

## TRENDS

## Prevalence And Trends In Obesity Among Aged And Disabled U.S. Medicare Beneficiaries, 1997–2002

The rise in obesity among beneficiaries, along with expansions in treatment coverage, could greatly increase obesity-related Medicare spending.

by **Jalpa A. Doshi, Daniel Polsky, and Virginia W. Chang**

**ABSTRACT:** Given Medicare's recent national coverage decision on bariatric surgery, as well as potential coverage expansions for other obesity-related treatments, data on obesity in the Medicare population have great relevance. Using nationally representative data, we estimate that between 1997 and 2002, the prevalence of obesity in the Medicare population increased by 5.6 percentage points, or about 2.7 million beneficiaries. By 2002, 21.4 percent of aged beneficiaries and 39.3 percent of disabled beneficiaries were obese, compared with 16.4 percent and 32.5 percent, respectively, in 1997. Using 2002 data, we estimate that three million beneficiaries would be eligible for bariatric surgery coverage under current Medicare policy. [*Health Affairs* 26, no. 4 (2007): 1111–1117; 10.1377/hlthaff.26.4.1111]

ON 21 FEBRUARY 2006 the Centers for Medicare and Medicaid Services (CMS) expanded national coverage for certain bariatric surgeries to Medicare beneficiaries with a body mass index (BMI) of 35 or greater, at least one comorbidity related to obesity, and no success with medical treatment for obesity.<sup>1</sup> Given this policy development, data on obesity in this population have great relevance. The rising burden of obesity in U.S. adults and children has been widely documented.<sup>2</sup> However, studies on the prevalence of obesity are sparse for elderly Medicare beneficiaries and nonexistent for beneficiaries under age sixty-five who are en-

titled to Medicare through Social Security Disability Insurance (SSDI).<sup>3</sup> Data on obesity in the oft-forgotten group of younger disabled beneficiaries are particularly important, because they are more likely than elderly beneficiaries to undergo bariatric surgery.<sup>4</sup> Furthermore, little is known about the health of obese beneficiaries or their prevalence of obesity-related comorbidities, even though Medicare will reimburse obesity-related treatments (including bariatric surgery) only for obese beneficiaries with diseases resulting in or worsened by obesity.

In this study we examine national trends from 1997 to 2002 in the prevalence of obesity

.....  
*Jalpa Doshi (jdoshi@mail.med.upenn.edu) is a research assistant professor of medicine at the University of Pennsylvania (UPenn) School of Medicine in Philadelphia. Daniel Polsky is an associate professor there. Virginia Chang is an assistant professor of medicine at the UPenn School of Medicine, an assistant professor of sociology at UPenn, and a staff physician at the Philadelphia Veterans Affairs Medical Center.*

among aged and disabled Medicare beneficiaries. We also examine the prevalence of obesity-related comorbidities and other health characteristics in this population.

### Study Data And Methods

■ **Data.** The study used data from the Medicare Current Beneficiary Survey (MCBS), a nationally representative survey of Medicare beneficiaries.<sup>5</sup> This is a premier data source for information on beneficiaries' health care experiences. Each year approximately 12,000 beneficiaries sampled from Medicare enrollment files (both aged and disabled and living both in the community and in institutions) are surveyed using computer-assisted personal interviewing. We examined all beneficiaries in the 1997–2002 MCBS Cost and Use files to estimate the prevalence of obesity. Within each annual cross-section, we stratified the sample by the beneficiary's Medicare entitlement status (aged or nonelderly disabled). Although people with end-stage renal disease are also entitled to Medicare, this group was too small to be examined separately. Data from the latest available MCBS year (2002) were used to examine obesity-related comorbidities and health characteristics of obese aged and disabled beneficiaries. Although this was not a primary focus of our analysis, we also estimated obesity prevalence rates stratified by sex and race.<sup>6</sup>

