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The Impact Of Obesity On Rising Medical Spending

Higher spending for obese patients is mainly attributable to treatment for diabetes and hypertension.

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ABSTRACT:

Obese people incur higher health care costs at a given point in time, but how rising obesity rates affect spending growth over time is unknown. We estimate obesity-attributable health care spending increases between 1987 and 2001. Increases in the proportion of and spending on obese people relative to people of normal weight account for 27 percent of the rise in inflation-adjusted per capita spending between 1987 and 2001; spending for diabetes, 38 percent; spending for hyperlipidemia, 22 percent; and spending for heart disease, 41 percent. Increases in obesity prevalence alone account for 12 percent of the growth in health spending.

Evaluating the causes and health benefits of rising health care spending is important for designing effective cost containment interventions. The introduction of new medical technology is thought to account for most of the growth in health care spending, while aging and population growth account for smaller portions of the rise.[1] Several studies have estimated the impact of smoking, obesity, and other risk factors on spending at a given point in time. However, studies have not addressed the relationship between the increase in obesity prevalence and the growth in costs over time. Through 1980 there were only moderate changes in the prevalence of obesity, justifying its omission from the list of sources of health spending growth.[2] However, since 1980 the prevalence of obesity has doubled to 30 percent of the adult population; it has increased by eight percentage points since 1990.[3]

The risk of developing diabetes, gallstones, hypertension, heart disease, hyperlipidemia, stroke, and some forms of cancer is higher among obese people.[4] Moreover, the risk of death is higher among moderately and severely overweight men and women, regardless of age. Among the near-elderly (ages 50–69) medical care spending among the severely obese (body mass index, or BMI, 35.0 or higher) is 60 percent higher than for those of normal weight.[5] Recent studies have estimated that health care spending is approximately 36 percent higher among obese adults under age sixty-five.[6] These findings lead to the question: To what degree do increases in obesity prevalence and relative costs contribute to the growth in health care spending?

In this paper we estimate the share of spending growth attributable to changes in obesity and relative per capita spending among obese people, using nationally representative data from 1987 and 2001. We also examine the contribution of obesity-related factors to the growth in spending

for three conditions clinically linked to obesity: diabetes, hyperlipidemia, and heart disease (including hypertension).

Study Data And Methods

Data sources. The data for our analysis were drawn from the 1987 National Medical Expenditure Survey (NMES) and the 2001 Medical Expenditure Panel Survey, Household Component (MEPS-HC).[7] These surveys, conducted by the Agency for Healthcare Research and Quality (AHRQ), provide nationally representative estimates of health care spending among the noninstitutionalized civilian U.S. population. A more detailed description of both surveys has been published elsewhere.[8] The 1987 survey includes self-reported measures of each respondent's height and weight. We used these data to construct the BMI (calculated as weight in kilograms divided by the square of height in meters) for each respondent in the sample and classified respondents as underweight (BMI under 18.5), normal weight (BMI between 18.5 and 24.9), overweight (BMI between 25.0 and 29.9), and obese (BMI 30.0 or higher).[9] The 2001 MEPS-HC calculates and reports BMI using self-reported weight and height from the survey. Respondents to both surveys also self-report all medical conditions. These data were professionally coded using the *International Classification of Diseases,* Ninth Revision (ICD-9). The ICD-9 codes were collapsed to three-digit codes and subsequently coded into 259 clinically relevant medical conditions by AHRQ researchers using the AHRQ Clinical Classification System.[10] Excluding respondents under age nineteen and a small number of respondents (404 in 1987, 174 in 2001) with missing values for education and marital status and implausible (BMI less than 10; 12 in 1987, none in 2001) or missing values for BMI (3,150 in 1987, 864 in 2001) among adults, the sample sizes from the 1987 NMES and the 2001 MEPS are 20,989 and 21,460, respectively.[11]

Analysis. Using the two-part regression model, we estimated per capita total health care spending as well as spending to treat diabetes, heart disease/hypertension, and hyperlipidemia for underweight, normal, overweight, and obese adults age nineteen and older in 1987 and 2001.[12] We estimated separate models for each year. Both parts of the two-part model include the following as co-variates: weight (underweight, normal, overweight, obese), age (19–29, 30–39, 40–49, 50– 64, 65 and older), smoking, sex, education (less than high school, high school graduate, some college, college degree), health insurance status (months of private insurance, Medicaid, Medicare, other public insurance, CHAMPUS/TRICARE, uninsured), race/ethnicity (Hispanic, non-Hispanic black, other), income as a percentage of the federal poverty level (less than 100 percent, 100–199 percent, 200–399 percent, 400 percent or more), marital status (married, not married), and region (Midwest, South, West, Northeast).

