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MEDICARE HEALTH OUTCOMES SURVEY

FINAL REPORT

ON

PREVALENCE OF OBESITY IN MEDICARE ADVANTAGE ORGANIZATIONS AND ITS EFFECT ON HEALTH SERVICES UTILIZATION AND HEALTH RELATED QUALITY OF LIFE

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BACKGROUND

The increasing prevalence of obesity in Medicare Advantage Organizations (MAOs), its associations with the health of beneficiaries and their concomitant use of health services was the focus of this research study conducted on behalf of the Centers for Medicare & Medicaid Services (CMS). Understanding the potential impact of obesity in this population is a preliminary step towards developing a better understanding of its effect on health care spending.

SOURCES OF INFORMATION

Data from the Medicare Health Outcomes Survey (HOS) *2006 Cohort 9 Baseline* and *2008 Cohort 9 Follow Up* surveys were used to obtain information on the prevalence of obesity and its association with the health of beneficiaries. Self-reported height and weight information reported in 10 pound intervals from the HOS surveys were used to calculate Body Mass Index[A] (BMI), which was aggregated to classify beneficiaries categorically. Information about 2006 outpatient utilization (office/clinic, physician, and specialist visits) was obtained from the 2007 Medicare Advantage Consumer Assessment of Healthcare Providers and Systems (MA-CAHPS®[B]) survey. The 2007 MA-CAHPS Survey and the HOS *2006 Cohort 9 Baseline* survey both refer to health care that occurred in 2006. The analyses of the prevalence of obesity were based on 87,256 observations from the HOS *2006 Cohort 9 Baseline* survey. The analyses of the stability of BMI included 50,821 observations from beneficiaries who were included in both the baseline and follow up surveys. The analyses of utilization included 5,436 observations obtained from beneficiaries who participated in both the HOS *2006 Cohort 9 Baseline* and 2007 MA-CAHPS surveys.

KEY FINDINGS

Results of the analyses conducted in support of this study demonstrated among Medicare Advantage beneficiaries:

- The high prevalence of obesity
- The association of obesity with poorer health status and less ability to perform daily activities
- The association of obesity with higher healthcare utilization
- The general stability of BMI over a two-year period

More details about each of the key findings are provided on the next page.

[A] Body Mass Index (BMI) is defined as weight in kg divided by height in meters squared, and may be converted from English units (pounds per square inch of height) by multiplying by 703.
[B] MA-CAHPS® is a registered trademark of the Agency for HealthCare Research and Quality, a U.S. Government agency.

The high prevalence of obesity in the sample of Medicare beneficiaries

Approximately two thirds of all beneficiaries were either overweight (40%) or obese (25%). Younger beneficiaries tended to have higher BMI levels.

The association of obesity with poorer health status and diminished ability to perform daily activities

Obese beneficiaries described themselves as being in worse overall health than the normal or overweight beneficiaries. For example, 31.0% of obese beneficiaries had fair or poor self rated health compared to 21.8% for the normal and 21.9% for the overweight beneficiaries.

Using the Physical Component Summary (PCS) score from the Veterans RAND 12-Item Health Survey (VR-12) as a measure of physical health, the mean of the obese beneficiaries (36.7) was found to be half a standard deviation lower than that of normal weight beneficiaries (42.3), which is considered a "moderate" difference. In contrast, the difference in PCS scores between overweight and normal beneficiaries was only about one tenth of a standard deviation.

Most undesirable health conditions were significantly more prevalent among the obese than normal weight beneficiaries, for example, high blood pressure (75.8% of obese vs. 53.9% of normal), diabetes (34.8% vs. 12.7%), and arthritis of the hip or knee (55.3% vs. 31.3%)[$p<0.001$]. In contrast, osteoporosis and stroke were exceptions to the tendency for notably greater prevalence of undesirable conditions with increasing BMI. Osteoporosis was significantly less prevalent among the obese (16.1%) than those with normal weight (26.9%) [$p<0.001$]. In the case of stroke, prevalence increased only slightly with BMI, 7.3% for normal weight, 7.4% for overweight, and 7.9% for obese ($p<0.01$).

Obese beneficiaries had substantially greater limitations than normal weight beneficiaries with Activities of Daily Living (ADLs) which are classified here as difficulty with or being unable to do the activity, such as walking (40.0% of the obese vs. 20.4% of the normal weight), getting in and out of chairs (28.3% vs. 12.5%), and dressing (10.4% vs. 5.6%). Having at least some difficulty with these tasks was approximately twice as prevalent for obese than for normal weight beneficiaries. Again, differences between overweight and normal beneficiaries were small.

The association of obesity with increased healthcare utilization

In general, obese beneficiaries had more office/clinic visits, more personal doctor visits, and saw more specialists than beneficiaries of normal weight. For example, 18.4% of obese beneficiaries, but only 12.7% of normal weight beneficiaries, had five or more office/clinic visits in a six-month period.

The general stability of BMI over a two-year period

Obesity classification was generally stable over two years. Of beneficiaries who were in the normal, overweight or obese BMI groups at baseline, 82.4%, 74.8% and 79.1%, respectively, remained in the same BMI group at follow up two years later.

KEY RECOMMENDATIONS

Obese beneficiaries, much more than merely overweight beneficiaries, appeared to disproportionately account for poor health and high utilization. Although effort helping overweight beneficiaries attain normal weight may be of value, a focus on (1) helping obese beneficiaries attain overweight BMI and (2) preventing overweight beneficiaries from becoming obese may have the greatest potential to improve the health related quality of life of beneficiaries while decreasing the utilization and associated costs of their health care.

Results of this research also suggest that there may be value in developing a quality indicator that measures the success of health plans in reducing obesity over time. HEDIS measures, one of the most widely used set of health care performance measures, have the potential to not only measure plan performance, but also to bring about improvement over time in the processes measured.

Chapter 1: Introduction

BACKGROUND AND PURPOSE

The increasing prevalence of obesity, its effect on the health of individuals, as well as the effect on health care spending, has been a topic of considerable interest. In the United States, the rising numbers of both overweight and obese individuals have been reported in successive waves of the National Health and Nutrition Examination Survey (NHANES).[1] Ogden and colleagues (2006) reported on obesity prevalence and trends in the 2003-2004 NHANES. Their results showed that almost one in three persons aged 60 or older (31%) were obese.[2] Results based on the 1998-2006 Medical Expenditure Panel Survey showed that obesity accounts for approximately one third of the increase in per capita Medicare spending. This increase was due to an increase in the prevalence of obesity, rather than per capita cost increases for obese beneficiaries. [3]

Though there is considerable agreement over the deleterious effects of obesity and the association between obesity and mortality in young adults,[4, 5] there is still controversy about the role of obesity for older adults. Among younger adults, obesity appears to lessen life expectancy markedly.[6] Among seniors, the underweight and extremely obese persons have higher mortality than normal, overweight, and obese persons.[5] This U-shaped relationship in mortality differs from the apparent linear relationship between weight and disability,[7] which indicates increased disability at each level of increasing body mass index (BMI). [C] Very low BMI is thought to largely be a consequence of exogenous ill health, rather than a distal cause of mortality.[8, 9] Greater disability is one of the contributors to reduced health status (that is, poorer health related quality of life – HRQOL).[10] The English Longitudinal Study of Ageing found that men in the obese BMI category were more likely to have Activities of Daily Living (ADL) limitations and functional impairment than men in the normal BMI category.[7]

Medicare has more than 43 million beneficiaries.[11] Almost one quarter of those beneficiaries are enrolled in Medicare Advantage Organizations (MAOs). Excluding beneficiaries in Puerto Rico, Guam and the U.S. Virgin Islands, MAOs enrolled approximately 10 million beneficiaries in 2009.[12] The Medicare Health Outcomes Survey (HOS) and the Medicare Advantage Consumer Assessment of Healthcare Providers and Systems (MA-CAHPS®[D]) are two important national surveys of this population.

The HOS survey was first implemented in 1998 by the Centers for Medicare & Medicaid Services (CMS) to measure a health plan's ability over time to maintain or improve the physical and mental health of its beneficiaries.[13] The HOS assesses the physical and mental functioning of the beneficiaries at a baseline and a two year follow up. The instrument obtains data from beneficiaries regarding their physical and mental health status, demographics, selected chronic disease conditions, and limitations related to ADLs. Beneficiary responses are summarized into a physical component summary (PCS) score and a mental component summary (MCS) score. The PCS and MCS scores are derived from a primary component of the HOS survey, the *Veterans RAND 12-Item Health Survey* (VR-12). The PCS and MCS scores were normalized to the 1990 population of the United States and standardized to have a mean of 50 and a standard deviation of 10.[14]

[C] Body Mass Index (BMI) is defined as weight in kg divided by height in meters squared, and may be converted from English units (pounds per square inch of height) by multiplying by 703.
[D] MA-CAHPS® is a registered trademark of the Agency for Healthcare Research and Quality a U.S. Government agency.

The HOS is a patient-reported, mailed survey with telephone follow up. The protocol includes a mailed pre-notification postcard, a first mailing of the survey, a reminder/thank you post card, a second mailing of the survey to people who did not respond initially, and up to six follow up telephone calls to those individuals who did not respond to the second mailing.

The MA-CAHPS survey is a cross-sectional survey that assesses the beneficiaries' experiences with and perceptions of the health care and service provided by their health plan. MA-CAHPS is also a self-administered, mailed survey with telephone follow up. Information on this survey is located on the CAHPS website.[15, 16] "Since its launch in 1997, the CAHPS survey has become the national standard for measuring and reporting on the experiences of consumers with their health plans. At least one instrument from this survey is conducted in almost every State."[17] The survey contains 68 questions divided into six sections: *your health plan, your care in the last 6 months, your personal doctor, getting health care from specialists, your Medicare rights,* and *about you*.

This research study examined the prevalence of obesity, its association with health status and quality of life, and the relationship between obesity and health services utilization among MAO beneficiaries. This study also examined the stability of BMI classification over a two-year interval. The ability to obtain data from two reliable surveys of this large senior population, the HOS and the MA-CAHPS, facilitated the examination of these important issues in this population.

