The Socioeconomic Impact of Morbid Obesity and Factors Affecting Access to Obesity Surgery

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KEYWORDS

• Prevalence • Obesity • Economic impact • Bariatric and metabolic surgery
• Access to care

KEY POINTS

- From 1999 through 2014, obesity prevalence increased among adults and youth. However, among youth, prevalence did not change from 2003–2004 through 2013–2014.
- In 2010 dollars, the nationwide expenditure for obesity-related health care increased to more than $315 billion. These costs increase exponentially with an increase in body mass index greater than 35 kg/m^2.
- In general, the labor market consequences of obesity are greater for women than for men, and greater for white women than for other women.
- Bariatric surgery has been shown to be cost-effective and even cost-saving in certain patient subgroups, that is, type 2 diabetics. The resultant improvement in obesity-related comorbidities has led to reduced prescription drug costs after surgery.
- Patient access to surgical treatment for obesity remains a major economic dilemma in the United States. Of the eligible patients that qualify for bariatric surgery, less than 1% will actually undergo the procedure.

PREVALENCE OF OBESITY

Obesity remains a significant public health issue. It is a chronic disease associated with increased risks of cardiovascular disease, stroke, diabetes, certain cancers, and decreased quality of life. Individuals with severe obesity (body mass index, BMI, >35 kg/m^2) or obesity (>30 kg/m^2) have a 50% to 100% increased risk of premature death compared with individuals of a healthy weight.[1]

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Data recently published from the National Center for Health Statistics revealed during 2011 to 2014 the prevalence of obesity in the United States was more than 36% in adults and 17% in youth. From 1999–2000 through 2013–2014, a significant increase in obesity was observed in both adults and youth; however, over the past 4 years, the rate of increase in adult obesity has slowed whereas there has been no significant change in prevalence among youth (**Fig. 1**).[2]

According to this report, age, gender, and race are significant factors in the overall prevalence of obesity. Prevalence among middle-aged adults aged 40 to 59 (40.2%) and older adults aged 60 and over (37.0%) was higher than among younger adults aged 20 to 39 (32.3%) (**Fig. 2**).[2]

Overall, the prevalence of obesity among women (38.3%) was higher than among men (34.3%). For adults aged 20 to 39 and 40 to 59, the prevalence of obesity was higher among women than among men, but the difference between older women and men aged 60 and over was not significant.[2]

The prevalence of obesity was lowest among non-Hispanic Asian adults (11.7%), followed by non-Hispanic white (34.5%), Hispanic (42.5%), and non-Hispanic black (48.1%) adults. All differences were significant. The only gender differences found among the ethnic groups were among the non-Hispanic black and Hispanic adults. The prevalence of obesity among non-Hispanic black women was 56.9% compared with 37.5% in non-Hispanic black men. The prevalence of obesity was 45.7% among Hispanic women compared with 39.0% in Hispanic men (**Fig. 3**).[2]

The prevalence of obesity among US adults remains higher than the Healthy People 2020 goal of 30.5%[3]; however, the actual obesity rate among adults in 2010 was lower (35.7%) than the 2003 prediction by the Centers for Disease Control and Prevention (40%).

Although the overall prevalence of childhood obesity is higher than the Healthy People 2020 goal of 14.5%, the prevalence among children aged 2 to 5 years is less than

