# Final Report

# The Economic Impact of Obesity in the South: Assessing Medical Expenditures Attributable to Obesity

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## INTRODUCTION

Overweight and obesity are leading public health concerns in the US. Although overweight and obesity are preventable conditions in the majority of cases, their prevalence has increased significantly over the past two decades. Recent estimates indicate that 64.5 percent of Americans are classified as overweight or obese, while 30.5% are classified as obese (Flegal et al., 2002).

Overweight and obesity are associated with a number of serious and costly chronic medical conditions, including type 2 diabetes, cardiovascular disease, hypertension (Must et al, 1999; Field et al., 2001; Visscher & Seidell, 2001) and certain cancers (Visscher & Seidell, 2001). The economic impact of overweight and obesity on the health care system is therefore staggering. A review of the literature by Thompson and Wolf (2001) estimated that obesity accounted for 5.5 to 7.0% of US health care expenditures. Sturm (2002) estimated that obese adults incurred medical expenditures that were 36 percent higher than expenditures for adults of normal weight. Finkelstein, Fiebelkorn, and Wang (2003) estimated that overweight- and obesity-attributable medical spending accounted for 9.1 percent of the total annual US medical expenditures in 1998. When adjusted for inflation, this translated into 93 billion dollars in the year 2002.

The above national expenditure estimates are alarming, yet to date, no comprehensive study of health care spending attributable to overweight and obesity in the south has been conducted. Thus, the objectives of this study are to 1) determine the prevalence of overweight and obesity in the southern region for adults overall and for sociodemographic subgroups; and 2) estimate overweight- and obesity-related health care expenses for adults overall and for sociodemographic subgroups.

The current study differs from previous research in two ways. First, the focus of this study is on the southern region and for good reason. The Southern states have some of the highest rates of adult obesity in the nation (Mokdad et al., 2001; Mokdad et al, 2003), and Mississippi leads the nation with an obesity rate of 25.9 percent (Mokdad et al., 2003). Many of the southern states also lead the nation in the prevalence of youth overweight (Centers for Disease Control and Prevention, 2004). In addition, 11 of the 12 states in the southern region have obesity-attributable spending estimates higher than the national average (Finkelstein, Fiebelkorn, & Wang, 2004). Second, this study assesses prevalence and spending estimates by sociodemographic subgroups, including age, gender, race/ethnicity, education, and income groups. Rates of overweight and obesity have increased in all gender, age, and racial groups, with the highest rates of overweight and obesity in non-Hispanic black women (Flegal et al., 2002). Only one study was identified that assessed the role of body mass index (BMI, $kg/m^2$) in combination with various sociodemographic factors in predicting health care costs (Bungum et al., 2003). In that study, BMI was the only significant predictor of health care costs; age, gender, level of education, and race did not add significantly to the predictive model. However, a study by Paeratakul et al (2002), reported that although health risks increased with level of obesity in all populations, that the specific degree of weight-related risk varied depending on gender, race, and socioeconomic status. For example, the prevalence of obesity-related co-morbidities was generally higher in black people and those with lower income and level of education compared with their peers. Thus, weight-related disease burden, and therefore medical costs, may vary depending on sociodemographic factors, although studies in this area are clearly lacking. The current study will further the understanding of the magnitude of overweight and obesity in the

south and their impact on healthcare spending for the various population subgroups in this region.

## METHODS

### Data

Two nationally representative data sets were used to develop cost estimates: the Medical Expenditure Panel Survey (MEPS) and the National Health Interview Survey (NHIS). MEPS, co-sponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics, is a nationally representative survey of the civilian non-institutionalized population that collects data about health care utilization and annual medical spending, including the percentage of spending by out-of-pocket and third-party payers. MEPS contains information about insurance status, region (Northeast, Midwest, South, and West), and sociodemographic characteristics.