DATA SOURCES AND METHODOLOGY

The HOS *2006 Cohort 9 Baseline* was the data source to measure obesity and the health status of beneficiaries. Data was obtained from beneficiaries enrolled in 203 MAOs. The total sample size was 188,515. Of that number, 7,725 survey responses were ineligible (beneficiary deceased, not enrolled in MA Plan, incorrect address and phone number or language barrier). 60,082 respondents had incomplete surveys for which PCS or MCS scores could not be calculated and were eliminated from the sample, yielding 120,708 surveys and a response rate of 66.8%. A total of 93,070 surveys were left after applying the following additional restrictions: at least 65 years of age; did not use a proxy to fill out the questionnaire; filled out the survey themselves and were not institutionalized (e.g. hospital, nursing home). Further eliminations included those surveys where we were not able to calculate a BMI resulting in a final analytic sample size of 89,090.

Self-reported height and categorical weight were elicited categorically, then specific values were inferred when the response included a range of values. Next BMI was calculated from these specific values and then classified into categories.

Self reported height was elicited from a survey item which presented categorical response options for height to the nearest inch. Response options were available for each inch of height from 5 feet 1 inch through 6 feet 2 inches. Shorter and taller individuals were to indicate "five feet or less" and "6 foot 3 inches or more," respectively. For purposes of calculation, those who indicated heights of five feet or less were treated as if they were five feet in height and those who indicated heights of six foot three inches or more were treated as if they were six feet three inches in height.

Weight was elicited from a survey item which presented categorical response options with ten pound intervals from 91-100 pounds through 311-320 pounds. Lighter and heavier beneficiaries were to indicate "90 pounds or less" or "321 pounds or more." For purposes of calculation, midpoints were used for 10 pound intervals (e.g. 95.5 pounds for those indicating 91-100 pounds). For those indicating 90 pounds or less, 85.5 pounds was used; for those indicating 321 pounds or more, 325.5 pounds was used. Using these specific values for height and weight, BMI was calculated in kg/m^2. BMI values were then classified into four groups: underweight (< 18.5), normal (18.5 - < 25), overweight (25 - <30) and obese (BMI≥30).

Numerous studies have confirmed that the underweight are fundamentally different from other BMI groups. Evidence from longitudinal studies of BMI and morbidity and mortality using multiple time points suggest that the underweight status is a consequence of disease rather than a direct cause of mortality.[8, 9] Unlike those studies, HOS baseline and follow up data contain only two waves of information, which is insufficient for clear inference of the direction of causality among morbidity, weight loss, and mortality. An ideal approach involves a start point prior to the onset of much of the disease and at least four times of measurement. Ideally, one would observe for a substantial number of subjects (1) BMI in a first wave prior to the onset of disease or weight loss, then (2) observe either disease onset or weight loss (but not both) in a second interval, then (3) observe the other member of the "disease or weight loss" set in a third interval, and then (4) observe mortality in a fourth wave. These events might be measured in many more than four intervals, but to the extent that they occur in distinct intervals that allow their ordering in time, clearer inference about causal sequences are possible. Because they are limited to two waves and often begin after the onset of substantial disease burden, these analyses of HOS data do not provide the kind of information that supports analyses regarding the association of BMI and mortality as do other studies which cover a greater time span and with more points of measurement. Because HOS beneficiaries, when restricted to seniors as they are here, are a representative sample of community dwelling seniors in managed care, the pattern observed in other studies should also hold true for HOS. In fact, it was confirmed in the present sample that the underweight in this study population had the highest mortality and reported the least stable weight of all the BMI categories during the two year wave that we could observe, patterns consistent with previous research.

Because of the fundamental difference of the underweight seen in other research and replicated to some degree in this population, we excluded the underweight group from the analyses that follow except for the analyses that assessed the stability of obesity classification over time, which necessarily included all BMI classifications. This resulted in the exclusion of 1,834 underweight beneficiaries (2.0%) from all analyses that were restricted to the baseline data set. After excluding those beneficiaries with missing BMI information, we had a final analytic sample size of 87,256 for these analyses.

During the period covered by HOS *Cohort 9,* beneficiaries had to be continuously enrolled in a participating health plan for at least six months to be included in the survey. A random sample of beneficiaries was selected in the spring for a baseline survey. Two years later, these same members were resurveyed if they were still enrolled in the same health plan, with a response rate to the follow up survey of 81.8%. Data from the HOS *2006 Cohort 9 Baseline* and *2008 Cohort 9 Follow Up* surveys were used to generate the information on stability of obesity (n = 50,821).

The 2007 MA-CAHPS survey was utilized to provide information about healthcare utilization. It is conducted annually, and beneficiaries enrolled in a MAO or those who left the plan within the previous six months are eligible to be in the sample. The 2007 MA-CAHPS and the HOS *2006 Cohort 9 Baseline* survey both asked about health care received in 2006. The response rate for the 2007 MA-CAHPS survey was 51%.[18] The 2007 MA-CAHPS was fielded from January to March and the HOS *2006 Cohort 9 Baseline* was fielded from April to July. The 2007 MA-CAHPS contained 335,249 observations. When the two data sets were merged, the resulting data set contained 5,436 (1.2%) observations from beneficiaries who responded to both surveys. This number was further reduced to 4,751 when underweight and under age 65 beneficiaries were excluded.

Three MA-CAHPS items were examined to understand the association between obesity and utilization. The following items were used as outcome variables in multivariable regression analyses:

- In the last six months, not counting the times you went to an emergency room, how many times did you go to a doctor's office or clinic to get health care for yourself? (Item 7)
- In the last six months, how many times did you visit your personal doctor to get care for yourself? (Item 10)
- How many specialists have you seen in the last six months? (Item 18)

The survey responses to the first two questions have seven options or categories: *none, 1, 2, 3, 4, 5-9,* and *10 or more*. Responses to the last question regarding specialists have six options: *none, 1, 2, 3, 4,* and *5 or more.* In the regression models that examined utilization, some response categories with relatively low prevalence were combined to improve the stability of estimates. Office or clinic visits and personal doctor visits were combined into none, 1 or 2, 3 or 4 and five or more visits. The number of specialists seen was combined into none, 1 or 2, 3 and 4 or more visits.

ANALYSES

We performed cross-sectional analyses of *2006 HOS Cohort 9 Baseline* and merged 2007 MA-CAHPS/*2006 HOS Cohort 9 Baseline* data. We also performed longitudinal analyses that merged *Cohort 9 Baseline* and *Follow Up* data.

This study used bivariate analysis and multivariable regression models as described below.

Prevalence

The prevalence obesity classification across beneficiary characteristics was examined via two-way tables of obesity classification and three types of beneficiary characteristics: sociodemographic characteristics, health status, and health conditions. The sociodemographic characteristics included age, sex, race/ethnicity, education level, household income and marital status. The health status and health conditions included the PCS and MCS scores, self-rated general health, ADLs, smoking status, cardiovascular disease, hypertension, diabetes, inflammatory bowel disease, currently under treatment for cancer (breast, colon, lung), arthritis (lower and upper extremities), occurrence of falls, urine leakage, stroke and osteoporosis. Tests of significance are included using normal weight beneficiaries as the reference group.

Health Related Quality of Life

Multiple linear regression models were used to examine the association between obesity classification and the HRQOL as captured by PCS scores. Unadjusted mean PCS scores were compared using models that predicted PCS scores controlling for successively more factors in a staged series of models in which the independent variable of greatest interest was BMI category. Although there is some evidence that marital status, income, and education may have some effect on health,[19] the first regression model controlled for those demographic factors generally considered unlikely to be influenced by obesity: age, sex, race/ethnicity, marital status, household income and education. The second regression model added to these demographic factors specific conditions, some of which might be consequences or mediators of the association between obesity and the PCS score: myocardial infarction, coronary heart disease, congestive heart failure, other heart disease, hypertension, diabetes, inflammatory bowel disease, arthritis (lower and upper extremities), falls, urine leakage, stroke and osteoporosis. The third regression model added measures of function to the predictors in the second model. These measures may directly influence PCS and thus mediate the association between obesity status and PCS: ADL limitations (using chairs, walking, and dressing, eating, bathing and using the toilet). The normal weight group was the reference group for all of these analyses.

In addition, graphics are presented to illustrate the extent to which a five point change in PCS score corresponds to substantial changes in function in day-to-day activities such as difficulty with moderate activities (moving a table, pushing a vacuum cleaner, bowling or playing golf) or with climbing several flights of stairs. The graphics illustrate the proportion of beneficiaries unable to perform common activities at a given PCS score.

Stability of Obesity Classification

The primary analysis of the stability of obesity classification (underweight, normal, overweight, and obese) from baseline to follow up used a two-way table of beneficiary obesity classifications at baseline and two-year follow up, with emphasis on the percentage of beneficiaries who remained in their baseline category at follow up. A supporting analysis examined mortality between baseline and follow up by baseline obesity classification.

Healthcare Utilization

For each of the three measures of utilization – office/clinic visits, personal doctor visits, and number of specialists seen in the past six months, ordered logistic regression was used to model the association between obesity classification and utilization. Each of the models also controlled for the same demographic variables used in the HRQOL model – age, sex, race/ethnicity, marital status, household income, and education. Tabular and graphic descriptive statistics were also presented.

Because the measures of utilization were derived from the combined HOS/MA-CAHPS analytic data set, analyses were limited to the 4,751 beneficiaries in the combined data sets. The final numbers of beneficiaries used in the regression models were fewer than 4,751 because some beneficiaries did not answer the corresponding utilization item on the MA-CAHPS survey or an independent variable on the HOS survey. The regression models for office or clinic visits, personal doctor visits, and number of specialists seen included 4,561, 4,593, and 4,476 observations, respectively.

The proportionate odds assumption required by ordered logistic regression was assessed via the Pearson test and was met for all three models ($p>0.05$ in each case). The coefficients were displayed as log-odds. The signs of these coefficients indicate the direction of the association, with a positive sign indicating a positive association with utilization (Appendix).

In order to illustrate the magnitude of the association of obesity with utilization, two hypothetical scenarios were simulated. In the first scenario, one third of the beneficiaries from the overweight group were moved into the normal group, and one third of the beneficiaries from the obese group were moved into the overweight group, reducing population obesity. In the second scenario, one third of the beneficiaries from the overweight group were moved into the obese group, and one third of the beneficiaries from the normal group were moved into the overweight group, increasing population obesity. The changes in utilization that would occur if the associations observed in the models were entirely causal were calculated for purposes of illustration and compared to present levels of utilization.

Chapter 2: The Prevalence of Obesity and Characteristics of Obese Beneficiaries in Medicare Advantage Organizations

PURPOSE

The purpose of these analyses was to determine the prevalence of obesity among MAO beneficiaries, as well as the characteristics of these obese beneficiaries in particular regard to their health status and ability to perform ADLs. An additional research question concerned the stability of beneficiary BMI classification over a two-year period (2006-2008).