■ **Methods.** To compute BMI, we used self-reported height and weight collected by MCBS interviewers during the in-home surveys. The four weight classes were underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25–29.9), and obese (BMI ≥ 30). Obesity was further classified as Class I (BMI 30–34.9), Class II (BMI 35–39.9), and Class III (BMI ≥ 40). We examined the prevalence of obesity-related diseases for which self-reports were available: diabetes, heart disease, hypertension, lung disease, and osteoarthritis. We also examined other health characteristics such as self-reported health status, limitations in activities of daily living (ADLs), and history of mental illness. These characteristics were examined by Medicare

entitlement status among all obese beneficiaries and among those with a BMI of 35 or greater (Class II or III obesity), the subgroup that would meet BMI requirements for coverage of bariatric surgery under Medicare's recent policy decision. We used the characteristics of normal-weight beneficiaries as reference points within each entitlement group. We used respondent-level weighting to generate nationally representative estimates of the Medicare population. All analyses were conducted in Stata 8.0, using the survey ("svy") estimators.

### Study Findings

The study samples in each year from 1997 to 2002 included approximately 12,500 beneficiaries. These annual samples represented a weighted Medicare population of 39.7 million in 1997 and 41.7 million in 2002. The age, race, and sex distribution did not change significantly over this time period (56.1 percent female, 85.0 percent white, mean age of 72.2 years [standard deviation = 14.1] in 2002).

■ **Weight prevalence and trends.** Over the six years, the prevalence of normal weight declined significantly, the prevalence of overweight remained constant, and the prevalence of obesity increased significantly in both aged and disabled beneficiaries (Exhibit 1). The prevalence of obesity among all beneficiaries increased 5.6 percentage points (31 percent relative increase) between 1997 and 2002 ( $p < 0.001$ ). By 2002, 21.4 percent of aged beneficiaries and 39.3 percent of disabled beneficiaries were obese compared with 16.4 percent and 32.5 percent, respectively, in 1997. One of the largest relative increases occurred in the prevalence of Class III obesity, followed by Class II. In each year between 1997 and 2002, the prevalence of obesity was almost twofold higher and the prevalence of Class III obesity was fivefold higher in disabled beneficiaries than in aged beneficiaries.<sup>7</sup>

■ **Health characteristics.** In both the aged and disabled groups, obese beneficiaries were significantly more likely than normal-weight beneficiaries to have one of the five examined comorbidities (Exhibit 2). For in-

**EXHIBIT 1**  
**Distribution Of Weight Classes Among Medicare Beneficiaries, By Year And Medicare Entitlement Status, 1997–2002**

Beneficiary group, weight class	Prevalence, by year						Absolute change, 1997– 2002	Relative change	p value <sup>a</sup>
	1997	1998	1999	2000	2001	2002			
All (millions)	39.7	40.1	40.3	40.5	41.0	41.7	2.0	5%	
Missing	1.1%	1.4%	1.0%	1.0%	1.1%	1.2%	0.1%	9	0.66
Underweight	4.3	3.8	3.6	3.6	3.5	3.0	-1.3	-30	<0.001
Normal weight	40.1	39.8	38.2	36.9	36.0	35.4	-4.7	-12	<0.001
Overweight	36.2	35.6	35.8	36.0	36.9	36.5	0.3	1	0.68
Obese	18.3	19.4	21.4	22.5	22.5	23.9	5.6	31	<0.001
Class I obese	12.9	13.5	14.8	15.3	15.3	16.0	3.1	24	<0.001
Class II obese	3.6	3.9	4.6	4.9	4.7	5.2	1.6	44	<0.001
Class III obese	1.8	2.0	2.0	2.3	2.5	2.7	0.9	50	<0.001
Aged (millions)	34.8	34.9	35.0	35.0	35.4	35.8	1.0	3%	
Missing	1.1%	1.4%	1.0%	1.1%	1.2%	1.3%	0.2%	18	0.86
Underweight	4.5	4.0	3.8	3.6	3.5	3.0	-1.5	-33	<0.001
Normal weight	41.3	41.2	39.8	38.5	37.4	37.0	-4.3	-10	<0.001
Overweight	36.8	36.1	36.5	36.9	37.9	37.3	0.5	1	0.41
Obese	16.4	17.3	19.0	20.0	20.0	21.4	5.0	30	<0.001
Class I obese	12.2	12.8	14.2	14.5	14.5	15.3	3.1	25	<0.001
Class II obese	3.1	3.2	3.6	4.0	3.9	4.5	1.4	45	<0.001
Class III obese	1.1	1.3	1.2	1.5	1.6	1.6	0.5	45	0.011
Disabled under age 65 (million)	4.8	5.0	5.2	5.4	5.6	5.8	1.0	21%	
Missing	0.9%	1.3%	1.5%	0.7%	0.7%	1.2%	0.3%	33	0.21
Underweight	2.9	2.4	2.7	3.4	3.2	3.1	0.2	7	0.74
Normal weight	32.0	30.0	27.5	26.9	27.1	25.3	-6.7	-21	<0.001
Overweight	31.6	31.8	31.0	29.9	30.9	31.2	-0.4	-1	0.77
Obese	32.5	34.6	37.3	39.1	38.1	39.3	6.8	21	<0.01
Class I obese	18.6	18.7	19.4	20.4	20.0	20.6	2.0	11	0.19
Class II obese	7.7	8.8	11.1	10.8	10.2	9.5	1.8	23	0.12
Class III obese	6.3	7.1	6.8	8.0	7.9	9.2	2.9	46	<0.01

