The Economic Costs of Obesity and the Impact of Bariatric Surgery

Nathan G. Richards, MD, Alec C. Beekley, MD, David S. Tichansky, MD*

Any discussion of economic costs of a disease and associated treatment is inherently complex. The disease has direct costs to the health care system for required hospitalizations, medications, and procedures, and indirect costs to the health care system in lost opportunities to treat other patients and diseases. The disease also has direct, non–health care costs in lost economic productivity and income in patients with the disease, workforce losses from early mortality and disability, and the cost of recruitment and training of replacement personnel. Any treatment of the disease costs the health care system directly, and treatments successful in improving longevity may increase health care expenditures over time (patients who live longer may incur more health care costs in their lifetimes). Most surgical treatments also result in temporary workforce losses while patients are getting the procedure and recovering. When assessing the cost-effectiveness of a given disease treatment, the cost of the treatment must be weighed against the cost to the health care system if the patient does not get the treatment. Although economic cost cannot be the only criteria by which the health care system administers or withholds treatment, the upwardly spiraling costs of health care in the United States have made these kinds of analyses a priority.

Obesity is associated with many other diseases. Powerful links have been established between obesity and a host of illnesses or conditions including adult-onset diabetes/insulin resistance, hypertension, heart disease, obstructive sleep apnea, gastroesophageal reflux disease, nonalcoholic fatty liver disease, nonalcoholic steatohepatitis, degenerative joint disease, obesity hypoventilation syndrome, pseudotumor cerebri, depression, and even certain cancers. Hence, correction of obesity and the diseases that are caused or exacerbated by obesity has the potential to improve quality of life and longevity, reduce long-term health care costs, and reduce...
global economic losses from lost productivity, workforce losses, absenteeism, and the costs of replacement workers.

**THE ECONOMIC IMPACT OF OBESITY**

When examining the economic impact of obesity and weight-loss surgery, in addition to the savings in personal health care cost after bariatric surgery, there is also the impact that obesity has on lost work productivity and absenteeism. Another concern for the workforce economy is early mortality in US workers. In theory, many employees required training to do their jobs, at many different levels of costs to employers. Their loss, through absenteeism, early retirement, or early mortality requires the recruitment and training of replacement employees, which also severely affects the national workforce and its associated economy.

The first impact of obesity on the workforce is absenteeism. Ewing and colleagues\(^1\) recently examined the economic impact of obesity on a small region in Texas. They found that morbidly obese employees missed 11 times more days of productivity because of illness or injury (33 days vs 3 days per year) than the average US worker. Assuming people work 250 days per year, morbidly obese employees have 217 days of productivity per year versus 247 for the average US worker. Thus, the average obese worker was only 87.8\% as productive as an average US worker.

However, Finkelstein and colleagues\(^2\) found that men with a body mass index (BMI) between 35 and 40 kg/m\(^2\) only miss about 2 more work days per year because of the illness or injury than do healthy-weight men, and overweight men who have low-grade obesity (BMI between 30 and 35 kg/m\(^2\)) did not miss significantly more days than healthy-weight men. In women, Finkelstein and colleagues\(^2\) found that the number of additional work days missed per year was a half day for overweight women, 1.8 days for obese women, 3 days for grade II obesity, and 5 days for grade III obesity, so, although these numbers imply that absenteeism is greater in obese workers, it may not be as great as previously described by Ewing and colleagues.\(^1\)

However, Finkelstein and colleagues\(^2\) went on to try to quantify this absenteeism in dollars. Their conclusions were that the range of cost attributed to overweight and obesity was from $175 per year for an overweight man to $2485 per year for grade II obese woman. Thirty percent of these costs were from increased absenteeism. In addition, only 3\% of the employees had a higher-grade obesity (grade III), but they accounted for 21\% of the costs associated with obesity. Cawley and colleagues\(^3\) summarized their data by estimating that absenteeism secondary to obesity costs $4.3 billion annually in the United States.