Each year, the sample for the MEPS Household Survey is derived from the previous year's NHIS. For example, the sample for the 1998 MEPS survey was derived from the 1996-1997 NHIS. Height and weight data, necessary to determine the Body Mass Index (BMI), are available for a subset of adult NHIS participants and can linked to the MEPS data. For purposes of this analysis, and in order to maximize the sample size, we pooled MEPS/NHIS linkage files for the 1996-2000 period. Only adults residing in the southern region were included. Pregnant women were excluded. The final analysis sample included 20,307 adults nineteen years of age and older with weighting variables that allow for generating regionally representative estimates.

### Procedures

NHIS data were used to determine the prevalence of each BMI category (underweight, normal, overweight, obese) for adults overall and by age, gender, and race/ethnicity for the time

period between 1996 and 2000. NHIS data were also used to determine the prevalence of each BMI category for adults in each of the five years.

To predict overweight- and obesity-attributable healthcare spending, a four-equation regression approach was used following the same approach developed by the RAND Health Insurance Experiment (Manning et al. 1987; Manning et al. 1998) and utilized by Finkelstein et al. (2003). Variables representing the four BMI categories were included in the regressions to predict their impact on healthcare spending. The regressions included age, sex (male, female), race/ethnicity (White, Black, Hispanic, Asian, other), household income (less than 100 percent of poverty, 100-199 percent, 200-399 percent, 400 percent or more), education (less than college graduate, college graduate, masters or doctoral degree, other degree), and marital status (married, widowed, divorced/separated, single). These variables were included to generate estimates of the increase in healthcare spending due to overweight and obesity for each sociodemographic subgroup. The regressions also included each person's insurance status (private, Medicaid, Medicare, uninsured, other public) and year (1996, 1997, 1998, 1999, 2000).

The regressions were estimated using SUDDAN version 8.0. SUDAAN is a statistical software that controls for the complex sample design of MEPS. The software is specifically designed for analysis of cluster-correlated data and allows for the specification of how data were correlated and weighted.

The regression results were used to estimate the effect of overweight and obesity on healthcare spending. Aggregate predicted expenditures attributable to overweight was computed as aggregate predicted expenditures for the overweight group with the dichotomous overweight variable set to 1 minus aggregate predicted expenditures for the overweight group with the dichotomous overweight variable set to 0. Aggregate predicted expenditures attributable to

obesity was computed in a similar manner. The percentage of aggregate expenditures attributable to overweight (or obesity) in each demographic subgroup was then computed by dividing aggregate predicted expenditures attributable to overweight (or obesity) by total predicted expenditures for all people in the specific demographic subgroup.

**RESULTS**

Table 1 presents the prevalence of each BMI category by year for all adults in the south. For the overall sample (1996-2000), 36 percent of adults were overweight and 19 percent were obese. Thus, 55 percent of adults overall were overweight or obese. Obesity rates increased during this five-year period from 18 percent in 1996 to 22 percent in 2000, reflecting a change of 19 percent.

Table 1. Prevalence of each BMI Category by Year (1996-2000)

| BMI | Underweight < 18.5 | Normal 18.5-24.9 | Overweight 25.0-29.9 | Obese ≥ 30.0 |
|---|---|---|---|---|
| Unweighted N | 439 | 8,264 | 7,339 | 4,265 |
| Overall (1996-2000) | 2.4% | 42.7% | 35.8% | 19.1% |
| 1996 | 2.5% | 44.8% | 34.7% | 18.1% |
| 1997 | 2.8% | 43.0% | 35.8% | 18.5% |
| 1998 | 2.5% | 40.8% | 37.1% | 19.7% |
| 1999 | 1.7% | 41.6% | 37.1% | 19.6% |
| 2000 | 2.3% | 41.6% | 34.7% | 21.5% |

Table 2 presents the prevalence of each BMI category by age (19-44, 45-64, ≥ 65), gender, race/ethnicity, level of education, and income. Overweight and obesity rates combined (62%) were highest among the 45-64 age group. The prevalence of overweight was 16 percentage points higher among males than females, while the prevalence of obesity was 2 percentage points higher among females than males. Interestingly, 7 out of 10 men 45-64 years old were classified as overweight or obese. The obesity rate was highest among Black adults (26%) and, specifically, among Black women (30%). However, when overweight and obesity were combined, the rate was similar for Black and Hispanic adults, but 10 percentage points higher than that of White adults.