**SOURCE:** Medicare Current Beneficiary Survey, 1997–2002.

**NOTE:** Body mass index (BMI) was used to define weight classes (see details in text).

<sup>a</sup>Based on Pearson chi-square statistic corrected for survey design.

stance, the prevalence of diabetes was almost three times higher in obese aged beneficiaries and two times higher in obese disabled beneficiaries than in their normal-weight counterparts. Most obese aged (93 percent) and obese disabled (84.5 percent) beneficiaries had at least one comorbidity. The prevalence of at least one comorbidity among beneficiaries with Class II or III obesity was similarly high. In both groups, more than two of five obese beneficiaries and more than half of those with Class II or III obesity had three or more of these comorbidities.

Almost one-third of obese aged and two-thirds of obese disabled beneficiaries reported fair to poor health; this proportion was signifi-

cantly higher than in their normal-weight counterparts. In addition, obese beneficiaries were significantly more likely to report an ADL limitation than normal-weight beneficiaries in both the aged and disabled groups. Functional limitations were highest among obese disabled beneficiaries, in whom the prevalence of three or more ADL limitations was 1.6 times greater than in normal-weight disabled beneficiaries and two times greater than in obese aged beneficiaries. The prevalence of fair to poor health and ADL limitations in beneficiaries with Class II or III obesity was even higher.

■ **Mental condition.** About 22 percent of all obese (and Class II or III obese) disabled

**EXHIBIT 2**  
**Health Characteristics Of Medicare Beneficiaries, By Selected Weight Classes And Medicare Entitlement Status, 2002**