Both Cawley and colleagues\(^3\) and Ewing and colleagues\(^1\) put forth a concept that obese workers may be less productive even though they are present at work. The term presenteeism has been coined. Gates and colleagues\(^4\) studied this concept of obesity in presenteeism and the impact of BMI on workplace productivity. Reviewing the work patterns of 341 manual laborers in manufacturing through a work limitations questionnaire found that workers with a BMI greater than or equal to 35 kg/m\(^2\) experience the greatest health-related work limitations, specifically regarding time needed to complete tasks and the ability to perform physically demanding jobs. These limitations were quantified as a 4.2\% loss in productivity from health-related causes, which was greater than the loss for all other employees. This equated to $506 annually in losses per worker. He put forth the concept of a threshold effect, with people with a BMI greater than 35 kg/m\(^2\) becoming significantly less productive than mildly obese workers. This productivity loss endured in spite of the absenteeism this group not being significantly different.
Ricci and colleagues\textsuperscript{5} studied lost productive time associated with excess weight in the whole US workforce. By using results of a health interview conducted via a telephone survey, they compared so-called lost productive time in normal-weight, overweight, and obese workers. Obese workers were more likely to report lost productive time because of obesity at 42\% versus 36\% in normal-weight workers. Only 34\% of overweight workers reported lost productive time. There was no significant difference in lost productive time in overweight versus normal-weight individuals. Workers who reported lost productive time quantified equal amounts of lost productive time, which was 4.2 hours per week. The reasons for the lost productive time included influenza, musculoskeletal pain, headache, fatigue, or digestive issues. It was estimated that this lost productive time caused by obesity amounts to approximately $42 billion per year in the United States, approximately $1627 on average per obese worker per year. However, two-thirds of that cost was in reduced work performance and not true absenteeism, which makes the loss more difficult to pinpoint. The numbers for overweight workers are even greater at $55 billion per year. This cost is not related to overweight workers having more lost productivity per worker, but to the greater number of overweight workers nationally. When judging these results, it is important to realize that most of these employees were between 40 and 65 years old. Sixty-nine percent of these workers were educated beyond high school, 81\% worked full time, and 67\% worked in a white-collar job. Thus, this lost productivity or low work performance was not necessarily in people doing manual-labor jobs; which intuitively may be more susceptible to losses from injury or physically not feeling well.

Frezza and Wachtel\textsuperscript{6} and Ewing and colleagues\textsuperscript{1} classified loss of output income as between $1660 and $2389 per household. Most of these previous studies only discussed pure work. When adding in the approximately $60 billion in losses caused by diabetes-related absenteeism,\textsuperscript{6} lost labor productivity, and unemployment, the financial losses to the United States business and the labor workforce directly attributable to obesity and its related diseases are huge.

As previously stated, the financial impact of weight-loss surgery in health care costs are significant largely because of the reduction of the cost of treating comorbid conditions. So does bariatric surgery have a positive impact, for example, on absenteeism, presenteeism, and productivity? Can the observed improvement in comorbid conditions also reduce absenteeism and result in more work productivity? Hawkins and colleagues\textsuperscript{7} noted that, although obese subjects had 83\% less productivity and lower earnings than normal-weight people, patients who had laparoscopic Roux-en-Y gastric bypass and laparoscopic adjustable gastric banding had significant improvement. In 59 patients, there was a 32\% increase in the number of people who were in paid work since surgery, and mean weekly hours increased from 30.1 to 35.8 hours. Almost all 59 reported a decrease in physical limitations or emotional limitations on their ability to do work. In addition, the same patients claimed state benefits at a rate of approximately 3 to 4 times higher before than after surgery.

Brounts and colleagues\textsuperscript{8} studied productivity from a more utilitarian angle. If employees cannot do their jobs for any reason, their replacements need to be recruited and trained at significant cost to the employer. They studied the outcomes of soldiers on active duty undergoing gastric bypass and found that the expected outcomes of bariatric surgery also prevailed in a military population. However, the military can base productivity on 2 solid measures: promotability and deployability into war zones. Brounts and colleagues\textsuperscript{8} found that 5 of 27 patients who underwent gastric bypass and had previously been nonpromotable because of weight were reclassified as promotable and 24 of the 27 patients were either able to maintain or achieve...
deployable status after surgery. Perryman and colleagues\textsuperscript{9} reported the effect of the gastric banding procedures and their benefits in people in the Texas Employees Retirement System. From a pure health and cost recovery model, the direct health costs of the laparoscopic gastric banding procedure were recovered in 23 to 24 months. From a societal perspective, Texas could have business gains of $195 million in expenditure, $94 million in gross product, and 1354 person years of employment if patients in the Texas Employment Retirement System were to undergo a successful laparoscopic adjustable gastric banding procedure.

The overall conclusion of studies examining bariatric surgery and improved work productivity is that most workplace losses from obesity dissipate following bariatric surgery. Thus, the benefits of bariatric surgery in workplace losses, although not well quantified in many studies, can be summarized as follows: of the billions of dollars that are lost each year because of obesity, most could be reclaimed if the obesity and morbid obesity rates were controlled with weight-loss surgery.