FINDINGS

Below we compare sociodemographic and health status data of normal weight, overweight and obese beneficiaries using the *2006 Cohort 9 Baseline* data set.

Sociodemographic Characteristics (Table 1)

Table 1 shows the distribution of sociodemographic characteristics for normal, overweight, and obese beneficiaries. Results are summarized below.

Approximately two-thirds of beneficiaries were overweight (40%) or obese (25%). Younger beneficiaries tended to have higher BMI levels, so that the mean age in the obese category was 73.7 whereas the average age of the normal beneficiary was 76.6 ($p<0.001$). The overall mean age was 75.2.

African Americans were especially likely to be obese or overweight. This is reflected by the fact that African Americans constituted 10.5% of the obese beneficiaries, and 6.4% of the overweight beneficiaries, but only 4.9% of the normal weight beneficiaries ($p<0.001$). In contrast, Asian Pacific Islanders were less likely to be obese or overweight; and constituted 3.9% of the normal weight, 1.6% of the overweight and 0.6% of the obese beneficiaries.

Lower educational attainment was associated with higher BMI categories: 20.6% of normal weight and 24.9% of obese beneficiaries did not complete high school; similarly, 8.9% of normal weight beneficiaries and 5.9% of obese beneficiaries attained a Bachelor's degree.

Married beneficiaries were especially likely to be overweight or obese, while separated beneficiaries were especially likely to be obese. This is reflected by the fact that married beneficiaries made up 54.4% of obese beneficiaries, 60.7% of overweight beneficiaries, but only 51.7% of normal weight beneficiaries. Similarly, separated beneficiaries constituted 1.2% of the obese and 0.7% of normal weight beneficiaries ($p<0.001$). In contrast, widowed beneficiaries were less likely to be obese or overweight, constituting 29.7% of the obese, 25.8% of the overweight, and 33.7% of normal weight beneficiaries ($p<0.001$).

TABLE 1 – SOCIODEMOGRAPHIC CHARACTERISTICS BY BMI LEVEL FOR HOS *2006 COHORT 9 BASELINE*				
Characteristics	**Normal (%)**	**Overweight (%)**	**Obese (%)**	**Total (%)**
Sample, n (%)	30,376 (35)	34,877 (40)	22,003 (25)	87,256 (100)
Age, mean (SD)	76.6 (6.8)	75.0 (6.2)	73.7 (5.7)	75.2 (6.4)
Female	67.3	49.6***	63.3***	59.3
Age Group				
65 < 70	19.9	25.1***	31.5***	24.9
70 < 75	24.5	29.0***	31.4***	28.0
75 < 80	24.3	24.0	21.7***	23.5
80 < 85	18.7	14.6***	11.4***	15.2
85+	12.7	7.4***	4.0***	8.4
Race Ethnicity				
Caucasian	82.7	82.9	80.0***	82.1
African American	4.9	6.4***	10.5***	6.9
Asian/Pacific Islander	3.9	1.6***	0.6***	2.1
Hispanic	5.0	5.6***	5.1	5.2
Multi-Race	2.0	2.0	2.3	2.1
Native American	0.3	0.3	0.3	0.3
Other Race	0.7	0.6	0.6	0.6
Missing	0.7	0.7	0.6	0.7
Education Level				
Up to 8th grade	6.8	6.9	7.9***	7.1
Some HS	13.8	14.2	17.0***	14.8
GED or Diploma	37.9	38.6	40.3***	38.8
Some college or AA	22.8	22.5	22.0*	22.5
Bachelors	8.9	8.1***	5.9***	7.8
Advanced degree	9.1	9.0	6.2***	8.3
No education given	0.8	0.7	0.7	0.7
Household Income				
Less than $5,000	2.7	2.2***	2.7	2.5
$5,000-$9,999	6.6	5.6***	7.1	6.3
$10,000-$19,999	23.0	21.7***	24.8***	22.9
$20,000-$29,999	16.9	18.6***	19.2***	18.2
$30,000-$39,999	10.4	12.2***	11.2	11.3
$40,000-$49,999	6.6	7.7***	6.7	7.1
$50,000-$79,999	7.4	8.2***	6.9**	7.6
$80,000-$99,000	2.0	2.2*	1.3***	1.9
$100,000 or More	2.5	2.6	1.5***	2.3
Don't Know	10.9	9.0***	9.8***	9.8
Missing	10.9	10.0	8.9	10.0
Marital Status				
Married	51.7	60.7***	54.4***	56.0
Divorced	10.0	9.5	11.0***	10.1
Separated	0.7	0.8	1.2***	0.9
Widowed	33.7	25.8***	29.7***	29.5
Never Married	3.4	2.6***	3.1*	3.0
Missing	0.6	0.5	0.6	0.6

* p=<0.05/ ** p=<0.01/ ***p=<0.001

Health Status and Function (Table 2)

Table 2 shows the distribution of health measures and ADL limitations by BMI category. Mean PCS scores were significantly higher for normal weight (42.3) than obese (36.7) beneficiaries, The difference in the average PCS score between these two categories (5.6 points, 0.56 standard deviations) was approximately half a standard deviation. This is a *medium* effect size according to Cohen's *d* formulation. Cohen's *d* divides the difference between two means x_1 and x_1 by the standard deviation s: $d = (x_1 - x_2)/s$, Cohen provides heuristics for effect sizes that are "small" (0.2), "medium" (0.5). and "large" (0.8). [20]In contrast, the difference in PCS scores between overweight and normal weight beneficiaries was quite small, only about one tenth of a standard deviation. In general, health measures for overweight beneficiaries, while generally worse than for normal weight beneficiaries (and statistically significantly so), were more similar to what was seen for normal weight beneficiaries than what was seen for obese beneficiaries. Thus much of what follows contrasts obese and normal weight beneficiaries. The MCS score used to measure mental health was similar across the three BMI groups, 52.2-53.5, and so was not analyzed further (Table 2).

31.0% of obese beneficiaries reported to be in fair or poor health as compared to 21.9% of overweight and 21.8% of the normal weight beneficiaries ($p<0.001$). Differences between the self rated health of overweight and obese were generally statistically significant (not shown). Differences in self-rated health between overweight and normal weight beneficiaries were smaller than differences between obese and normal weight beneficiaries.

Survey items assessing ADL limitations included impairments in walking, dressing, eating, using the toilet and getting in or out of chairs. Difficulty with ADLs was approximately twice as prevalent among the obese as for the normal BMI group. The percentage of beneficiaries with walking limitations (difficulty with or unable to do the specified activity) was almost twice as high in obese (40.0%) as in normal weight beneficiaries (20.4%). Similarly, nearly twice as many beneficiaries in the obese category as in the normal group had limitations in their ability to dress (10.4% versus 5.6%). Significantly more obese beneficiaries than normal weight reported that they were unable to perform ADLs measured: getting in and out of chairs, walking, dressing, eating, bathing and using the toilet.

Most undesirable health conditions were also more prevalent among the obese than normal BMI group. Differences in the prevalence of chronic diseases between normal and overweight groups were generally smaller than differences found between the normal and the obese BMI groups. Differences in the prevalence of undesirable health conditions were generally statistically significant between the overweight and obese BMI groups. Substantially more obese, than normal weight beneficiaries, had high blood pressure (75.8% versus 53.9%). Obese beneficiaries had approximately a three-fold greater prevalence of diabetes than normal weight beneficiaries (34.8% versus 12.7%). The prevalence of arthritis of hip or knee was greater among obese beneficiaries than normal weight beneficiaries (55.3% versus 31.3%). Urine leakage, which strongly affects social activities, was one-third more prevalent among obese beneficiaries (42.9%) than among normal weight beneficiaries (31.8%). Osteoporosis, smoking, and stroke were exceptions to the tendency for notably greater prevalence of undesirable health conditions or behaviors with increasing BMI. In the case of stroke, prevalence increased only slightly with BMI, 7.3% for normal weight, 7.4% for overweight, and 7.9% for obese ($p<0.01$). In the case of osteoporosis, overweight and obese beneficiaries had significantly less prevalence ($p<0.001$) than the normal weight individuals (15.9 %, 16.1 %, and 26.9 % respectively). Similarly, overweight (5.9%) and obese (3.9%) beneficiaries were less likely to smoke every day than were the normal weight (8.7%) beneficiaries ($p<0.001$).

TABLE 2 – HEALTH STATUS AND FUNCTION OF MEDICARE BENEFICIARIES
HOS *2006 COHORT 9 BASELINE*

Characteristics	Normal (%)	Overweight (%)	Obese (%)	Total (%)
Sample (N)	30,376 (35)	34,877 (40)	22,003 (25)	87,256 (100)
PCS, mean (SD)	42.3 (11.4)	41.4 (11.3)***	36.7 (11.7)***	40.5 (11.7)
MCS, mean (SD)	53.2 (9.8)	53.5 (9.8)	52.2 (10.7)	53.1 (10.0)
Self-rated General Health				
Excellent	8.5	6.6***	3.1***	6.4
Very good	29.2	28.5*	20.5***	26.7
Good	38.8	41.7***	43.8***	41.2
Fair	18.2	18.7	25.9***	20.3
Poor	3.6	3.2***	5.1***	3.8
No self-rated health given	1.6	1.4	1.5	1.5
Activities of Daily Living Difficulty				
Difficulty Getting in or out of Chairs				
No, I do not have difficulty	86.1	82.4***	70.4***	80.7
Yes, I have difficulty	12.0	15.9***	27.5***	17.5
I am unable to do this activity	0.5	0.5	0.8***	0.5
Missing	1.4	1.3	1.3	1.3
Difficulty Walking				
No, I do not have difficulty	78.2	74.6***	58.6***	71.8
Yes, I have difficulty	18.8	22.6***	37.1***	24.9
I am unable to do this activity	1.6	1.6	2.9***	1.9
Missing	1.4	1.3	1.4	1.3
Difficulty Dressing				
No, I do not have difficulty	93.1	92.8*	88.4***	91.8
Yes, I have difficulty	5.1	5.6*	9.7***	6.5
I am unable to do this activity	0.5	0.5	0.7**	0.5
Missing	1.3	1.2	1.2	1.2
Difficulty Eating				
No, I do not have difficulty	95.9	96.5***	95.9	96.2
Yes, I have difficulty	2.4	1.9***	2.2	2.1
I am unable to do this activity	0.2	0.2	0.3*	0.3
Missing	1.5	1.3	1.5	1.4
Difficulty Bathing				
No, I do not have difficulty	90.6	90.9	84.9***	89.3
Yes, I have difficulty	7.0	7.0	12.2***	8.3
I am unable to do this activity	1.1	1.0	1.7***	1.2
Missing	1.2	1.2	1.2	1.2
Difficulty Using Toilet				
No, I do not have difficulty	94.5	94.1***	90.7***	93.4
Yes, I have difficulty	3.6	4.2***	7.3***	4.8
I am unable to do this activity	0.5	0.5	0.7**	0.5
Missing	1.4	1.2	1.2	1.3
Health Conditions				
Smoke every day	8.7	5.9***	3.9***	6.3
Cardiovascular Disease	30.6	33.3***	36.8***	33.2
Hypertension or High Blood Pressure	53.9	64.0***	75.8***	63.4
Diabetes, or high blood sugar	12.7	20.5***	34.8***	21.4
Inflammatory Bowel Diseases	4.8	4.1***	5.0	4.6
Under Treatment for Breast Cancer	2.1	1.7***	2.4	2.0
Under Treatment for Colon Cancer	0.9	1.1	1.0	1.0
Under Treatment for Lung Cancer	0.7	0.5**	0.5**	0.6
Arthritis of hip or knee	31.3	39.0***	55.3***	40.5
Arthritis of hand or wrist	32.9	34.0*	41.5***	35.5
Fell in Past 12 Months	18.5	17.1***	22.1***	18.8
Urine Leakage in Past 6 Months	31.8	33.4***	42.9***	35.2
Stroke	7.3	7.4	7.9**	7.5
Osteoporosis	26.9	15.9***	16.1***	19.8