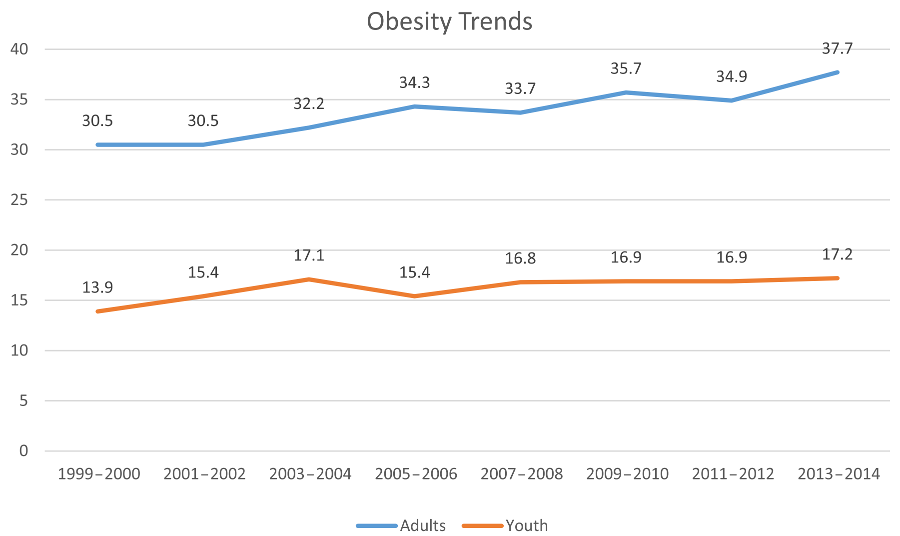

Fig. 1. Trends in obesity prevalence among adults aged 20 and older and youth aged 2 to 19 years: US, 1999–2000 through 2013–2014. (*Data from* Ogden CL, Carroll MD, Fryar CD, et al. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS Data Brief 2015;(219):1–8.)

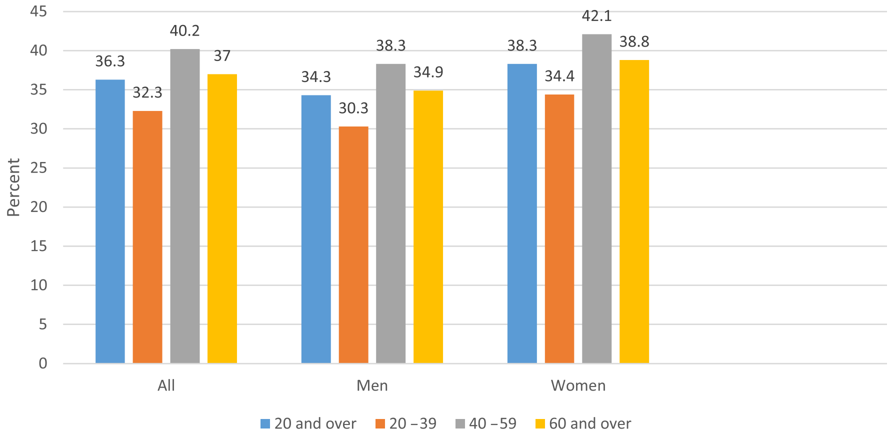

Fig. 2. Prevalence of obesity among adults aged 20 and older, by sex and age: United States, 2011 to 2014. (*Data from* Ogden CL, Carroll MD, Fryar CD, et al. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS Data Brief 2015;(219):1–8.)

the goal of 9.4%.[3] According to the 2012 American Heart Association Statistical Fact Sheet, overweight adolescents have a 70% probability of becoming overweight adults; this increases to 80% if at least one parent is overweight or obese (**Fig. 4**).[4]

Although the overall trajectory of obesity in the United States may have begun to flatten over the past 4 years, the overall change over the past 50 years clearly demonstrates a significant public health issue. More alarming than the overall prevalence is the impact by individual BMI categories. Measured BMI data from the 1960 to 1962 and 2009 to 2010 National Health and Nutrition Examination Surveys (NHANES)

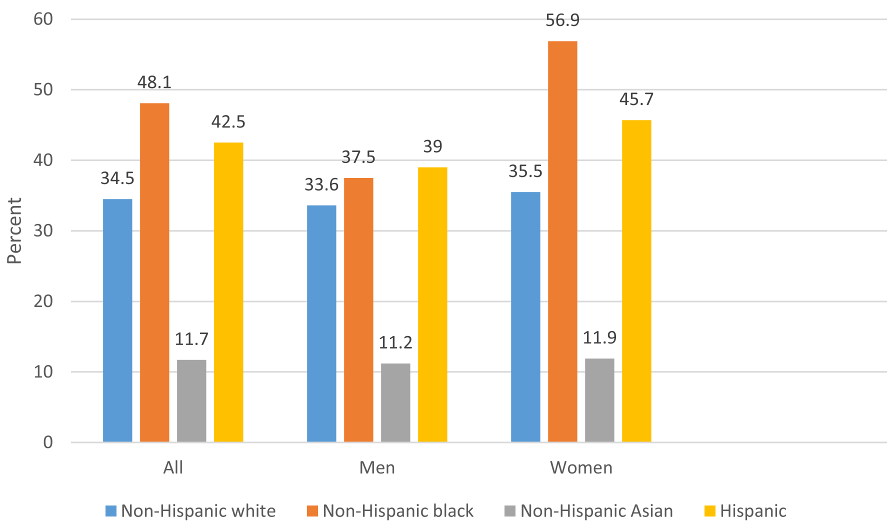

Fig. 3. Prevalence of obesity among adults aged 20 and older, by sex and race and Hispanic origin: United States, 2011 to 2014. (*Data from* Ogden CL, Carroll MD, Fryar CD, et al. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS Data Brief 2015;(219):1–8.)