For each person in the sample, we calculated predicted (retransformed from log dollars to dollars) per capita spending levels by multiplying predicted values from the first and second stage. To summarize the impact of weight on per capita spending, we computed four predicted spending levels. The first is what per capita spending would be if every person were underweight. Next, we computed what per capita spending would be if every person were normal, and then if every person were overweight and obese. Computing predicted values in this manner nets out the impact of observable individual characteristics (such as age, insurance status, income) on per capita spending predictions.

Since the NMES and MEPS samples include a complex stratification design, we used the svymean command in Stata, version 8, for the means and standard errors of per capita spending by obesity category. This accounts for both the complex sample design and the weighting of observations. We calculated standard errors and 95 percent confidence intervals for the regression-adjusted per capita spending estimates using the bootstrap technique with 1,000 replications.[13] The alpha value was set at .05, and all tests were two-sided. We used the gross domestic product (GDP) personal consumption deflator to adjust per capita spending levels for changes in economy-wide price levels.[14] Per capita cost estimates are expressed in 2001 dollars.

Decomposition of spending growth over time. To evaluate the contribution of rising obesity rates and changes in the relative spending of underweight, normal-weight, obese, and seriously obese people, we decomposed the actual per capita spending increase between 1987 and 2001 into a portion attributable to these factors and a portion attributable to other causes. The decomposition was performed by computing a "counterfactual" per capita spending level equal to what per capita spending would have been in 2001 if obesity rates and relative per capita spending levels by weight category had remained unchanged from 1987 levels.[15] Using this counterfactual level, we then computed how much per capita spending levels would have increased if none of these factors had changed and compared it with the actual spending increase, thus deriving an "obesity-attributable" share of spending growth.

We repeated the analysis for disease-specific spending on three conditions linked to obesity: diabetes, hyperlipidemia, and heart disease (which includes hypertension, congestive heart failure, pulmonary heart disease, and acute myocardial infarction). Following previously published methods, we linked diagnosis codes from NMES and MEPS-HC for each self-reported medical encounter (provider visits of any type and prescribed drugs) that prompted a person to seek medical care.[16] We calculated total spending for these three medical conditions for each person and then reran the regression models and decomposition analysis. Sample size and lack of statistical power precluded us from including other conditions linked to obesity such as gallstones and stroke.

Results

Over the fourteen-year study period, the proportion of the population with normal weight decreased by thirteen percentage points, and the proportion categorized as obese increased by 10.3 percentage points (both $p < .05$) (Exhibit 1). This increase in the proportion of the population with BMI greater than 30.00 is similar to the change in obesity prevalence observed from clinically derived estimates from the National Health and Nutrition Examination Survey (NHANES), although the self-reported rates of obesity are lower.[17]

EXHIBIT 1
Changes In The Prevalence Of Obesity, 1987–2001

	Prevalence				
	1987		2001		
Weight group	Percent	95% CI	Percent	95% CI	Percentage-point change
Underweight	3.6	3.3, 3.9	1.9	1.4, 1.8	−1.7
Normal weight	51.6	50.9, 52.4	38.6	37.4, 39	−13.0
Overweight	31.3	30.7, 32	35.7	35, 36.5	4.4
Obese	13.5	13, 13.9	23.8	23.7, 25.1	10.3

SOURCE: Authors' analysis of 1987 National Medical Expenditure Survey (NMES) and 2001 Medical Expenditure Panel Survey, Household Component (MEPS-HC).

NOTES: CI is confidence interval. Underweight is body mass index (BMI) less than 18.5; normal weight is BMI between 18.5 and 24.9; overweight is BMI between 25.0 and 29.9; obese is BMI of 30.0 or greater. See details in text.

Using the results from our multivariate analysis, we tabulated adjusted per capita spending among underweight, normal-weight, overweight, and obese people in 1987 and 2001 (Exhibit 2). By presenting results in terms of per capita spending levels, we net out the contribution of population increase to cost growth. We find statistically significant differences in mean per capita health care spending between the obese and normal-weight categories in 1987 and 2001. Estimated per capita spending in 1987 (in 2001 dollars) was $2,188 overall; there was a 15.2 percent difference between spending for normal-weight and obese people. By 2001 we find larger differences in spending by weight category ($p < .05$): Health care spending among the obese was 37 percent higher than it was among the normal-weight group. Moreover, the increase in per capita spending within the normal-weight and obese groups was 37 percent and 63 percent, respectively. The rate of growth among the obese was much higher than the overall growth rate in per capita spending (51 percent).