**THE ECONOMIC IMPACT OF OBESITY SURGERY**

The current medical literature supports the premise that bariatric surgery can extend life as well as quality-adjusted life years by leading to improvement or complete resolution of type II diabetes, hypertension, and heart disease.\textsuperscript{10–12} The well-known Swedish Obese Subjects (SOS) study, for example, showed that obese patients undergoing bariatric surgery had an unadjusted, overall 23.7\% reduction in mortality in a 10-year period compared with nonsurgical obese patients. When mortalities adjusted for gender, age, and risk factors were compared, this reduction in mortality increased to 30.7\%. This improvement in longevity seems to be caused by the improvement in most cardiovascular risk states.\textsuperscript{11,12} Although the long-term data are not yet available to determine whether surviving patients cost more or less to the health care system during the remainder of their lifetimes, from the shorter-term studies available, it seems that these costs will be less.

Cremieux and colleagues,\textsuperscript{13} in 2008, published a study of the impact of bariatric surgery on overall health care costs. Between 2000 and 2005, a large increase in the rate of morbid obesity in the United States was noted. In this time period, the obesity rate increased by 24\%. The morbid obesity rate (BMI $\geq$ 40 kg/m$^2$) increased by 50\% and the rate of patients with a BMI greater than 50 kg/m$^2$ increased by 75\%. “This trend in morbid obesity results in increased health care use and costs, as health care costs for the morbidly obese are 81\% above those for the non-obese population and 47\% above the costs for the non-morbidly obese population.”\textsuperscript{13}

The cost increases referenced later are predominantly composed of costs associated with the treatment of the components of metabolic syndrome: diabetes, hypertension, hyperlipidemia, and heart disease. As shown in this and other articles, bariatric surgery has been repeatedly shown to either ameliorate or eradicate these entities from patients who have undergone such surgical techniques.

Assuming the known benefits of bariatric surgery, Cremieux and colleagues\textsuperscript{13} undertook a study to determine the difference in costs in patients who no longer had these diseases. The investigators analyzed the cost-effectiveness of bariatric surgery by comparing costs gathered from patients starting at 6 months before bariatric surgery with costs generated in, and measured from, patients throughout the continuous involvement in their study. Their results showed that the mean investment for bariatric surgery in their cohort, laparoscopic or open, varied from $17,000 to $26,000. After controlling for observable patient characteristics, they estimated that costs for patients having bariatric surgery who underwent laparoscopic surgery...
were recouped within 2 years. Costs for patients who underwent open bariatric surgery were recouped within 4 years. Subsequent articles specifically analyzed costs associated with diabetes mellitus, hypertension, and heart disease.

In 2010, Makary and colleagues published their findings evaluating diabetes medication use and annual median health care costs in patients with type 2 diabetes mellitus who had undergone bariatric surgery. They retrospectively reviewed 2235 adult patients with type 2 diabetes and commercially available health insurance in the United States between 2002 and 2005. They specifically studied (1) the use of diabetes medications at specified time intervals before and after bariatric surgery, and (2) total median health care costs per year. They showed that bariatric surgery reduced the use of diabetes medications as well as total health care costs in patients with type 2 diabetes mellitus. In his study cohort, Makary and colleagues found that, at 6 months, 75% of the 2235 patients who had undergone bariatric surgery had eliminated diabetes medication therapy. At 1 year, 81%, and, by 2 years, 85% of patients who had remained in follow-up had stopped taking medications for their diabetes. From a cost savings perspective, standardized annual median cost per person from 2 years to 1 year before surgery was $6375 and from 1 year before surgery, the annual cost was $10,502. After bariatric surgery, the annual median costs of health care use went from $6882 in the first postoperative year to $4197 between years 1 and 2, to $1878 between postoperative years 2 and 3.

Type 2 diabetes mellitus has had such an excellent response to bariatric operations that it has sparked interest in bariatric surgery as a primary treatment of type 2 diabetes mellitus. Obesity has been linked to inflammatory and metabolic pathway derangements leading to insulin resistance and impaired pancreatic β-cell function resulting in type 2 diabetes. Bariatric operations have been shown to result in a 50% to 85% remission rate for type 2 diabetes, particularly if the operation is performed early in the onset of the disease. Bariatric procedures that functionally result in food anatomically bypassing the C-loop of the duodenum and the head of the pancreas seem to result in an almost immediate, improvement in glycemic control that is not associated with weight loss, but through hormonal mechanisms not yet clearly elucidated. Moreover, type 2 diabetes has been shown to respond to all currently offered bariatric procedures, probably through mechanisms associated with weight loss and diet.