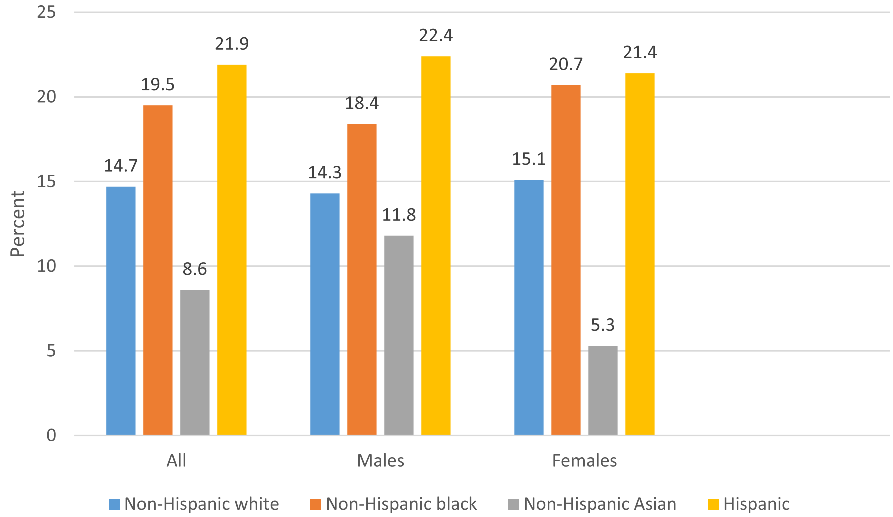

Fig. 4. Prevalence of obesity among youth aged 2 to 19 years, by sex and race and Hispanic origin: United States, 2011 to 2014. (*Data from* Ogden CL, Carroll MD, Fryar CD, et al. Prevalence of obesity among adults and youth: United States, 2011–2014. NCHS Data Brief 2015;(219):1–8.)

revealed the rapid expansion of obesity rates and extreme obesity (BMI>40) over this time period. In 1962, 31.5% of the population was overweight; 13.4% were obese, and less than 1% were in the extreme obesity range. In 2009 to 2010, rates of overweight were roughly the same but at the expense of those in the normal weight range, rates of obesity increased to 36.1%, and the rates of extreme obesity increased more than 6-fold to 6.6%. Among women, the rate of extreme obesity was 8.5%. Forecasts of obesity prevalence rates suggest that by 2030, the obesity rate will creep up to 42%, but the rate of extreme obesity will nearly double to 11.1%.[5]

ECONOMIC IMPACT OF OBESITY

The adverse health effects of obesity, and especially severe obesity, are well documented. Obesity adversely affects nearly every system of the human body, but has the most deleterious effects on rates of diabetes, cardiovascular diseases, and several cancers.[5]

Health Care Costs of Obesity

In 2009, Finkelstein and colleagues[6] released data estimating the costs of obesity for the United States across payers (Medicare, Medicaid, and private insurers) in separate categories for inpatient, non-inpatient, and prescription drug spending. Their analysis demonstrated an undeniable connection between rising rates of obesity and rising medical spending. This study relied on data from the 1998 and 2006 Medical Expenditure Panel Surveys (MEPS). Their results revealed that across all payers, per capita medical spending for the obese is $1429 higher per year, or roughly 42% higher, than for someone of normal weight. In aggregate, the annual medical burden of obesity has increased from 6.5% to 9.1% of annual medical spending and could be as high as $147 billion per year, in 2008 dollars. The results also provided new evidence of the important role of prescription drug spending in driving the costs of obesity. As a result of the Part D prescription drug benefit, the obesity-attributable prescription drug costs to Medicare were $7 billion for the noninstitutionalized patient.[6]

Cawley and Meyerhoefer,[7] in 2012, expanded on the work of Finkelstein and presented data that showed the previous estimates of the economic burden of obesity had been substantially underestimated. Their results were arrived at using the instrumental variables model using the 2000 to 2005 MEPS data. Their study provided the first estimates of the impact of obesity on medical costs that adjust for measurement error in weight. Their estimate of the national medical care costs of obesity-related illness in adults is $209.7 billion, or 20.6% of US national health expenditures, which is considerably higher than the previous estimate of 9.1%.