EXHIBIT 2
Predicted Per Capita Spending By Weight Group, Medical Condition, And Year, 1987 And 2001

	Per capita spending, 1987		Per capita spending, 2001	
Weight group/ medical condition	Mean ($)	Relative to normal	Mean ($)	Relative to normal
Total				
Underweight	2,437	1.15[a]	3,255	1.12[b]
Normal weight	2,117	1.00	2,907	1.00[b]
Overweight	2,154	1.02	3,247[c]	1.12[b]
Obese	2,438	1.15[b]	3,976[c]	1.37[b]
All	2,188	1.03	3,298[c]	1.13[b]
Diabetes				
Underweight	39	1.23	80	1.38
Normal weight	31	1.00	58[c]	1.00[b]
Overweight	46	1.48[a]	90[c]	1.56[b]
Obese	104	3.33[b]	193[c]	3.35[b]
All	50	1.59[b]	106[c]	1.84[b]
Hyperlipidemia				
Underweight	1	0.36	7	.20[b]
Normal weight	3	1.00	34	1.00[c]
Overweight	5	1.53	59[c]	1.71[b]
Obese	6	1.86	78[c]	2.29[b]
All	5	1.31	54[c]	1.59[b]
Heart disease[d]				
Underweight	225	0.99	266	0.96
Normal weight	228	1.00	276	1.00
Overweight	305	1.34[b]	348	1.26[b]
Obese	398	1.75[b]	514[c]	1.86[b]
All	284	1.25[b]	365[c]	1.32[b]

SOURCE: Authors' analysis of 1987 National Medical Expenditure Survey (NMES) and 2001 Medical Expenditure Panel Survey, Household Component (MEPS-HC).

NOTES: Underweight is body mass index (BMI) less than 18.5; normal weight is BMI between 18.5 and 24.9; overweight is BMI between 25.0 and 29.9; obese is BMI of 30.0 or greater. See details in text.

[a]Significantly different from normal ($p < .10$) in 1987 or 2001.

[b]Significantly different from normal ($p < .05$) in 1987 or 2001.

[c]Significantly different from same BMI category between 1987 and 2001 ($p < .05$).

[d]Includes hypertension.

Using these multivariate results, we calculated the share of growth in real per capita spending attributable to the rise in obesity prevalence and the rise in relative spending among the obese. Between 1987 and 2001, inflation-adjusted spending per capita increased by $1,110 (Exhibit 3). Per capita spending would have increased by an estimated $809 had the prevalence of obesity and relative spending among people in each weight category remained at 1987 levels. We attribute the residual, $301 or 27 percent of the growth, to changes in prevalence and relative spending among the obese relative to the nonobese. When we isolate the impact of changes in obesity prevalence alone, we find that the increase in the proportion of the population that is obese accounts for 12 percent of real per capita spending growth.

EXHIBIT 3
Inflation-Adjusted Obesity-Attributable Increase In Per Capita Health Care Spending, 1987–2001

Per capita health spending in 2001	$3,298
Counterfactual per capita spending in 2001 at 1987 obesity and relative spending levels	$2,997
Per capita spending in 1987 (2001 dollars)	$2,188
Actual increase	$1,110
Obesity-attributable increase	$ 301
Increase due to other factors	$ 809
Obesity-attributable share of spending growth[a]	0.27

SOURCE: Authors' analysis of 1987 National Medical Expenditure Survey (NMES) and 2001 Medical Expenditure Panel Survey, Household Component (MEPS-HC).
[a]Includes increase in spending as a result of changes in prevalence and relative spending among overweight and obese people relative to normal-weight people.

Obesity has been linked to several medical conditions, including diabetes, hyperlipidemia, and heart disease. Our tabulations from NMES and MEPS-HC reveal a sharp rise in the number of treated cases of diabetes (79 percent) and hypertension (29 percent) during this period. Thus, the rise in health spending traced to obesity is most likely concentrated in higher spending for treating these medical conditions. From the regression models, we predicted per capita spending levels for each person for each of the three conditions by weight category. Spending predictions differed significantly by weight group in both 1987 and 2001 ($p < .05$) across these conditions. The rise in obesity prevalence and relative spending accounted for a significant portion of the rise in spending on each of the three medical conditions examined (Exhibit 4). The trends in obesity accounted for more than 38 percent of diabetes spending growth, 22 percent of hyperlipidemia spending growth, and 41 percent of heart disease spending growth. Collectively, these three medical conditions accounted for 22 percent of the overall rise in spending attributable to obese people ($65 of the $301 increase per capita from Exhibit 4). These medical conditions are among the fifteen priority medical conditions identified by the Institute of Medicine (IOM) for needed improvements in the efficiency of treatment, prevention, and quality.[18]

EXHIBIT 4
Obesity-Attributable Spending Increases By Condition, 1987–2001

	Diabetes	Hyperlipidemia	Heart disease[a]	Total for three conditions	Overall
Actual increase, 1987–2001	$56	$50	$81	$187	$1,110
Obesity-attributable increase, 1987–2001	$21	$11	$33	$ 65	$ 301
Obesity-attributable share of spending growth	0.38	0.22	0.41	0.35	0.27

SOURCE: Authors' analysis of 1987 National Medical Expenditure Survey (NMES) and 2001 Medical Expenditure Panel Survey, Household Component (MEPS-HC).