* p=<0.05/ ** p=<0.01/ ***p=<0.001

BMI and Mortality in the HOS Sample

A total of 89,090 beneficiaries who were 65 and older were used to determine the death rate of beneficiaries between the baseline and follow up survey. This number includes the analytic group of 87,256 plus the underweight group of 1,834. After the baseline survey, 6,912 beneficiaries died with an overall death rate of 7.8%. Higher baseline BMI was not associated with higher mortality for beneficiaries. The death rates were 9.2%, 6.6% and 6.4% for normal weight, overweight and obese respectively. The underweight category had the highest death rate (22.1%).

Stability of BMI (Table 3)

Matched data from the *HOS 2006 Cohort 9 Baseline* and the *2008 Cohort 9 Follow Up* surveys, including beneficiaries who were underweight at baseline, were used to generate the information on BMI stability illustrated in Table 3 (n=50,821). A clear majority of beneficiaries remained within the same BMI category between baseline in *2006* and follow up in 2008. Of beneficiaries who were in the normal, overweight or obese BMI groups at baseline, 82.4%, 74.8% and 79.1% respectively, remained in the same BMI group at follow up two years later. The underweight category was notably less stable than the other three BMI categories with only 65.4% of beneficiaries who were underweight at baseline, remaining in that category two years later. In general, changes of more than one BMI category were rare (<3% for those with normal, overweight, or obese classifications in 2006). The one exception was the least stable underweight category, from which 10.4% of beneficiaries who were underweight in 2006 moved to overweight or obese categories in 2008.

TABLE 3 – STABILITY OF BMI
PREVALENCE OF CROSS-CLASSIFIED COMBINATIONS OF BMI FROM HOS *COHORT 9 BASELINE* 2006 AND HOS *COHORT 9 FOLLOW UP* 2008

Frequency Row Pct	Under-weight	Normal	Over-weight	Obese	Total
Underweight	538 65.4	199 24.2	47 5.7	39 4.7	823
Normal	488 2.9	14,057 82.4	2291 13.4	231 1.4	17,067
Overweight	57 0.3	3057 15.0	15,213 74.8	2010 9.9	20,337
Obese	32 0.3	331 2.6	2275 18.1	9,956 79.1	12,594
Total	1,115	17,644	19,826	12,236	50,821

Chapter 3: BMI and its Relationship to Health Related Quality of Life as Measured by PCS Scores

PURPOSE

The purpose of these analyses was to illustrate the importance of the relationship of BMI with the quality of life of the Medicare beneficiaries. These analyses compared HRQOL by BMI among Medicare beneficiaries using PCS scores and ADL limitations.

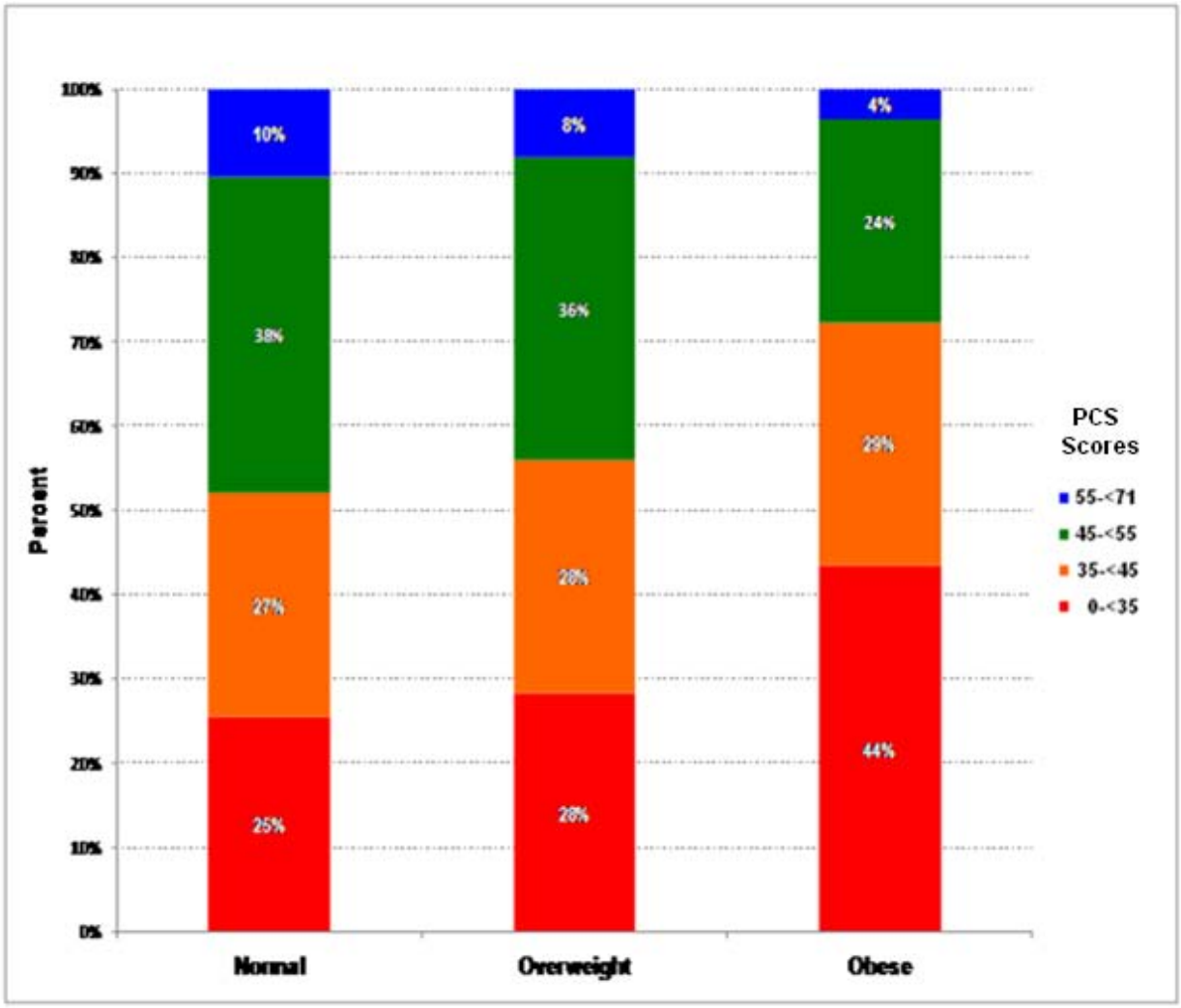
FINDINGS

The analyses include: a description of the distribution of PCS scores by BMI; a series of regression models that characterize the association between BMI and HRQOL controlling for variables in a staged series of models; and two figures which illustrate the effect of changes in PCS scores on ability to perform ADLs.

Distribution of PCS Scores by BMI Category (Figure 1)

Obesity was associated with lower HRQOL, as measured by PCS scores by BMI categories illustrated below in Figure 1. In a general population, PCS scores have a mean of 50 and a SD of 10. We classified beneficiaries into four categories: *high* PCS scores (≥55) that are more than 0.5 SD above the population average; *medium* PCS scores (45-54) that are within 0.5 SD of the population average; *low* PCS scores (35-44) 0.5-1.5 SD below the population average, or *very low* PCS scores (<35) which are more than 1.5 SD below the population average. Obese beneficiaries had substantially lower HRQOL than the normal and overweight beneficiaries. For example, 44% of obese beneficiaries, but only 28% of overweight, and 25% of normal weight beneficiaries had *very low* PCS scores. Conversely, 28% of obese, 44% of overweight, and 48% of normal weight had *medium* or *high* PCS scores.

FIGURE 1 – DISTRIBUTION OF PCS SCORES BY BMI



BMI and Health Related Quality of Life Regression Models (Table 4)

Table 4 presents selected coefficients from three models that characterize the association between BMI and HRQOL. In particular, the coefficients contrast the PCS of overweight and obese beneficiaries with that of a normal weight reference group. The full sets of coefficients for these models appear in the Appendix as Tables A2-A4. Models predicted PCS scores controlling for successively more factors in a staged series of three models in which the independent variable of interest was BMI category. Descriptive analyses show mean PCS by obesity category. Model 1, the base model, includes indicators of BMI category as well as demographic covariates as predictors in order to estimate total PCS differences by BMI. Model 2 included health conditions as predictors in addition to demographic covariates and indicators for BMI category. Model 3 built on Model 2, adding ADL limitations as predictors.

Mean PCS scores decreased with increasing BMI category. Mean PCS scores for both obese (36.7) and overweight (41.4) were lower than for the normal weight group (42.3).

Model 1 accounted for demographic factors related to PCS scores that are generally considered unlikely to be attributable to obesity, such as age, sex, race/ethnicity, marital status, household income and education (although there is some evidence that marital status, income, and education may have some effect on health).[19] The model shows the differences in HRQOL associated with BMI. This model indicated that after controlling for demographics, being overweight was associated with a PCS score that was on average 1.9 points or 0.19 SD lower than that of the normal BMI group, a *small* difference according to Cohen.[20] Being obese was associated with a PCS score that was 6.6 points or 0.66 SD lower than the normal BMI group, a medium-to-large "effect size". The full multivariable model is shown as Table A2 in the Appendix.