In 2015, Cawley and colleagues[8] updated and expanded their work from 2012 and included more recent MEPS data for 2000 to 2010. In 2010 dollars, the nationwide expenditure for obesity-related health care increased to more than $315 billion. In this study, they also evaluated the health care costs associated with different BMI values. They found the relationship of medical care costs over BMI is J-shaped, that is, expenditures decrease with BMI through the underweight and healthy weight categories, are relatively constant with BMI in the overweight category, and then increase exponentially with BMI through the obese category, especially at BMI levels greater than 35 kg/m^2 (**Fig. 5**).[8]

The nonlinearity of this relationship is important. It implies that, in the obese range, savings from a given reduction in weight will increase with the starting BMI. **Table 1** represents the reduction in annual medical care costs associated with a given percentage reduction in BMI (5%, 10%, 15%, or 20%) from a given starting BMI and cost-savings per person, per year.

As seen in **Table 1**, cost-savings are greater among the class 3 obese (BMI$\geq$40 kg/m^2) than among the class 2 obese (35 kg/m^2$\leq$BMI$\geq$40 kg/m^2), and in turn, the savings

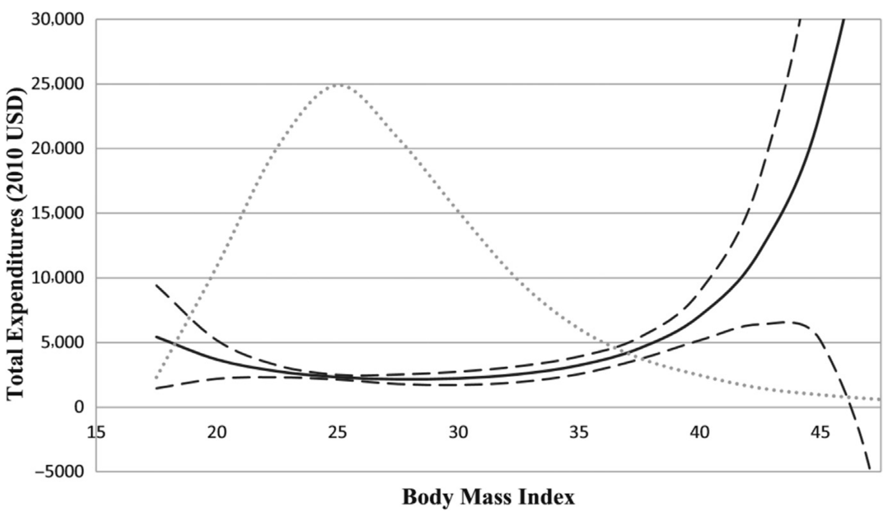

Fig. 5. Predicted total annual medical expenditures. Dashed lines represent 95% confidence intervals. Medical expenditures are denoted by the solid lines and are measured on the left axis. The dotted line indicates the distribution of individuals in the population. (*Data from* Cawley J, Meyerhoefer C, Biener A, et al. Savings in medical expenditures associated with reductions in body mass index among US adults with obesity, by diabetes status. Pharmacoeconomics 2015;33(7):707–22.)

Table 1
Predicted change in total annual medical expenditures ($US) from the instrumental variables model: costs are per person per year

	Reduction in BMI			
Starting BMI (kg/m^2)	**5%**	**10%**	**15%**	**20%**
30	69.35	56.18	−41.36	−234.91
32	202.24	297.58	290.53	203.35
35	528.04	853.15	1030.07	1086.61
37	921.94	1495.47	1839.44	2018.76
40	2137.15	3401.82	4160.56	4606.71
42	3859.08	6017.45	7264.29	7993.11
45	10,030.69	15,071.78	17,742.27	20,229.05

among the class 2 obese are much greater than those among the class 1 obese (30 kg/m^2 $\leq$BMI$\leq$35 kg/m^2). The savings associated with a given reduction in weight can be nearly 13 times greater for those with a BMI of 44 kg/m^2 than for those with a BMI of 35 kg/m^2. A second observation from the table is that the annual medical care costs of the class 1 obese are not that much higher than those of the healthy weight or overweight. A third finding is that doubling the weight loss does not double the savings. Because medical expenditures increase exponentially with BMI in the obese region, the initial 5% weight loss results in more savings than subsequent additional increments of 5% weight loss.[8] These findings are significant because the fastest growing portion of the obese population is in the class 3 category. Public health policy decision-makers should take into consideration the impact of directing limited health care resources toward the class 3 obese population.