[a]Includes hypertension.

Concluding Comments

Both the rising prevalence of obesity and higher relative per capita spending among obese Americans accounted for 27 percent of the growth in real per capita spending between 1987 and 2001. During this period, the prevalence of obesity increased by 10.3 percentage points—to nearly 24 percent of the adult population. The rise in obesity contributed to large spending increases for the three medical conditions examined (diabetes, hyperlipidemia, and heart disease). Our estimates are valid only for the civilian, noninstitutionalized population. To the extent that changes in obesity prevalence and the impact of obesity on spending differ in the institutionalized population, our estimates may over- or understate the impact of obesity on cost growth nationally.

The obesity-attributable cost estimate of 27 percent incorporates two trends: the increase in obesity prevalence and the increase in spending on the obese relative to those in the normal-weight category. This latter component captures changes in medical technology that provide physicians better options for treating obese patients and the diseases common among them.[19] Thus, our obesity-attributable spending growth estimate is inclusive, rather than exclusive, of changes in medical technology and simply represents a different approach to characterizing spending growth.

Obesity has a sizable impact on the U.S. health care system. It is associated with higher rates of mortality, even among those without other risk factors such as smoking or a previous medical condition. Similar to previous estimates, our results indicate that costs incurred by the obese were 37 percent higher than costs for those with normal weight in 2001.[20] Moreover, growth in obesity and spending on obese people accounted for 27 percent of the growth in inflation-adjusted per capita health care spending between 1987 and 2001. To date, there is no evidence that the rise in the share of the U.S. population with BMI greater than 30.00 is abating. These results suggest that future cost containment efforts need to attack the rising prevalence and costs of obesity head on. This will require a focus on developing effective interventions to promote weight loss among obese people.

NOTES

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8. Ibid.
9. U.S. Centers for Disease Control and Prevention, "What Is BMI?," 17 April 2003, www.cdc.gov/nccdphp/dnpa/bmi/bmi-adult.htm (30 August 2004).
10. J.W. Cohen and N.A. Krauss, "Spending and Service Use among People with the Fifteen Most Costly Medical Conditions, 1997," *Health Affairs* 22, no. 2 (2003): 129–138.
11. We weighted observations using weights provided in the NMES data that account for the missing values for weight and height, as in J.A. Rhoades, B.M. Altman, and L.J. Cornelius, "Trends in Adult Obesity in the United States, 1987 and 2001: Estimates for the Noninstitutionalized Population, Age 20 to 64," Statistical Brief no. 37, August 2004, www.meps.ahrq.gov/papers/st37/stat37.htm (20 September 2004).
12. We also estimated modified two-part models as suggested in W.G. Manning and J. Mullahy, "Estimating Log Models: To Transform or Not to Transform?" *Journal of Health Economics* 20, no. 4 (2001): 461–494. However, we present results from the standard two-part model here because predictions were closer to the actual sample means and the Cook-Weisberg test could not reject the null of homoskedasticity in both years. We transformed the estimates to their original dollar scale using the smearing estimator. See N. Duan, "Smearing Estimate: A Nonparametric Retransformation Method," *Journal of the American Statistical Association* 78, no. 383 (1983): 605–610.
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14. National Aeronautics and Space Administration, "GDP Deflator Inflation Calculator," 26 March 2004, www.jsc.nasa.gov/bu2/inflateGDP.html (20 September 2004).
15. The counterfactual levels equal per capita spending for normal-weight people in 2001 multiplied by the sum of the products of per capita spending ratios and prevalence levels for each weight group in 1987. This level displayed in Exhibit 3 is $2,997 = $2,907 x (1.15 x 0.036 + 1.00 x 0.516 + 1.02 x 0.313 + 1.15 x 0.135).
16. Some medical events were associated with multiple medical conditions. However, nearly 90 percent of total spending linked to an event reported a single medical condition. Since we are interested in explaining the role of obesity in influencing spending growth within a condition, we are not concerned about double counting across conditions. We reach similar conclusions when the sample is limited to spending associated with medical events that report only the single condition (for example, diabetes only).
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