Model 2 accounted for demographics as in Model 1, but additionally controlled for health conditions. In particular, the regression model added indicators of specific health conditions, some of which might be consequences (or *mediators*) of the association between obesity and the PCS score: myocardial infarction, coronary heart disease, congestive heart failure, other heart disease, hypertension, diabetes, inflammatory bowel disease, arthritis (lower and upper extremities), falls, urine leakage, stroke and osteoporosis, to the demographic variables. We would expect the coefficients for overweight and obese status to be smaller in magnitude in Model 2 than in Model 1, because Model 1 measured the total association between BMI and PCS, whereas model 2 removes the indirect association of BMI with PCS that is attributable to the greater incidence of PCS-lowering chronic conditions, leaving only direct associations via other mechanisms. The difference between the obese and the normal BMI group, controlling for health and demographics was 3.4 points (0.34 SD), a small-to-medium effect size. This difference was about half as large as was seen in Model 1, but still statistically significant. Similarly, the remaining difference in PCS between normal weight and overweight beneficiaries in Model 2 was about half as large as in Model 1, but still statistically significant. These results suggest that about half of the differences in PCS by BMI may be attributable to an increased incidence of chronic conditions, but that substantial differences in PCS remain in beneficiaries with different BMI ever after matching with respect to the greater chronic disease burden of beneficiaries with BMI (a burden that may to a large degree have been caused by that higher BMI).[1,2,3,4,23,29] The full multivariable model is shown as Table A3 in the Appendix.

Model 3 accounted for the demographic and health conditions employed in Model 2 but also added specific measures of function. These measures of function may be additional consequences/mediators of the association between obesity and PCS and may directly influence PCS (getting in and out of chairs, difficulty walking, dressing, eating, bathing and using the toilet). We again expect smaller magnitudes of differences in PCS by BMI in these models in that we are removing differences in PCS associated with both increased incidence of specific chronic conditions and the loss of specific aspects of function. What remains are only differences in PCS through other mechanisms. Model 3 coefficients for overweight and obese relative to normal were about one-half as large as in Model 2 and about one-fourth as large as in Model 1 (e.g. -1.8 points/ 0.18 SD/a small effect for obese vs. normal), but still statistically significant. Thus about 75% of the total differences in PCS by BMI seen in overall Model 1 are linked to the specific health conditions and aspects of function included in Model 3, but 25% of those differences remain – perhaps because of greater incidence of unmeasured health conditions or aspects of function, or perhaps because of effects on HRQOL through mechanisms other than chronic conditions or loss of function. The full multivariable model is shown as Table A4 in the Appendix.

TABLE 4 – ASSOCIATION BETWEEN BMI AND HEALTH RELATED QUALITY OF LIFE (PCS SCORES) CONTROLLING FOR A STAGED SERIES OF VARIABLES (N = 87,256)

		Unadjusted Means		Model 1: Demographics*		Model 2: Demographics and Health Conditions**		Model 3: Demographics, Health Conditions and ADL Limitations***	
Variable	Group (N)	Mean	SD	Coefficient	SE	Coefficient	SE	Coefficient	SE
Normal (Ref)[E]	30,376	42.34	11.36						
Overweight	34,877	41.36	11.30	-1.85	0.09	-0.78	0.09	-0.43	0.08
Obese	22,003	36.68	11.75	-6.56	0.11	-3.41	0.10	-1.75	0.09

[E] Differences in PCS scores between normal, overweight and obese groups were significant at $p < 0.001$ for all comparisons in this table.

* Controlling for age, sex, race/ethnicity, marital status, household income and education.

** Controlling for all of the above and health conditions: myocardial infarction; coronary heart disease; congestive heart failure; other heart disease; hypertension; diabetes; inflammatory bowel disease; arthritis (lower and upper extremities); falls; urine leakage; stroke and osteoporosis.

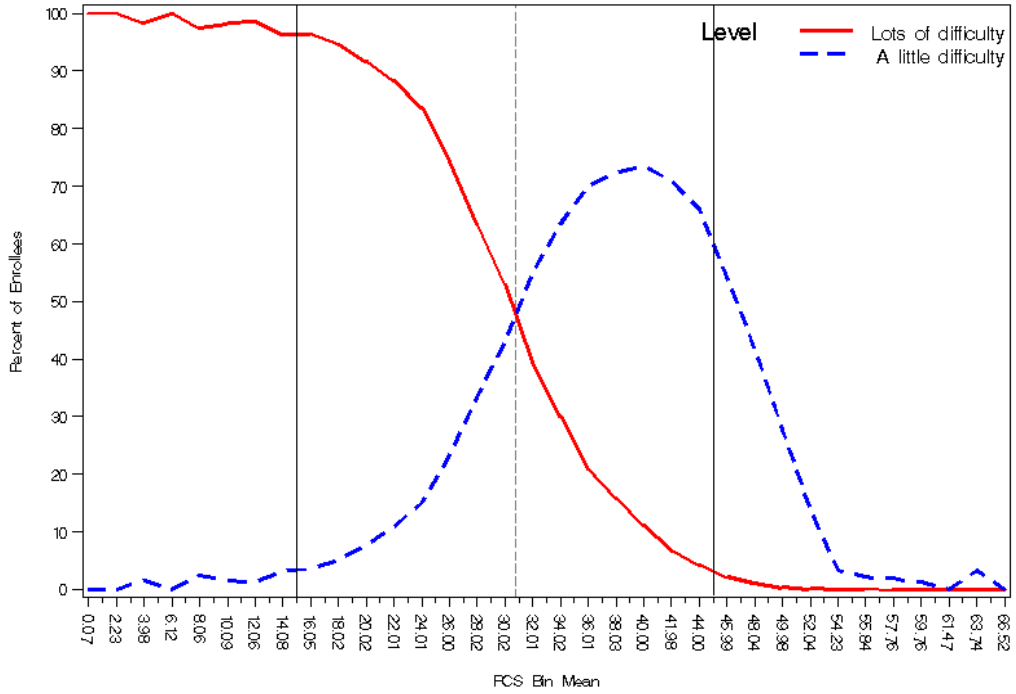
*** Controlling for all of the above and ADL limitations including the following: getting in and out of chairs; difficulty walking; dressing; eating; bathing and using the toilet.

PCS Scores and ADL Limitations (Figures 2A & 2B)

Figures 2A and 2B provide several examples that attempt to illustrate how changes in PCS scores affect the ability to perform specific ADLs (difficulty climbing stairs and difficulty with moderate activity).

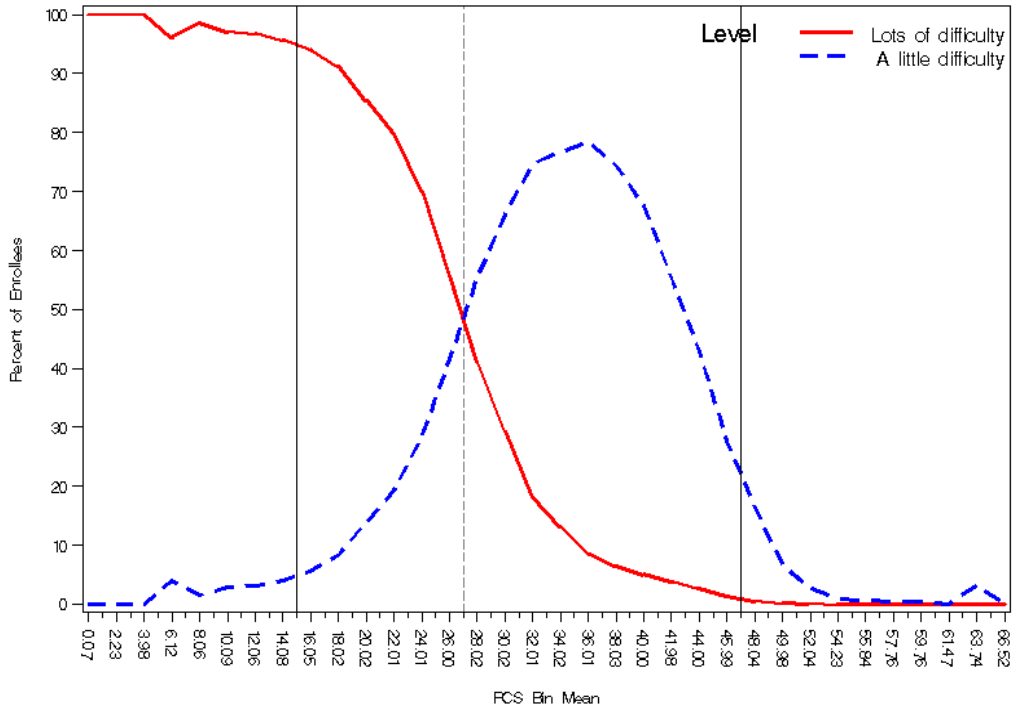
PCS scores are standardized to have a mean of 50 and a standard deviation of 10 in the general U.S population.[21] Figures 2A and 2B are intended to translate those scores into ability to perform ADLs such as climbing stairs or other moderate activities, thereby providing some insight for the practical implications of specific PCS scores. At PCS scores less than 15, virtually all beneficiaries showed "a lot of difficulty" while at PCS scores 45 or higher, virtually no beneficiaries reported "a lot of difficulty" with climbing stairs and moderate activity. At PCS scores between 30 and 45, the majority of the beneficiaries reported "a little difficulty" with climbing stairs and moderate activity and for scores between 15 and 30, the majority reported "a lot of difficulty." Within the PCS range from about 15 to 55, even a five-point change in PCS scores corresponded to a large change in the percentage of beneficiaries that reported a little or a lot of difficulty with the two activities. Thus a difference of five points in PCS would have significant practical implications for most Medicare beneficiaries 65 and older. As previously indicated, (Table 4) being obese was associated with a PCS score that was 2-7 points lower than the normal weight group, thus being obese could have significant practical limitations.

FIGURE 2A – DIFFICULTY OF CLIMBING SEVERAL FLIGHTS OF STAIRS BY PCS SCORE



Data Source: *Medicare HOS 2006 Cohort 9 Baseline*
Sample size = 93,070 Age range = 65 to 104
Horizontal axis is means of 2–unit wide PCS bins

FIGURE 2B – DIFFICULTY WITH MODERATE ACTIVITY BY PCS SCORE



Data Source: *Medicare HOS 2006 Cohort 9 Baseline*
Sample size = 93,070 Age range = 65 to 104
Horizontal axis is means of 2–unit wide PCS bins

Chapter 4: The Relationship between Obesity and Health Services Utilization

PURPOSE

The purpose of these analyses was to determine the relationship between obesity, as measured by BMI category, and health care utilization within the MA population, using beneficiaries responding to both the HOS and MA-CAHPS surveys.

