less sophisticated methods for modeling diabetes and bariatric surgery than the study by Hoerger et al. (4,6). It may be necessary to conduct an analysis from a 5-year perspective with the model from the study by Hoerger et al. in order to motivate private payers in the U.S. to cover bariatric surgery for severely obese adults with diabetes.

Another practical limitation to providing bariatric surgery to those who would benefit is the imbalance between workforce supply and patient demand. Quantification of the bariatric surgeon shortage is challenging since bariatric surgery is not an accredited surgical subspecialty. However, it is known that most bariatric surgeons are general surgeons (18), and it is clear that there is a general surgery crisis with anticipated deficits of at least 1,875 surgeons by 2020 (19). Shortages in the number of general surgeons will undoubtedly translate into shortages of bariatric surgeons. In addition to the limited surgeon supply, there is already a high demand for bariatric surgeries (20), which will likely grow as more populations are proven to benefit from bariatric surgery. Recent research has suggested that laparoscopic banding surgery may be appropriate for adolescents (21). Additionally, this analysis suggests that bariatric surgery may be cost-effective in diabetes populations that are currently not mentioned in care guidelines (e.g., patients with BMI between 30 and 34 kg/m²).

Apart from these financial and workforce constraints, the use of bariatric surgery as a standard approach to treating diabetes would represent a fundamental shift in thinking for much of the public health community. Bariatric surgery is an intensive medical and highly technical treatment for diabetes, and many in the public health community may be reluctant to embrace surgery as an approach to addressing diabetes in the obese population. Most of the current NIH- and CDC-funded efforts to improve diabetes care in the community have focused on creating

programs that improve the delivery of diabetes medical treatments and behavioral therapies in health care facilities and communities. An entire workforce of physicians, diabetes educators, nurse practitioners, and psychologists would have to shift their orientation in order to endorse bariatric surgery as a major public health approach to diabetes treatment.

Bariatric surgery is an important treatment for diabetes. However, research with high patient retention and long-term outcomes is needed to reduce the model uncertainty of current cost-effectiveness analyses. Widespread bariatric surgery for severely obese patients with diabetes may be limited because of increases in overall costs, limited bariatric surgeons, and uncertain public health support. As promising as bariatric surgery is for improving diabetes, it is unlikely to be the sustainable treatment for diabetes and obesity for future generations. So even in the face of this effective treatment, further research on all modalities—behavioral, medical, and surgical—are needed in order to combat the dual diabetes and obesity epidemics.

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