Health characteristics	Aged			Disabled under age 65		
	Normal weight	Obese	Class II or III obese	Normal weight	Obese	Class II or III obese
All (millions)	13.2	7.7	2.2	1.5	2.3	1.1
Obesity-related comorbidities						
Hypertension	51.6%	72.8% <sup>a</sup>	76.1% <sup>a</sup>	37.2%	64.1% <sup>a,b</sup>	70.8% <sup>a</sup>
Osteoarthritis	51.6	66.5 <sup>a</sup>	74.4 <sup>a</sup>	40.8	57.9 <sup>a,b</sup>	60.3 <sup>a,c</sup>
Cardiovascular disease <sup>d</sup>	40.9	45.8 <sup>a</sup>	50.2 <sup>a</sup>	30.2	41.9 <sup>a</sup>	44.1 <sup>a</sup>
Diabetes	12.7	34.3 <sup>a</sup>	42.8 <sup>a</sup>	15.2	30.2 <sup>a</sup>	37.1 <sup>a</sup>
Lung disease <sup>e</sup>	13.9	17.4 <sup>a</sup>	20.7 <sup>a</sup>	20.4	24.4 <sup>b</sup>	29.0 <sup>a,c</sup>
At least one obesity-related comorbidity <sup>f</sup>	82.7	93.1 <sup>a</sup>	95.7 <sup>a</sup>	68.0	84.5 <sup>a,b</sup>	85.9 <sup>a,c</sup>
Number of obesity-related comorbidities <sup>f</sup>						
0	17.3	6.9 <sup>a</sup>	4.3 <sup>a</sup>	32.0	15.5 <sup>a,b</sup>	14.1 <sup>a,c</sup>
1	27.8	18.4 <sup>a</sup>	13.6	23.8	18.9	17.0
2	29.6	28.6	26.6	24.9	23.5 <sup>b</sup>	18.4 <sup>c</sup>
3–5	25.3	46.1 <sup>a</sup>	55.5 <sup>a</sup>	19.3	42.1 <sup>a</sup>	50.5 <sup>a</sup>
Fair to poor health	24.2	29.2 <sup>a</sup>	36.6 <sup>a</sup>	59.2	65.5 <sup>a,b</sup>	70.0 <sup>a,c</sup>
ADL limitations						
0	69.1	60.9 <sup>a</sup>	46.0 <sup>a</sup>	52.9	42.8 <sup>a,b</sup>	37.6 <sup>a,c</sup>
1–2	17.1	25.1 <sup>a</sup>	34.2 <sup>a</sup>	30.0	29.8 <sup>b</sup>	32.9 <sup>a</sup>
3–6	13.8	14.0	19.9 <sup>a</sup>	17.1	27.5 <sup>a,b</sup>	29.5 <sup>a,c</sup>
Mental condition as primary or secondary cause of Medicare entitlement among disabled	– <sup>g</sup>	– <sup>g</sup>	– <sup>g</sup>	23.4	21.9	22.0
Any history of mental illness	18.9	18.1	20.8	54.3	54.9 <sup>b</sup>	60.3 <sup>c</sup>

**SOURCE:** Medicare Current Beneficiary Survey, 2002.

**NOTE:** ADL is activities of daily living.

<sup>a</sup>Significantly different from normal weight (body mass index [BMI] 18.5–24.9) counterpart, *p* < 0.05.

<sup>b</sup>Significantly different from obese (BMI ≥ 30) aged beneficiaries, *p* < 0.05.

<sup>c</sup>Significantly different from Class II or III obese (BMI ≥ 35) aged beneficiaries, *p* < 0.05.

<sup>d</sup>Includes myocardial infarction, angina, coronary heart disease, congestive heart failure, valve disease, arrhythmias, and other heart problems.

<sup>e</sup>Includes asthma, chronic obstructive pulmonary disease (COPD), and emphysema.

<sup>f</sup>Includes the five comorbidities listed here (hypertension, osteoarthritis, cardiovascular disease, diabetes, and lung disease).

<sup>g</sup>Not applicable.

beneficiaries were entitled to Medicare because of a mental disability. This rate was similar in normal-weight disabled beneficiaries. Obese and normal-weight beneficiaries did not differ in history of mental illness in either the aged or the disabled group; however, the prevalence was three times higher in obese disabled beneficiaries than in obese aged beneficiaries.

**Summary And Discussion**

Between 1997 and 2002, the prevalence of obesity in the Medicare population increased

5.6 percentage points, by about 2.7 million obese beneficiaries. This percentage increase was similar among aged and disabled Medicare beneficiaries; by 2002, about one in five aged beneficiaries were obese, compared with two in five disabled beneficiaries. To our knowledge, our study is the first to examine obesity among the Medicare disabled under age sixty-five—the fastest-growing segment of the Medicare population.<sup>8</sup> We found that obesity rates in disabled Medicare beneficiaries were not only double the rates in aged

beneficiaries but also much higher than those reported in the general U.S. adult population younger than age sixty-five in 2002.<sup>9</sup>

As reported previously for the general U.S. adult population, we found that obese Medicare beneficiaries were more likely than their normal-weight counterparts to be living with conditions such as diabetes, hypertension, cardiovascular disease, lung disease, and osteoarthritis.<sup>10</sup> About 93 percent of obese aged and 85 percent of obese disabled beneficiaries had at least one of these five comorbidities. These estimates are probably conservative because our survey data did not capture other obesity-related comorbidities, such as sleep apnea, hypothyroidism, and Cushing's syndrome.