Work-Related Costs of Obesity

In 2010, Finkelstein and colleagues[9] published an analysis regarding the cost of obesity in the workplace. They evaluated data for full-time employees from the 2006 MEPS and the 2008 US National Health and Wellness Survey. In aggregate, the cost of obesity among US full-time employees was estimated to be $73.1 billion. Their results revealed that presenteeism (decreased productivity while on the job) was the single largest driver of cost of poor health among full-time employees regardless of BMI. For men, they estimated the cost of obesity in the workplace to be $33.8 billion. Work loss due to presenteeism accounted for 44% of the total. For women, the estimated work loss was $39.3 billion, with presenteeism accounting for 38% of the total.

A Gallup poll conducted in 2011 revealed a significantly higher cost due to absenteeism in unhealthy US full-time workers.[10] Their findings were based on Gallup-Healthways Well-Being Index data collected between January 2 and October 2, 2011. Gallup surveyed 109,875 full-time employees during that time period. Their survey revealed total costs due to absenteeism totaled $153 billion per year. Overweight and obese workers contributed an astonishing $113 billion, or 75% of the total loss. Chronic medical conditions associated with obesity (heart attack, high blood pressure, high cholesterol, cancer, diabetes, asthma, depression, or recurring physical pain in the neck, back, or knees) were found to be the major contributors to lost productivity. They found if the worker had no chronic medical conditions, loss due to absenteeism was 0.34 days per month; with 1 to 2 chronic conditions, loss of 1.1 days per month; 3 or more chronic conditions, a loss of 3.5 days per month was found. By projection, if overweight and obese workers were normal weight, the prevalence of 3+ chronic conditions would be cut in half, reducing losses from absenteeism by $40 billion or about 25%.

Although obesity adversely affects workplace productivity and absenteeism, it also appears to reduce employee earnings. Using data from the National Longitudinal Survey of Youth (NLSY) 1979 Cohort, Cawley[11] reported his findings in 2004 regarding the impact of obesity on overall earnings. His research revealed that weight lowers wages for women: an increase in weight of 2 standard deviations (roughly 64 pounds) is associated with 9% lower wages. The survey revealed the labor market consequences of obesity are greater for women than for men, and greater for white women than for other women. Based on NLSY data, it is impossible to say whether the labor market consequences of obesity are the result of relatively worse health impairing productivity, or to employer discrimination, but other studies suggest that discrimination plays an important role.

ECONOMIC IMPACT OF BARIATRIC AND METABOLIC SURGERY

Morbid obesity is associated with a myriad of serious comorbid conditions, including hypertension, type 2 diabetes mellitus, dyslipidemia, osteoarthritis, and gallbladder disease.[12,13] There have been numerous studies demonstrating the effectiveness in obtaining weight loss[14,15] and marked resolution of comorbidities with bariatric and metabolic surgery.[16] However, determination of the economic impact of these procedures has been challenging due to the complexity of assessing relative short- and long-term costs and cost-savings of bariatric surgery compared with nonsurgical treatment of severe obesity. Although the average initial cost of bariatric surgery in the United States is in the $11,500 to $26,000 range, the cost appears to be at least somewhat offset by reductions in subsequent overall health care costs related to obesity comorbidities.[17]

In 2009, Cremieux and colleagues[18] quantified the effect of bariatric surgery on direct medical costs. They evaluated the time required for third-party payers to recover the initial investment associated with bariatric surgery (ie, the return on investment). Their analysis revealed, after taking into account age, sex, and comorbidities, the initial investment is returned within 4 years for patients who undergo open surgery and within 2 years for patients who undergo laparoscopic surgery. They concluded that even ignoring potential quality-of-life and length-of-life benefits, as well as disability and work loss, third-party payers can rely on bariatric surgery paying for itself through decreased comorbidities within 2 to 4 years. These returns on investment result from reductions in prescription drug costs, physician visit costs, and hospital costs (including emergency department visits and inpatient and outpatient visits).