FINDINGS

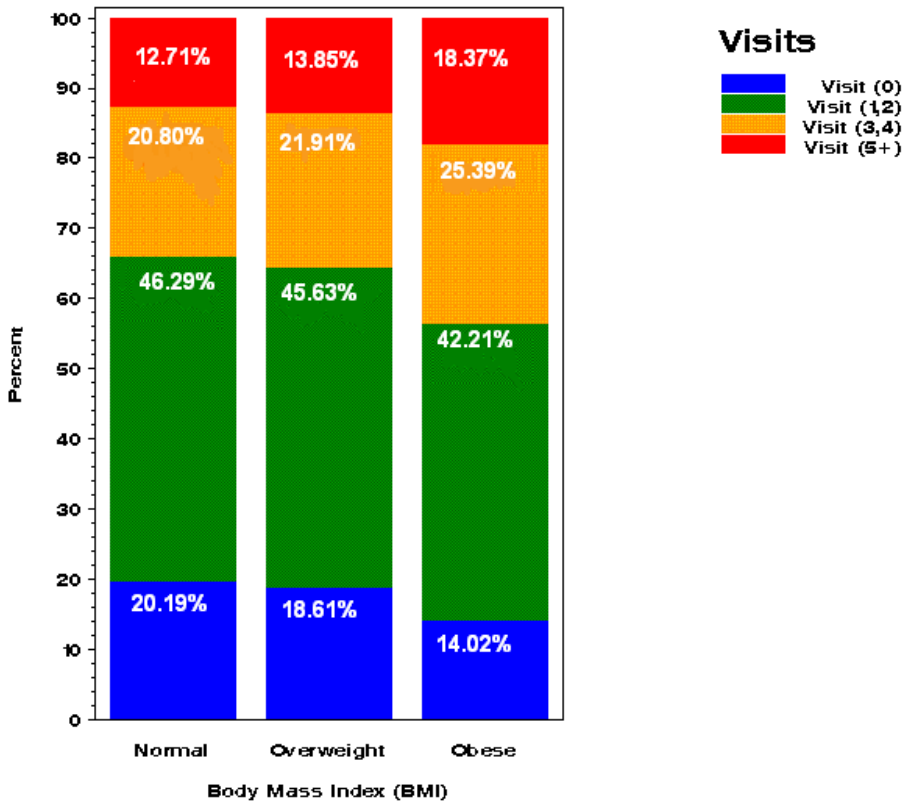
Self-reported height and weight data from the HOS were used to calculate BMI. Healthcare utilization was measured by items from the MA-CAHPS survey. Results are as follows. Figures 3-5 illustrate the association of BMI category with three measures of utilization: the number of office/clinic visits, the number of personal MD visits, and the number of specialists seen within the last six months.

Consistent with previous studies, the present study found greater utilization of health services with higher BMI. In general, results showed very small differences in utilization between the overweight and the normal BMI groups. Differences in utilization between the overweight and obese BMI groups were generally statistically significant. Greater differences in utilization were apparent between the normal and obese BMI groups.

BMI and Office Visits in the Past Six Months (Figure 3)

Respondents indicated that they had 0, 1-2, 3-4, or 5 or more office visits in the past six months. As indicated in Figure 3 on the next page, for all BMI groups, almost half (42.2-46.3%) had one or two office/clinic visits within the past six months. Obese beneficiaries (25.4%) were more likely to have 3-4 visits in the past six months than the normal weight category (20.8%) and overweight beneficiaries (21.9%). Similarly, 18.4% of obese beneficiaries as compared 13.9% of overweight and 12.7% of normal weight beneficiaries had 5 or more visits within six months. Overall, utilization was highest for obese beneficiaries, with the highest level of utilization approximately one and a half times as prevalent for obese beneficiaries as for their normal weight counterparts. Utilization was significantly higher for obese than normal weight beneficiaries (OR = 1.59, 95% CI 1.37, 1.85), but did not significantly differ between overweight and normal weight beneficiaries (OR = 1.12, 95% CI 0.98, 1.28).

FIGURE 3 – DISTRIBUTION OF NUMBER OF OFFICE VISITS IN PAST 6 MONTHS
OBESITY CATEGORY:
COVARIATE ADJUSTED PROPORTIONS

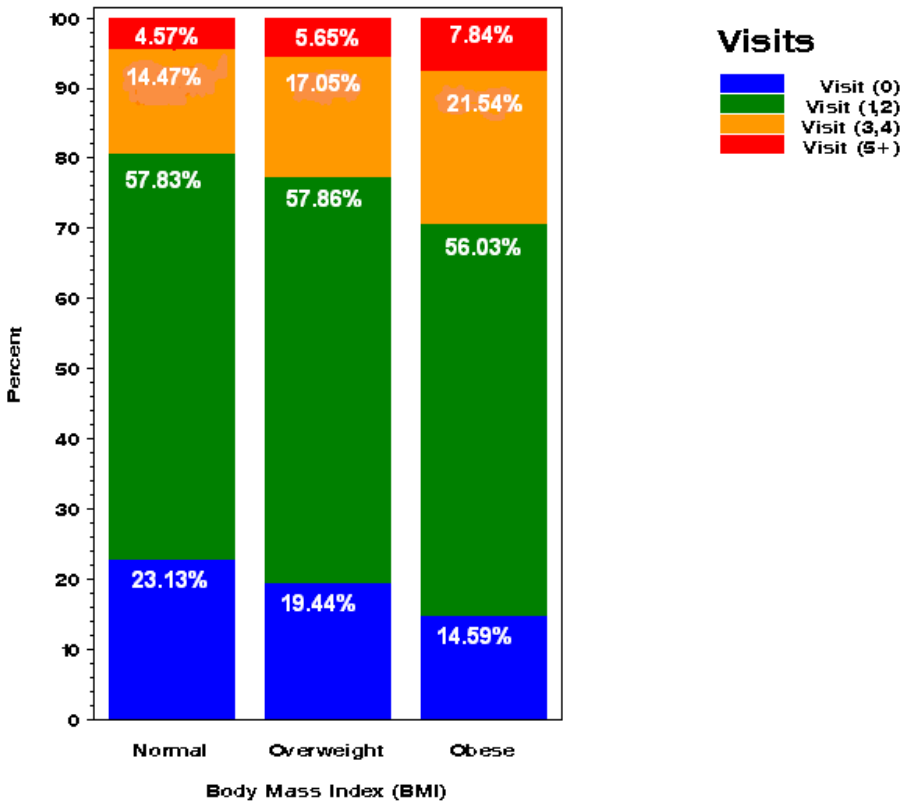


Data Source: *Medicare HOS 2006 Cohort 9 Baseline and MA–CAHPS 2007*
Sample size = 4,561

BMI and Personal Doctor Visits in the Past Six Months (Figure 4)

Respondents indicated that they had 0, 1-2, 3-4, or 5 or more personal doctor visits in the past six months. For all BMI groups, over half (56.0-57.9%) had one or two personal doctor visits within the past six months. Obese beneficiaries (21.5%) were more likely to have 3-4 visits in the past six months than the normal weight category (14.5%) and overweight categories (17.1%). Similarly, 7.8% of obese beneficiaries as compared to 5.7% of overweight and 4.6% of normal weight beneficiaries had 5 or more visits within six months. Overall, utilization was highest for obese beneficiaries, with the highest level of utilization was thus over one and a half times as prevalent for obese beneficiaries as for their normal weight counterparts. Utilization was significantly higher for obese than normal weight beneficiaries (OR=1.77, 95% CI 1.51, 2.07), but less so between overweight and normal weight beneficiaries OR=1.29, 95% CI 1.11, 1.48).

FIGURE 4 – DISTRIBUTION OF NUMBER OF PERSONAL DOCTOR VISITS IN PAST 6 MONTHS BY OBESITY CATEGORY: COVARIATE ADJUSTED PROPORTIONS



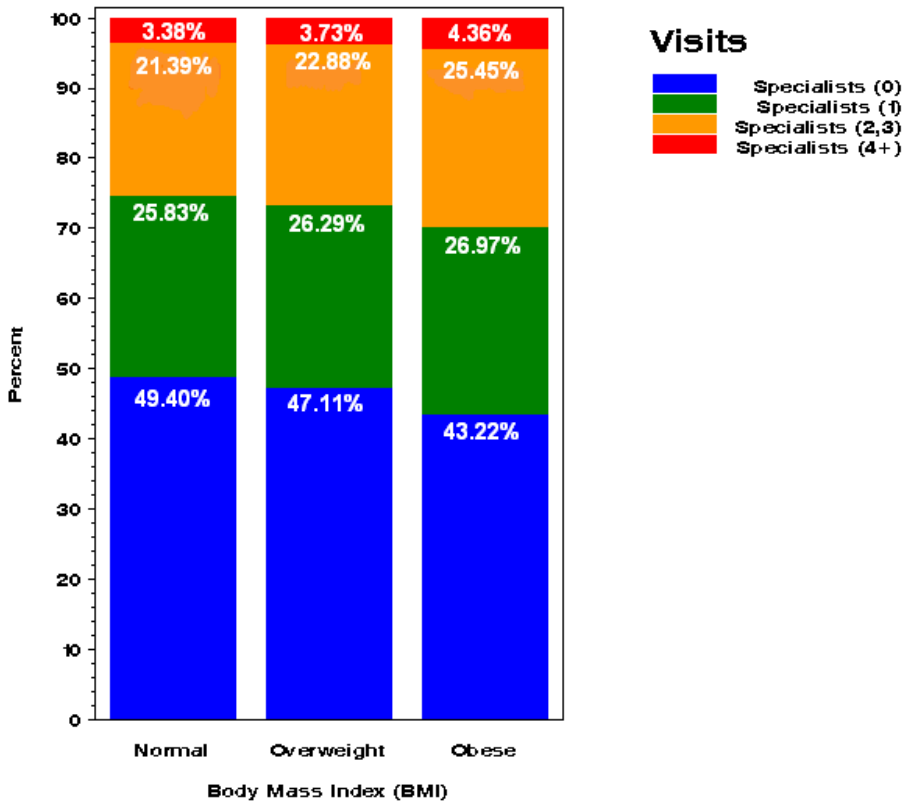
Data Source: *Medicare HOS 2006 Cohort 9 Baseline and MA–CAHPS 2007*
Sample size = 4,593

BMI and Number of Specialists Seen in the Past Six Months (Figure 5)

Respondents to the survey indicated that they had seen 0, 1, 2-3 or 4 or more specialists within the past six months. For all BMI groups, almost half (43.2-49.4%) of beneficiaries did not see a specialist within the past six months (Figure 5) on the next page. Differences were found for the category of 2-3 specialists seen with 21.4% for the normal group, 22.9% for the overweight and 25.5% for the obese. Similarly, differences were apparent with 4.4% of obese beneficiaries, compared to 3.7% of overweight and 3.4% of normal weight beneficiaries seeing four or more specialists within six months. Compared to the normal, the obese group had a substantially greater likelihood of seeing two or more specialists (obese 29.8% versus normal, 24.8%).