Regardless, these findings highlight two important issues. First, they point to the potentially high burden of obesity on Medicare spending, given the treatment-intensive nature of these comorbidities. Second, they indicate that a majority of obese Medicare beneficiaries are already eligible for obesity-related treatments (including bariatric surgery) under current Medicare coverage, which reimburses such services only when they are an integral and necessary part of a course of treatment for at least one disease resulting in or aggravated by obesity. Also, on 15 July 2004, the CMS removed the language "obesity is not considered an illness" from its *Coverage Issues Manual*.<sup>11</sup> Although treatments for obesity alone are still not covered, removal of this language reduces barriers for anti-obesity treatments for obese beneficiaries without obesity-related comorbidities. Individuals or organizations wishing to modify current coverage determinations can now request a national coverage determination (NCD) on each treatment and potentially receive favorable decisions from the CMS. As our study shows, younger disabled beneficiaries are more likely to have obesity alone than are obese aged beneficiaries, and any such future changes in coverage policy will more likely benefit this group.

**"Approximately three million beneficiaries are now potentially eligible for Medicare coverage for bariatric surgery."**

■ **Eligibility and costs for bariatric surgery.**

This study provides important information in light of the CMS's recent coverage decision on bariatric surgery.<sup>12</sup> We found that 6.1 percent (approximately 2.2 million) of elderly and 18.7 percent (approximately 1.1 million) of disabled beneficiaries had Class II or III obesity and that 96 percent (approximately 2.1 million) and 86 percent (approximately 0.95 million) of them, respectively, had at least one obesity-related comorbidity in 2002. This

identifies approximately three million Medicare beneficiaries who are now potentially eligible for Medicare coverage for bariatric surgery. Because this surgery, on average, costs \$10,000–\$15,000 per Medicare patient, total costs for the Medicare program would be \$30–\$45 billion if all such eligibles received surgery.<sup>13</sup>

If the CMS were to expand its current NCD to also include Class III obese beneficiaries without comorbidities—a group that the National Institutes of Health (NIH) consensus statement also considers eligible for bariatric surgery and that was in fact included in the original NCD request to the CMS—then the number of potential eligibles would increase by another 100,000, and Medicare costs would further increase by \$1–\$1.5 billion if all such eligibles received bariatric surgery.<sup>14</sup>

Although the total Medicare costs of surgery could be substantial, many morbidly obese beneficiaries, who often do not benefit from nonsurgical treatments, might benefit from bariatric surgery, potentially reducing long-term Medicare spending.<sup>15</sup> A recent meta-analysis found that the overall percentage of excess weight loss across all types of bariatric procedures was 61.2 percent.<sup>16</sup> As a result of that weight loss, comorbidities such as diabetes, hyperlipidemia, obstructive sleep apnea, and hypertension improved or resolved in a majority of patients. In terms of safety, one study reported ninety-day mortality rates after bariatric surgery to be low (approximately 1 percent) in both aged and disabled beneficia-

ries when the procedure was performed by surgeons with high bariatric procedural volumes.<sup>17</sup> However, most studies to date have been conducted in the general adult population, and there is a strong need to assess the health benefits, risks, and cost-benefits of bariatric surgery specifically in the Medicare population.

■ **Predicament for obese disabled beneficiaries.** Our results also highlight the predicament of obesity prevention and treatment, particularly in disabled beneficiaries. More obese disabled beneficiaries have fair to poor health and functional limitations than do their normal-weight and obese aged counterparts. Although the causal pathway between physical limitations and obesity can work in both directions, the physical disabilities and high levels of functional limitations in these beneficiaries indicate that exercise and physical activity might not control or reduce obesity in this group. Hence, many of these beneficiaries might require more radical treatments, such as bariatric surgery. However, given the need for long-term treatment and follow-up, as well as for patients' understanding and acceptance of the permanent lifestyle changes caused by the procedure, approval for bariatric surgery generally requires a mental health professional's determination that the patient is a psychologically appropriate candidate. Consequently, many obese disabled beneficiaries who would otherwise be eligible might still not qualify for surgery, because of the high prevalence of mental disorders in this group.