Control of type 2 diabetes may be one of the most important economic effects of bariatric surgery, because improved glycemic control as measured by hemoglobin A1C has been shown to reduce short-term health care costs and is anticipated to reduce long-term health care costs. The landmark SOS study further buttresses these data. Narbro and colleagues, in 2002, found that the average annual cost for all medications in obese individuals was approximately $140, whereas, in the reference nonobese population, the annual cost of medications was only $80. This statistically significant difference underscores the significant pharmaceutical costs associated with obesity. An analysis of patient costs in the obese group who underwent bariatric surgery versus those who did not revealed, for diabetes medication, that the surgically treated group decreased their costs by an average of $9 per year. Obese patients who underwent bariatric surgery also saw their costs for medications associated with heart disease and hypertension decrease annually by $19. Performed over 6 years, Narbro and colleagues concluded that surgical obesity treatment can decrease costs associated with diabetes, heart disease, and hypertension.

In 2004, Sjostrom and colleagues showed that, at 10 years after bariatric surgery, rates of resolution of diabetes, hypertriglyceridemia, low-high-density lipoprotein, and
hypertension continued to improve in obese patients who had undergone bariatric surgery, and the average weight loss in these patients decreased by 16.1% from their presurgical weights. Conversely, in the reference (nonoperative) group of obese patients, weight had increased by 1.6% at 10 years and the rates of these diseases continued to worsen. Although the costs associated with diabetes, hypertension, and hypertriglyceridemia were not analyzed in this work, the intuitive inference is that, because the disease processes were ameliorated by the weight loss associated with bariatric operation, the need for medications decreased, as did the amount of money that needed to be spent in their treatment.

Athyros and colleagues reviewed 20 years’ (1990–2010) worth of studies that were searchable on bariatric surgery in MEDLINE, Current Contents, and the Cochrane Library. Their findings further revealed the effectiveness of bariatric surgery in resolving major comorbidities associated with morbid obesity, including type 2 diabetes mellitus, hypertension, dyslipidemia, metabolic syndrome, nonalcoholic fatty liver disease, nephropathy, left ventricular hypertrophy, and obstructive sleep apnea. Separately, Clifton reviewed the large, recent canon of bariatric literature to further elucidate the specific effects of bariatric surgery on these diseases. He found that, although randomized controlled trials are necessary to further support the current literature, “bariatric surgery has powerful and usually persistent effects on type 2 diabetes mellitus, dyslipidemia, and hypertension.” Other studies have shown resolution or improvements in pseudotumor cerebri, coronary artery disease, reduced cancer incidence in women, and gastroesophageal reflux disease.

Supported by data presented by Makary and colleagues, Cremieux and colleagues, and Narbro and colleagues, these reviews and meta-analyses identify the considerable effect that bariatric surgery has on significantly decreasing health care costs associated with common, often mortal, comorbidities that frequently accompany morbid obesity, including type 2 diabetes mellitus, hypertension, dyslipidemia, and heart disease.

SUMMARY

The current obesity epidemic clearly has far-reaching implications for both the economic future and health care future in the United States. As recent debates about the country’s budgetary issues highlight, the fate of the health care system and the economy as a whole are inextricably linked. Health care expenditures accounted for 17.6% of gross domestic product in 2009. This is expected to grow; most budgetary proposals currently being debated only slow this growth. Treatments that repeatedly show reduction in health care costs over time should be approved and made available to as many patients as possible. It is our opinion that bariatric surgery meets this criterion. However, statistics show that bariatric surgery likely cannot provide the impact necessary for reduction in health care and economic costs on a national scale. In 2006, less than 0.4% of the more than 22 million Americans eligible for bariatric surgery received an operation. A rough analysis shows that, with roughly 22 million obese Americans, it would take 5500 bariatric surgeons doing 400 cases a year each for 10 years to attempt to surgically treat every obese American. These numbers are not achievable with the country’s current surgical and health care resources.

The conclusion from this analysis is that the obesity epidemic must begin to be addressed by long-term, concerted policy efforts at the local, state, and national levels. Such efforts could include gradual infrastructure change and incentives designed to encourage healthy commuting (eg, biking or walking), reformation and regulation of our nation’s food supply, education, and continued research into novel,
nonsurgical treatments for obesity. As experts on obesity, bariatric surgeons must be prepared to guide and inform these efforts.

REFERENCES