Table 2. Prevalence of each BMI Category by Sociodemographic Group

| | Underweight | Normal | Overweight | Obese |
|---|---|---|---|---|
| BMI | < 18.5 | 18.5-24.9 | 25.0-29.9 | ≥ 30.0 |
| Age | | | | |
| 19-44 | 3.1% | 46.4% | 32.4% | 18.1% |
| 45-64 | 1.4% | 36.9% | 39.9% | 21.8% |
| ≥ 65 | 2.4% | 42.3% | 37.8% | 17.4% |
| Gender | | | | |
| Male | 0.8% | 36.9% | 44.2% | 18.2% |
| Female | 4.0% | 48.2% | 27.9% | 20.0% |
| Age by Gender | | | | |
| Age 19-44 | | | | |
| Male | 0.9% | 40.6% | 40.9% | 17.7% |
| Female | 5.4% | 52.6% | 23.4% | 18.6% |
| Age 45-64 | | | | |
| Male | 0.3% | 28.6% | 49.8% | 21.3% |
| Female | 2.4% | 44.7% | 30.6% | 22.3% |
| Age ≥ 65 | | | | |
| Male | 1.4% | 40.7% | 43.7% | 14.3% |
| Female | 3.2% | 43.6% | 33.5% | 19.7% |

Overall, the prevalence data indicates more variation in overweight rates than obesity rates among the demographic subgroups. Overweight rates ranged from 23% among women age 19-44 to 50% among men age 45-64. Obesity rates ranged 14% among men 65 years of age and older to 30% among Black women.

Expenditure data are presented in tables 3 and 4. Between 1996 and 2000, 8.5 percent of aggregate expenditures in the southern region were attributable to overweight and obesity. When inflated to 2003 dollars, this translates to approximately $25.5 billion dollars. Overweight- and obesity-attributable expenditures were higher among men than women, adults age 19-44 and age 45-64 than older adults, and Blacks and Hispanics relative to other racial/ethnic groups (Table 3).

Table 3. Overweight- and Obesity-Attributable Medical Expenditures and Fractions—Overall and by Sociodemographic Group (MEPS 1996-2000)

| | Overweight BMI 25-29.9 | Obese BMI≥ 30 | Overweight and Obesity Combined |
|---|---|---|---|
| Overall (%) | 3.1% | 5.5% | 8.5% |
| Expenditures (M$) | $9,120 | $16,327 | $25,447 |
| Age | | | |
| 19-44 | 3.4% | 5.8% | 9.2% |
| 45-64 | 3.3% | 6.4% | 9.7% |
| ≥ 65 | 2.7% | 4.8% | 7.4% |
| Gender | | | |
| Male | 3.6% | 5.6% | 9.3% |
| Female | 2.7% | 5.3% | 8.0% |
| Race/Ethnicity | | | |
| White | 3.0% | 4.9% | 7.9% |
| Black | 3.3% | 8.5% | 11.8% |
| Hispanic | 3.7% | 7.4% | 11.1% |
| Asian | 2.5% | 1.1% | 3.5% |
| Other | 2.6% | 7.2% | 9.8% |

The estimated per capita increase in medical spending attributable to overweight was 9.7 percent or $261 (inflated to 2003 dollars) and ranged between 8.3 percent ($480) for older adults and 12.0 percent ($140) for adults age 19-44. The estimated per capita increase in medical spending attributable to obesity was 30.3 percent or $832 (inflated to 203 dollars) and ranged between 27.8 percent ($1,622) for older adults and 36.6 percent ($417) for Asians (Table 4).