Diabetes appears to severely compound the costs related to obesity.[19] In 2011, Klein and colleagues[20] evaluated the economic impact of the clinical benefits of bariatric surgery on medical costs and return on investment of the surgery in patients with obesity (BMI>35 kg/m^2) and diabetes. At the time of their study, estimated yearly costs of managing a diabetic patient ($13,243) was more than 5 times that of a patient without diabetes ($2560). In this study, total surgery costs were fully recovered on average after 30 months in 1999 to 2007 for all types of surgeries. Clinical benefits appeared to be the underlying driver of the return on investment results. For diagnostic claims of diabetes, by the first 3-month period after surgery, 40.7% of surgery patients had a diabetes-related claim compared with 72.1% of control patients (P<.001). The drug utilization also had statistically significant results. By the first 3-month period after index, 45.6% of surgery patients had filled a prescription for diabetes medication in the previous 3 months, compared with 90.8% of control patients. At month 6, the percentages were 33.5% and 89.7%, respectively ($P<.001$). Among patients who had insulin claims before index date, insulin claims dropped to 42.8% for surgery patients and remained at 92.4% for control patients at month 3 after index ($P<.001$). Among surgery patients who had claims for noninsulin diabetes medications before surgery, 37.3% had claims for noninsulin medications at month 3, compared with 86.3% of control patients ($P<.001$); 84.5% of surgery patients who had claims for noninsulin medication at index had no claims for any diabetes medications by month 36. By the first 3-month period after index, the average total cost of diabetes medications and supplies for surgery patients was $33 compared with $123 for control patients ($P<.001$); this drug cost-savings trend was sustained for the duration of the study period.

In 2013, Neovius and colleagues[21] reported a long-term evaluation of health care use patterns using the ongoing Swedish Obese Subjects prospective, matched cohort. Previously, these investigators reported a 28% reduction in all-cause mortality after surgery compared with nonsurgical treatment of severe obesity. They assessed health care use over 20 years by obese patients treated conventionally or with bariatric surgery. Health care utilization was measured by hospital days, nonprimary care outpatient physician visits, and drug costs. In the 20 years following their bariatric procedure, surgery patients used a total of 54 mean cumulative hospital days compared with 40 used by those in the control group ($P = .03$). During the years 2 through 6, surgery patients had an accumulated annual mean of 1.7 hospital days versus 1.2 days among control patients ($P \leq .001$). From year 7 to 20, both groups had a mean annual 1.8 hospital days ($P = .95$). Surgery patients had a mean annual 1.3 nonprimary care outpatient visits during the years 2 through 6 versus 1.1 among the controls ($P = .003$), but from year 7, the 2 groups did not differ. From year 7 to 20, the surgery group incurred a mean annual relative decreased cost (US $930) compared with control patients ($1123) ($P \leq .001$). They concluded that, compared with controls, surgically treated patients used more inpatient and nonprimary outpatient care during the first 6-year period after undergoing bariatric surgery but not thereafter. Drug costs from years 7 through 20 were lower for surgery patients than for control patients. In a review of more than 12 cost assessment studies of bariatric surgery, investigators reported that all 12 studies demonstrated cost-effectiveness for bariatric surgery and one-third demonstrated cost-savings.[22]

FACTORS EFFECTING ACCESS TO BARIATRIC AND METABOLIC SURGERY

The evidence clearly demonstrates that bariatric and metabolic surgery is an effective treatment for obese patients, and in particular, obese patients with diabetes. However, approximately 11% of people with a BMI greater than 35 kg/m^2, almost 18 million in the United States alone, may be clinically eligible for surgery, but only 1% of those eligible have undergone surgery.[23] The reasons for this great disparity are multiple and represent complex socioeconomic issues surrounding the very problem that has led to the epidemic levels of obesity in this country.

In 2010, Martin and colleagues[24] reviewed the socioeconomic disparities between the portion of the population that was eligible for bariatric surgery and the patients that actually underwent the procedure. The national bariatric eligible population was identified from the 2005 to 2006 NHANES and compared with the adult noneligible population. The eligible cohort was then compared with the patients who had undergone bariatric surgery in the 2006 Nationwide Inpatient Sample. More than 22 million people were identified as bariatric eligible. Compared with the noneligible group, the bariatric eligible group had significantly lower family incomes, lower education levels, less access to health care, and a greater proportion of nonwhite race (all $P<.001$). Bariatric eligibility was associated with significant adverse economic and health-related markers, including days of work lost (5 vs 8, $P<.001$). More than one-third (35%) of bariatric-eligible patients were either uninsured or underinsured, and 15% had incomes less than poverty level. Almost 88,000 inpatient bariatric surgical procedures were performed in 2006. Three-fourths were performed in white patients with greater median incomes (80%) and private insurance (82%). Significant disparities associated with a decreased likelihood of undergoing bariatric surgery were noted by race, income, insurance type, and gender.