■ **Validity of our estimates.** Our estimates may be conservative, given the fact that height and weight data were self-reported. Using data from the 1999–2002 National Health and Nutrition Examination Survey (NHANES), which has both self-reported and measured height and weight data, we estimated the extent of potential misclassification across weight classes defined using self-reported data.<sup>18</sup> If one were to apply corrections to our MCBS estimates using this NHANES analysis, an additional 950,000 beneficiaries, or a total of four million beneficiaries, would be potentially eligible for bariatric

surgery.

■ **Implications for the future.** Our study provides important information on the rising burden of obesity in the Medicare population. On the one hand, the increase in the number of obese Medicare beneficiaries as the baby boomers age, compounded by an increasing demand for treatment options and CMS expansions in treatment coverage, might greatly increase obesity-related Medicare spending.<sup>19</sup> On the other hand, obese Medicare beneficiaries might benefit from prevention, resolution, or improvement in obesity-related comorbidities, with consequent reductions in Medicare spending. Studies of the health benefits, risks, costs, and cost-effectiveness of anti-obesity treatments in this vulnerable population are urgently needed to help inform future Medicare coverage decisions.

.....  
*The authors are grateful for funding support from the University Research Foundation, University of Pennsylvania, Philadelphia; the National Institute of Child Health and Human Development (Grant no. K12-HD043459); and the National Institute on Aging (Grant no. R01-AG024451). The funding organizations played no role in the design and conduct of the study; the collection, management, analysis, and interpretation of the data; or the preparation, review, or approval of the manuscript.*

## NOTES

- Centers for Medicare and Medicaid Services, "Decision Memo for Bariatric Surgery for the Treatment of Morbid Obesity," 2006, <http://www.cms.hhs.gov/mcd/viewdecisionmemo.asp?id=160> (accessed 4 May 2007).
- K.M. Flegal et al., "Overweight and Obesity in the United States: Prevalence and Trends, 1960–1994," *International Journal of Obesity and Related Metabolic Disorders* 22, no. 1 (1998): 39–47; K.M. Flegal et al., "Prevalence and Trends in Obesity among U.S. Adults, 1999–2000," *Journal of the American Medical Association* 288, no. 14 (2002): 1723–1727; D.S. Freedman et al., "Trends and Correlates of Class 3 Obesity in the United States from 1990 through 2000," *Journal of the American Medical Association* 288, no. 14 (2002): 1758–1761; and A.A. Hedley et al., "Prevalence of Overweight and Obesity among U.S. Children, Adolescents, and Adults, 1999–2002," *Journal of the American Medical Association* 291, no. 23 (2004): 2847–2850.