Table 4. Per Capita Increase in Medical Expenditures Attributable to Overweight and Obesity—Overall and by Sociodemographic Group

| | Overweight | | Obese | |
|---|---|---|---|---|
| | Spending Increase ($) | Percent Increase | Spending Increase ($) | Percent Increase |
| Overall | 261 | 9.7 | 832 | 30.3 |
| Age | | | | |
| 19-44 | 140 | 12.0 | 428 | 34.6 |
| 45-64 | 289 | 10.2 | 973 | 30.4 |
| ≥ 65 | 480 | 8.3 | 1,622 | 27.8 |
| Gender | | | | |
| Male | 224 | 9.8 | 727 | 32.5 |
| Female | 318 | 9.5 | 922 | 29.0 |
| Race/Ethnicity | | | | |
| White | 292 | 9.4 | 935 | 29.3 |
| Black | 182 | 10.3 | 652 | 32.6 |
| Hispanic | 171 | 10.7 | 556 | 33.4 |
| Asian | 126 | 11.9 | 417 | 36.6 |
| Other | 328 | 8.8 | 986 | 31.5 |

## DISCUSSION

Results of this study indicated that 55% of adults in the southern region were classified as overweight or obese between the years 1996 and 2000. Although this rate is lower than the national estimate of 64.5% (Flegal et al., 2002), the data in the current study are based on self-reported height and weight, while national estimates were based on measured height and weight data. In this study, men aged 45-64 years experienced the highest combined rate of overweight and obesity. As in the study by Flegal et al. (2002), black women had the highest rate of obesity in this study. Results of the current study also are in agreement with those of Paeratakul et al (2002), who found that the rate of overweight was higher in men, while the rate of obesity was higher in women. The current research also provided the first and only estimates of overweight- and obesity-related medical costs in the southern region, as well as costs among various sociodemographic subgroups in this region. Combined, overweight and obesity accounted for 8.5% of aggregate medical spending in the south between 1996 and 2000, with adults aged 45-64 years and Black and Hispanic groups having some of the highest fractions.

Although estimating the medical expenditures related to obesity in the southern region is important in itself, it is hoped that the results of the current study will assist local, state, and federal policy makers who must decide on distribution of limited resources to address the obesity epidemic. The results of this study will assist policy makers in strengthening food and nutrition assistance programs aimed at low-income families. Since these programs are often the primary source of nutrition education for low-income families, their role in the prevention of obesity is vital. State and local health departments may use the information to develop new obesity prevention programs that are designed for the population subgroups that have the greatest prevalence of obesity and associated co-morbidities.

Trends in obesity-related medical spending over time could be determined by comparing future spending estimates with baseline data from this study. The data are also critical for future studies to estimate the cost effectiveness of weight management programs and of other efforts to reduce the prevalence of obesity in this region. Cost effectiveness is an increasingly important criterion for allocating scarce resources. Finally, the data can be used to estimate cost savings associated with incremental reductions in the prevalence of obesity in the south.

There are several limitations to the current study. The expenditures reported in this study reflect only direct medical costs, and do not address indirect costs that may be associated with obesity, such as decreased productivity or job absenteeism. Wolf and Colditz (1998) reported that these indirect costs are also significant, approaching the magnitude of the direct medical costs of obesity. In addition, data presented in this study do not represent potential cost savings, but rather the amount of money that could have been saved had the overweight or obesity never existed. An analysis conducted by Oster et al (1999) estimated the health and economic benefits of weight loss in obese persons. These researchers concluded that a modest (10%) weight loss was associated with a decrease in medical costs attributed to obesity-related comorbidities. Thus, although results of this study cannot be translated into potential cost savings, it is possible that weight reduction would be associated with decreased health care costs. Finally, estimates reported in the current study are for the southern region only and include data from different years of the MEPS/NHIS reported in Finkelstein et al. (2003). Thus, regional spending estimates reported in this study should not be compared with national estimates reported in Finkelstein et al. (2003). For much the same reason, estimates from this study should not be used to make direct comparisons to state specific data reported in Finkelstein et al (2004).

Prevalence of overweight and obesity continue to increase, and medical costs associated with weight-related co-morbidities will increase accordingly. Funding for public health programs focusing on obesity prevention and treatment should be directed to those programs that prevent illnesses and premature deaths related to obesity at little cost (Kuchler and Ballenger, 2002). Future research should focus on determining the actual costs and economic benefits of obesity prevention and weight management programs.

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