Bhogal and colleagues[25] published a systematic review and meta-analysis in 2015 that evaluated the inequity in the utilization of bariatric surgery. Nine studies providing data on more than 64 million patients were included in the meta-analysis. Of the patients eligible for bariatric surgery, only 260,677 (0.4%) patients received the surgery. Across studies, bariatric surgery-eligible patients who received surgery ranged from less than 1% (23–28) to 5% (29–31). Patients who received bariatric surgery were significantly more likely to be white than non-white (odds ratio [OR] 1.54; 95% confidence interval [CI], 1.08, 2.19), have private insurance than non-private insurance (OR 2.51; 95% CI 1.04, 6.05), and be female than male gender (OR 2.80; 95% CI 2.46, 3.22). Among those who were identified as being non-white, the majority were black (69%), followed by Hispanic (23.2%), other (7.4%), and Asian (0.4%). Additional analysis revealed that the odds of having bariatric surgery were more likely among those living in urban areas versus nonurban areas (OR 1.45; 95% CI 1.42, 1.48), and who were between the ages of 18 and 50 years versus 50 years of age and older (OR 2.39 95% CI 1.28, 4.48).

A study by Chawla and colleagues[26] aimed to further identify the barriers to bariatric and metabolic surgery, and second, to develop recommendations for stakeholders to improve patient access to surgery. In their review, they identified 6 categories that reflected significant barriers to patient access to bariatric surgery: (1) obesity bias: obese patients have been uniquely targeted as lacking willpower and ignoring healthy choices, resulting in a disproportionate focus on changes in patient behavior as a prerequisite to treatment; (2) patient-related barriers: cost, perceived risks associated with surgery, perception of one's own weight, and a lack of understanding of the impact of excess weight on life expectancy and morbidity; (3) current BMI-based selection criteria: the widespread use of a uniform BMI-centric criterion for patient selection across the world results in barriers to access. They recommend a shift away from a strict BMI-centric model to a comorbidity-centric model that would place the focus on complications rather than the weight itself; (4) access to Centers of Excellence or qualified surgeons; (5) infrequent clinical guideline updates and data gaps: approximately one-half of the guidelines (8/19) are largely based on the first US National Institutes of Health guideline, dating back to 1998. Guideline recommendations have not significantly changed in 16 years despite significant safety and efficacy data; (6) restrictive third-party payer coverage. Their study calls for updated public policies, patient education, updated reimbursement policies, and additional long-term data demonstrating the effectiveness of bariatric surgery.

SUMMARY

Based on scientific evidence, it is becoming increasingly clear and accepted that the only existing therapy for severe obesity that has been shown to result in clinically significant and durable weight loss is bariatric surgery. Furthermore, it has been shown that weight loss after bariatric surgery results in significant improvements in obesity comorbidity, quality of life, and reduced mortality. Short- and long-term complications of surgery, although not insignificant, appear to be reasonable and justifiable compared with the long-term risks of severe obesity. Economic analysis has demonstrated that bariatric surgery is cost-effective and perhaps cost-saving in certain subgroups such as those with type 2 diabetes. In addition, there is evidence that bariatric surgery may reduce indirect costs of obesity by improving workplace productivity and reducing absenteeism. Despite the aforementioned health and economic benefits of bariatric surgery, a relatively small percentage of patients who may benefit from surgery are receiving access to this very effective treatment. Much greater attention by health care providers, insurance carriers, and public health officials is required in order to address this tremendous disparity in access to the most effective treatment of severe obesity, perhaps the most threatening public health concern of our time.