The difference in utilization between the obese and normal weight beneficiaries was significant (OR = 1.40, 95% CI 1.20, 1.64), but the difference in utilization between overweight and normal weight beneficiaries was not significant (OR = 1.10, 95% CI 0.96, 1.27).

FIGURE 5 – DISTRIBUTION OF NUMBER OF SPECIALISTS SEEN IN PAST 6 MONTHS BY OBESITY CATEGORY: COVARIATE ADJUSTED PROPORTIONS



Data Source: *Medicare HOS 2006 Cohort 9 Baseline and MA–CAHPS 2007*
Sample size = 4,476

Weight Loss and Gain Scenarios and Associated Changes in Healthcare Utilization (Tables 5 & 6)

In order to illustrate the association between the population-level distribution of obesity among MA beneficiaries and utilization, we constructed two alternate scenarios that might correspond to a substantial increase or decrease in BMI across the population from the current distribution of 33% normal weight, 40% overweight, and 27% obese seen in this combined HOS-MA CAHPS sample (n=5,436), which is very similar to the 35% normal, 40% overweight, 25% obese distribution seen for the overall HOS sample.

Scenario 1, in which obesity decreases, involved one-third of overweight beneficiaries attaining normal weight and one-third of obese beneficiaries moving into the overweight category. In this scenario, 47% of beneficiaries would be normal weight, 35% overweight, and 18% obese.

Scenario 2, in which obesity increases, involved one-third of the beneficiaries from the normal group shifting to the overweight group and one-third of overweight beneficiaries moving into the obese group. The resulting prevalence simulated an increase in obesity (normal 22%, overweight 38% and obese 40%). The current distribution of obesity and the distributions corresponding to alternate Scenarios 1 and 2 are summarized in Table 5.

TABLE 5 – DISTRIBUTION OF OBESITY CLASSIFICATION CURRENTLY AND UNDER ALTERNATE SCENARIOS 1 AND 2			
	Normal	**Overweight**	**Obese**
Scenario 1: obesity decreases	47%	35%	18%
Current Classification	33%	40%	27%
Scenario 2: obesity increases	22%	38%	40%

Tables 6A through 6C illustrate the change in utilization associated with changes in the population distribution of obesity under Scenarios 1 and 2.

Under Scenario 1, (decreasing obesity), the proportion of the MA population with five or more office/clinic visits in the past six months decreased by 3.8 percentage points, and the proportion of the population with two or fewer visits increased by 4.4 percentage points (Table 6A). Under Scenario 2 (increasing obesity), the proportion of the MA population with five or more office/clinic visits in the past six months increased 4.9 percentage points and the percentage of the population with two or fewer visits decreased 5.6 percentage points (Table 6A).

TABLE 6A – PERCENTAGE CHANGE IN 6 MONTH PERIOD OFFICE/CLINIC VISIT FREQUENCY UNDER SCENARIOS 1 , 2				
	0	**1, 2**	**3,4**	**5 or more**
Scenario 1: obesity decreases	+3.5%	+0.9%	-2.0%	-3.8%
Current Classification	-------	-------	-------	-------
Scenario 2: obesity increases	-4.4%	-1.2%	+2.6%	+4.9%

Similarly, when we simulated a change in obesity to estimate its effect on personal MD visits, under Scenario 1 (decreasing obesity) the proportion of the MA population with five or more personal doctor visits in the past six months dropped by 5.8 percentage points and the percentage of the population with two or fewer visits increased 5.1% (Table 6B). Under Scenario 2 (increasing obesity) the proportion of the MA population with five or more personal doctor visits in the past six months increased 7 percentage points and the percentage of the population with two or fewer visits decreased 5.8% (Table 6B).

TABLE 6B – PERCENTAGE CHANGE IN 6 MONTH PERIOD IN PERSONAL MD VISITS FREQUENCY UNDER SCENARIO 1, 2				
	0	**1, 2**	**3,4**	**5 or more**
Scenario 1: obesity decreases	+4.8%	+0.3%	-4.3%	-5.8%
Current Classification	-------	-------	-------	-------
Scenario 2: obesity increases	-5.4%	-0.4%	+5.1%	+7.0%

Finally, when we simulated a change in obesity to estimate its effect on the number of specialists seen, under Scenario 1 (obesity decreasing) the proportion of the MA population with two or more specialist visits in the past six months dropped by 4.6 percentage points and the percentage of the population with no visits increased by 1.4% (Table 6C). Under Scenario 2 (increasing obesity) the proportion of the MA population with two or more specialist visits in the past six months increased 5.4 percentage points and the percentage of the population with no visits to a specialist decreased 1.6% (Table 6C).

TABLE 6C – PERCENTAGE CHANGE IN 6 MONTH PERIOD OF NUMBER OF SPECIALISTS SEEN FREQUENCY UNDER SCENARIO 1, 2

	0	1	2,3	4 or more
Scenario 1: obesity decreases	+1.4%	-0.5%	-1.9%	-2.7%
Current classification	-------	-------	-------	-------
Scenario 2: obesity increases	-1.6%	+0.5%	+2.2%	+3.2%

Chapter 5 – Discussion and Recommendations

This chapter contains a brief overview and discussion of the results of this study. Subsequently we offer suggestions with the hope of assisting health plans to allocate their scarce health care resources as related to the weight management of their beneficiaries, as well as offer some implications for public policy.

FINDINGS

We observed a high prevalence of obesity (25%) and overweight status (40%) among beneficiaries in this study. Levels of obesity tended to be highest in the younger beneficiaries (65-74 years) suggesting that cohorts of greater obesity may be entering Managed Care Organizations. African Americans were especially likely to be obese or overweight. While examining the BMI categories of beneficiaries over a two year period, it was apparent that a clear majority of beneficiaries remained in the same BMI category, though the underweight category was considerably less stable than the other three BMI categories.

Obese beneficiaries generally reported poorer health status, lower PCS scores, more undesirable health conditions and more limitations in ADLs than normal weight BMI beneficiaries. Osteoporosis, smoking, and stroke were exceptions to the tendency for notably greater prevalence of undesirable health conditions or behaviors with increasing BMI. In general, ADL limitations for overweight beneficiaries, while generally worse than for normal weight beneficiaries, were more similar to what was seen for normal weight beneficiaries than what was seen for obese beneficiaries. The differences in the prevalence of chronic diseases between normal and overweight followed the same pattern, with the differences in the number of reported chronic conditions between the normal and overweight groups generally smaller than the differences between the normal and the obese BMI groups.

Higher baseline BMI was not associated with higher mortality for beneficiaries. As in previous research with datasets better suited to establishing the causal direction of associations between BMI and mortality, the underweight group had the highest death rate of the three groups, over three times as great as the overweight and obese groups.

Obesity was associated with lower HRQOL and lower self-rated health. The study examined the relationship of BMI to HRQOL of the Medicare beneficiaries as measured by PCS scores and ADL limitations such as difficulty climbing several flights of stairs and difficulty with moderate activity. We demonstrated that differences in HRQOL of the magnitude observed between obese and normal weight beneficiaries translates into substantial loss of functions, and therefore will often have substantial ramification on daily lives.

The present study found greater utilization of health care services with higher BMI. In general, results showed small differences in utilization between the overweight and the normal weight BMI groups and greater differences between the normal and the obese groups. We described the possible impact of future changes in obesity distribution of MAO enrollees and show that if the association between obesity and utilization is causal, then moderate changes in the obesity distribution could substantially effect utilization.

DISCUSSION

HRQOL, and measures of self rated health, provide insight as to how the patient performs in his or her physical role functions at one point in time. Low PCS scores may indicate limitations in self care, physical role activities, bodily pain, frequent tiredness and lower self rated health. High PCS scores usually indicate no physical limitations, disabilities or decline in well-being, high energy level, and a high level of self-rated health. PCS scores in this study suggested overweight enrollees perform at essentially the same level in their roles as normal weight beneficiaries. This similarity of role performance of normal and overweight seniors found in the present study supported recent findings by others. For example, Finkelstein and colleagues (2009) reported that normal and overweight BMI adults had no difference in health care spending.[3]

In the general adult population, the association of BMI with mortality varies considerably by cause of death. In a study by Flegal et al, among US adults, the overweight and obese were associated with increased mortality from diabetes and kidney disease and decreased mortality from other non-cancer, non-CVD causes.[4] However, the association of BMI with mortality in older ages appears weak.[22, 4] The results of the present study looking at all cause mortality, were consistent with results reported in the literature that found an inverse relationship between BMI and mortality, with low BMI values being associated with increased mortality, and elevated BMI with reduced mortality risk.[23] The death rates of this study indicated that both the overweight and the obese had significantly lower death rates than the normal weight group. Only the underweight group in this study had significantly higher mortality rates than the normal weight beneficiaries. This is consistent with the literature that suggests that underweight status is often a consequence of illness, whereas obesity may more often be a cause of illness.[4]

Obesity is strongly associated with disability among the elderly.[7, 22, 24, 25, 26] Our study showed fifty percent more obese than normal weight beneficiaries had high blood pressure and three times as many obese compared to normal weight beneficiaries had diabetes. Though some research has shown that weight loss through diet and physical activity can effectively manage these conditions,[27] research has suggested that the annual medical spending for these progressive diseases do not return to the levels they were before diagnosis.[26] Thus, avoiding or delaying onset of these diseases by moving those beneficiaries who are obese to the overweight or normal status is critical to reduce spending.[28]