3. Flegal et al., "Prevalence and Trends"; D.E. Arterburn, P.K. Crane, and S.D. Sullivan, "The Coming Epidemic of Obesity in Elderly Americans," *Journal of the American Geriatrics Society* 52, no. 11 (2004): 1907-1912; and K.M. Flegal, B.I. Graubard, and D.F. Williamson, "Methods of Calculating Deaths Attributable to Obesity," *American Journal of Epidemiology* 160, no. 4 (2004): 331-338.
4. CMS, "Decision Memo."
5. G.S. Adler, "A Profile of the Medicare Current Beneficiary Survey," *Health Care Financing Review* 15, no. 4 (1994): 153-163.
6. Estimates stratified by sex and race are available as an online supplement at <http://content.healthaffairs.org/cgi/content/full/26/4/1111/DC1>.
7. Obesity prevalence rates by sex and race are presented in appendix Tables 1A and 1B, respectively; *ibid*.
8. G.F. Riley, J.D. Lubitz, and N. Zhang, "Patterns of Health Care and Disability for Medicare Beneficiaries under Sixty-five," *Inquiry* 40, no. 1 (2003): 71-83.
9. Hedley et al., "Prevalence of Overweight."
10. A. Must et al., "The Disease Burden Associated with Overweight and Obesity," *Journal of the American Medical Association* 282, no. 16 (1999): 1523-1529.
11. CMS, "National Coverage Decision (NCD) for Treatment of Obesity," 2004, [http://www.cms.hhs.gov/mcd/viewncd.asp?ncd\\_id=40.5&ncd\\_version=2&basket=ncd%3A40%2E5%3A2%3ATreatment+of+Obesity](http://www.cms.hhs.gov/mcd/viewncd.asp?ncd_id=40.5&ncd_version=2&basket=ncd%3A40%2E5%3A2%3ATreatment+of+Obesity) (accessed 4 May 2007).
12. CMS, "Decision Memo."
13. E.H. Livingston, "Hospital Costs Associated with Bariatric Procedures in the United States," *American Journal of Surgery* 190, no. 5 (2005): 816-820; W.E. Encinosa et al., "Use and Costs of Bariatric Surgery and Prescription Weight-Loss Medications," *Health Affairs* 24, no. 4 (2005): 1039-1046; and L.D. Angus et al., "DRG, Costs, and Reimbursement Following Roux-en-Y Gastric Bypass: An Economic Appraisal," *Obesity Surgery* 13, no. 4 (2003): 591-595.
14. "Gastrointestinal Surgery for Severe Obesity: Proceedings of a National Institutes of Health Consensus Development Conference," *American Journal of Clinical Nutrition* 55, no. 2 Supp. (1992): 487S-619S. The original formal NCD request for bariatric surgery made in May 2005 requested that "the population eligible for bariatric surgery should include persons with a BMI  $\geq 40$  kg/m<sup>2</sup> regardless of co-morbidity or a BMI  $\geq 35$  kg/m<sup>2</sup> with obesity related co-morbidities."
15. K. Fujioka, "Management of Obesity as a Chronic Disease: Nonpharmacologic, Pharmacologic, and Surgical Options," *Obesity Research* 10, no. 2 Supp. (2002): 116S-123S.
16. H. Buchwald et al., "Bariatric Surgery: A Systematic Review and Meta-Analysis," *Journal of the American Medical Association* 292, no. 14 (2004): 1724-1737.
17. D.R. Flum et al., "Early Mortality among Medicare Beneficiaries Undergoing Bariatric Surgical Procedures," *Journal of the American Medical Association* 294, no. 15 (2005): 1903-1908.
18. If one accounts for the misclassifications in weight class defined by self-reported height and weight data, the unadjusted correction factors to be multiplied with our MCBS prevalence estimates would be 0.92 for nonobesity rates, 1.28 for overall obesity rates, 1.24 for Class I obesity rates, and 1.31 for Class II or III obesity rates. These factors were obtained as follows. Using the 1999-2002 NHANES, we identified respondents covered by Medicare and having both self-reported and measured height and weight data. For each of these NHANES respondents, we then calculated and compared their weight class (non-obese, Class I obese, and Class II or III obese) based on the self-reported height and weight, and another one based on their measured height and weight. For instance, we found that 92 percent of those who were classified as Class II or III obese based on self-reported BMI were confirmed as Class II or III obese using measured BMI. However, 7.5 percent were classified as Class I obese and 0.4 percent as nonobese based on measured BMI. Similarly, 80 percent of those classified as Class I obese based on self-reported BMI were confirmed as Class I obese based on measured BMI, whereas 16 percent were classified as Class II or III obese and 4 percent were classified as nonobese based on measured BMI (additional data available upon request from authors; send e-mail to [jdoshi@mail.med.upenn.edu](mailto:jdoshi@mail.med.upenn.edu)). Although we estimate correction factors using measured height and weight, they should be interpreted in light of the fact that actual (measured) height has been found to decline with age as a result of vertebral bone loss and spinal curvature in older adults. Because BMI is inversely proportional to the square of height, this age-associated height loss may increase the value of BMI without an increase in adiposity. J.D. Sorkin et al., "Longitudinal Change in Height for Men and Women: Implications for Interpretation of the Body Mass Index: The Baltimore Longitudinal Study of Aging," *American Journal of Epidemiology* 150, no. 9 (1999): 969-977.
19. Arterburn et al., "The Coming Epidemic"; and Encinosa et al., "Use and Costs."