REFERENCES

1. Weiner RA. Indications and principles of metabolic surgery. Chirurg 2010;81(4):379–94 [in German].
2. Ogden CL, Carroll MD, Fryar CD, et al. Prevalence of obesity among adults and youth: United States, 2011-2014. NCHS Data Brief 2015;(219):1–8.
3. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Healthy People 2020 topics and objectives: nutrition and weight status. Washington, DC. Available at: http://www.healthypeople.gov/2020/topics-objectives/topic/nutrition-and-weight-status?topicid=29. Accessed February 1, 2016.
4. American Heart Association. Understanding childhood obesity. Available at: http://www.heart.org/HEARTORG/HealthyLiving/HealthyKids/ChildhoodObesity/What-is-childhood-obesity_UCM_304347_Article.jsp#.VqzVYo-cHid. Accessed February 1, 2016.
5. Finkelstein EA. How big of a problem is obesity? Surg Obes Relat Dis 2014;10(4):569–70.
6. Finkelstein EA, Trogdon JG, Cohen JW, et al. Annual medical spending attributable to obesity: payer- and service-specific estimates. Health Aff (Millwood) 2009;28(5):w822–31.
7. Cawley J, Meyerhoefer C. The medical care costs of obesity: an instrumental variables approach. J Health Econ 2012;31(1):219–30.
8. Cawley J, Meyerhoefer C, Biener A, et al. Savings in medical expenditures associated with reductions in body mass index among US adults with obesity, by diabetes status. Pharmacoeconomics 2015;33(7):707–22.
9. Finkelstein EA, DiBonaventura Md, Burgess SM, et al. The costs of obesity in the workplace. J Occup Environ Med 2010;52(10):971–6.
10. Gallup. Available at: http://www.gallup.com/poll/150026/unhealthy-workers-absenteeism-costs-153-billion.aspx. Accessed February 1, 2016.
11. Cawley J. The impact of obesity on wages. J Hum Resour 2004;39(2):451–74. Body Weight and Women's Labor Market Outcomes, NBER Working Paper No. 7841.
12. National Heart, Lung, and Blood Institute Web site. The practical guide: identification, evaluation, and treatment of overweight and obesity in adults. 2000. Available at: http://www.nhlbi.nih.gov/guidelines/obesity/prctgd_c.pdf. Accessed June 12, 2007.
13. Hensrud DD, Klein S. Extreme obesity: a new medical crisis in the United States. Mayo Clin Proc 2006;81(Suppl 10):S5–10.

14. Zhao Y, Encinosa W. Bariatric surgery utilization and outcomes in 1998 and 2004. Rockville (MD): Agency for Healthcare Research and Quality; 2007. Statistical brief 23.
15. Kendrick ML, Daken GF. Surgical approaches to obesity. Mayo Clin Proc 2006; 81(Suppl 10):S18–24.
16. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. JAMA 2004;292(14):1724–37 [Erratum appears in JAMA 2005;293(14):1728].
17. Salem L, Jensen Flum CC, Flum DR. Are bariatric surgical outcomes worth their cost? A systematic review. J Am Coll Surg 2005;200(2):270–8.
18. Cremieux PY, Buchwald H, Shikora SA, et al. A study on the economic impact of bariatric surgery. Am J Manag Care 2008;14(9):589–96.
19. Campbell RK, Martin TM. The chronic burden of diabetes. Am J Manag Care 2009;15:S248–54.
20. Klein S, Ghosh A, Cremieux PY, et al. Economic impact of the clinical benefits of bariatric surgery in diabetes patients with BMI $\geq$35 kg/m^2. Obesity (Silver Spring) 2011;19(3):581–7.
21. Neovius M, Narbro K, Keating C, et al. Health care use during 20 years following bariatric surgery. JAMA 2012;308(11):1132–41.
22. Chang SH, Stoll C, Colditz GA. Cost effectiveness of bariatric surgery: should it be universally available? Maturitas 2011;69(3):230–8.
23. Dixon JB. Adjustable gastric banding and conventional therapy for type 2 diabetes. JAMA 2008;299(3):316–23.
24. Martin M, Beekley A, Kjorstad R, et al. Socioeconomic disparities in eligibility and access to bariatric surgery: a national population-based analysis. Surg Obes Relat Dis 2010;6(1):8–15.
25. Bhogal SK, Reddigan JI, Rotstein OD, et al. Inequity to the utilization of bariatric surgery: a systematic review and meta-analysis. Obes Surg 2015;25(5):888–99.
26. Chawla AS, Hsiao CW, Romney MC, et al. Gap between evidence and patient access: policy implications for bariatric and metabolic surgery in the treatment of obesity and its complications. Pharmacoeconomics 2015;33(7):629–41.