Normal weight beneficiaries in our study were more likely to smoke every day than were overweight or obese beneficiaries. Many studies have suggested that the nicotine in cigarettes speeds the metabolism and decreases the appetite.[29] Concerns about weight gain following smoking cessation have been reported to inhibit attempts to stop smoking, especially in women.[30] In a study by Sanchez-Johnson at the University of Hawaii, it was found that African American woman tended to gain substantially more weight after quitting smoking than Caucasian woman. Since obesity is an especially large issue for African Americans, it is particularly critical that weight concerns be addressed simultaneously with weight loss strategies for this group as well as for all others.[31, 32, 30]

Osteoporosis is a major cause of disability and mortality in older adults. Research has shown that lifestyle factors such as cigarette smoking, BMI less than 19, inadequate physical activity, low calcium intake, as well as increasing age itself, all are linked to osteoporosis.[33] A number of research studies have found that being overweight has a protective effect against osteoporosis.[34] Higher BMI category in this study was associated with a decrease in the prevalence of osteoporosis. The incidence of osteoporosis presents significant challenges to health plans and the health care community. Persons with osteoporosis are particularly prone to hip fractures after a fall and it is forecasted that by 2020, the national direct and indirect cost of fall injuries among older adults is expected to reach 54.9 billion dollars (in 2007 dollars).[35]

Higher BMI category in this study was associated with increased utilization. Other researchers have reported differences in office-based visits by BMI of the patients. For example Lin and colleagues (2005) reported visits among US adults at least 18 years old. In visits where BMI was calculated, they found 27%, 31% and 37% of office visits were made by normal weight, overweight and obese patients, respectively.[36]

The American Geriatrics Society Foundation recommends that older adults see their doctor or healthcare provider at least once a year unless instructed to come in more often.[37] For all BMI groups in our study, almost half had one or two office/clinic visits within the past six months and over half had one or two personal doctor visits within the past six month. Medicare beneficiaries have fewer financial barriers to access care than the general population, so that their patterns of utilization may not reflect the same constraints as the utilization of persons with greater financial barriers. [38]

Our weight change scenarios which were developed to simulate an increase or decrease in obesity resulted in a concomitant change in the number of office visits, but how do these changes in outpatient utilization translate into dollars and what are the effects on Medicare? Several studies have attempted to quantify the lifetime costs of obesity.[39,40,41, 42] Researchers Yang and Hall studied the financial burden of overweight and obese elderly Americans upon health care costs. Their research suggested that elderly men and woman who were overweight or obese at age 65 had 6-13% and 11-17% respectively more life time health care expenditures than the same age cohort within the normal weight range. Their analyses looked at both the resulting increase in chronic conditions and acute medical care events related to body weight. Andreyeva, Sturm and Ringel estimated that for a group of 54 to 69 year olds, a BMI of 35-40 was associated with twice the increase in health care expenditures above normal weight.[38] Thus, the impact of increasing obesity on the Medicare system is a major concern.

LIMITATIONS

Several imitations should be kept in mind when interpreting the results of this study. The analyses were cross-sectional and observational, so causation cannot be inferred from statistically significant associations.

Self-reported height and weight categories were used to calculate BMI, which was then assigned into BMI categories. This approach may be insufficiently precise for clinical decisions at the individual level, but still permits population-level inferences. Research indicates that self-reported information about height tends to be high for men and on weight tends to be low for woman, reflecting a social desirability bias.[22] Also a normally, random/unbiased measurement error results in understating the strength of associations (attenuation bias). If self-report error is random, our estimates of the strength of association of BMI with health status and healthcare utilization will be conservative.

Only beneficiaries, who filled out the HOS by themselves, without help from proxies, were included in this study. This exclusion was likely to remove beneficiaries in the poorest health, from the analyses, which may have somewhat underestimated the association between obesity and health status.

This study analyzed the association between BMI and mortality over a two year period. A study that addresses the association between mortality and BMI requires longitudinal data and repeated measures of the same people, both before, during and after disease state in order to understand the true sequence of disease and its associated weight loss distinct from other exogenous sources of weight loss.

IMPLICATIONS

Research by Finkelstein and colleagues shows that obese beneficiaries, on average, cost Medicare over $600 more per beneficiary per year compared to normal weight beneficiaries.[3] In addition they indicate that the costs "attributable to obesity are almost entirely of costs generated from treating the disease that obesity promotes."[3] Thus the future holds challenges for MAOs. They must contend with a higher prevalence of obese enrollees who have more disabilities and are more complicated to treat due to more comorbidities. There is a real need to make changes on several levels to help create an environment that decreases rates of obesity in the Medicare population. The approach needs to target the Medicare beneficiaries on many levels; the individual, the health plan, the community and the public health level.

The Agency for Healthcare Research and Quality indicates that 20 percent of the population incurs 80 percent of total health care expenses.[43] Results of this study suggest that although effort helping overweight beneficiaries attain normal weight may be of value, a focus on (1) helping obese beneficiaries attain merely overweight BMI and (2) preventing overweight beneficiaries from becoming obese may have the greatest potential to improve the HRQOL of life of beneficiaries, while decreasing the utilization and associated costs of their health care.

Thus plans would be concentrating on the beneficiaries who have the high-cost chronic diseases and have the greatest risk for hospitalization. Particular effort should be focused on younger obese beneficiaries who on average have higher BMI levels. This would help in avoiding or delaying the onset of chronic disease and improve the HRQOL of the beneficiaries, as well as reducing health care costs.

A number of strategies exist to help older persons achieve and maintain weight-loss. Behavioral counseling on diet and physical activity appear to successfully reduce both utilization and health related spending among retirees.[44] For example, behavioral interventions have been shown to reduce the 10-year coronary heart disease risk by 12% to 14%.[45] Studies have produced results that showed modest increases in physical activity and modest weight loss produce substantial benefit.[22, 44]

The promotion of physical activity is a critical area in Healthy People 2010. Walking is a comparatively common activity among older adults who may be typically sedentary.[46] Neighborhood characteristics have been shown to strongly influence walking and other physical activity among the elderly.[47, 48] Fuzhong Li and colleagues (2004) studied the environmental characteristics related to neighborhood walking activity in older adults. Their results indicate that a resident's perception of proximity to recreational facilities and safety for walking in the neighborhood were significantly related to increases in neighborhood walking.[46] Public health strategies to promote walking in the elderly are critical but also need to take into account the important role of environmental influences to remove barriers for people to be more active.

Researchers have also shown that obesity is under-diagnosed and many opportunities for counseling are missed during office-based physician visits. However, when weight and height measures are performed, both diagnosis and counseling increase.[49]Evidence suggests that MAOs are better than traditional Medicare at delivering preventive services such as flu vaccinations and smoking cessation counseling.[50] Creating quality indicators that measure the frequency that a provider takes height and weight measurements and provides counseling regarding height and weight during an office visit, would provide a general indication of how well a Medicare MAO attempts to manage the weight of its members as well as providing a reliable overall measure of how the plan compares with other plans. These indicators would also provide a reliable measurement tool to be used in process improvement activities.

Results of this research also suggest that there may be value in developing a quality indicator that measures the success of health plans in reducing obesity over time. While approaches that assess plans on the basis of beneficiaries' initial BMI might encourage adverse selection, assessing a plan's success in reducing obesity over time may avoid these issues and provide a basis for incentivizing changes that are beneficial to plan members, plans and CMS. HEDIS measures, one of the most widely used sets of health care performance measures, have the potential to not only measure plan performance, but also to bring about improvement over time in the processes measured.[51,52, 53]

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APPENDIX

TABLE A1 – UNADJUSTED COEFFICIENTS FOR ASSOCIATION BETWEEN BMI AND HRQOL (PCS SCORES)
MEDICARE HEALTH OUTCOMES SURVEY *2006*
COHORT 9 BASELINE

Variable	coeff.	SE	t Value	Pr > |t|
Intercept	42.34	0.07	645.35	<0.0001
Overweight	-0.98	0.09	-10.92	<0.0001
Obese	-5.66	0.10	-55.93	<0.0001
Normal (ref)				
R-square = 0.0379				

TABLE A2 – MODEL 1: ASSOCIATION BETWEEN BMI AND HRQOL (PCS SCORES) ADJUSTING FOR SOCIODEMOGRAPHIC CHARACTERISTICS
MEDICARE HEALTH OUTCOMES SURVEY *2006 COHORT 9 BASELINE*

Variable	coeff.	SE	t Value	Pr > |t|
Intercept	70.28	0.53	133.41	<0.0001
Overweight	-1.85	0.09	-19.88	<0.0001
Obese	-6.56	0.11	-62.42	<0.0001
Normal (ref)				
Age	-0.37	0.01	-56.04	<0.0001
Female	-1.01	0.09	-11.57	<0.0001
African American	0.00	0.16	0.01	0.9913
Hispanic	0.77	0.18	4.37	<0.0001
Other race	-1.05	0.18	-5.88	<0.0001
Caucasian (ref)				
Single	0.04	0.12	0.29	0.7736
Widowed	0.57	0.10	5.47	<0.0001
Married (ref)				<0.0001
Less than $10,000	-1.32	0.14	-9.09	<0.0001
$20,000-$29,999	0.90	0.11	8.01	<0.0001
$30,000-$39,999	1.99	0.13	14.71	<0.0001
$40,000-$49,999	2.88	0.16	17.71	<0.0001
$50,000-$79,999	3.50	0.16	21.46	<0.0001
$80,000 or More	4.88	0.21	23.20	<0.0001
$10,000-$19,999 (ref)				<0.0001
Up to 8th grade	-1.34	0.16	-8.17	<0.0001
Some high school	-1.13	0.12	-9.33	<0.0001
Some college or AA	-0.00	0.11	-0.02	0.9810
Bachelors degree	1.06	0.16	6.70	<0.0001
Advanced degree	1.30	0.16	8.15	<0.0001
GED or high school diploma (ref)				
R-square = 0.1219				

TABLE A3 – MODEL 2: ASSOCIATION BETWEEN BMI AND HRQOL (PCS SCORES) ADJUSTING FOR DEMOGRAPHICS AND HEALTH CONDITIONS OF MEDICARE HEALTH OUTCOMES SURVEY *2006 COHORT 9 BASELINE*				
Variable	**coeff.**	**SE**	**t Value**	**Pr > |t|**
Intercept	66.03	0.49	133.50	<0.0001
Overweight	-0.78	0.09	-8.90	<0.0001
Obese	-3.41	0.10	-33.10	<0.0001
Normal (ref)				
Age	-0.24	0.01	-37.65	<0.0001
Female	0.31	0.09	3.54	0.0004
African American	-0.21	0.15	-1.40	0.1627
Hispanic	0.82	0.17	4.95	<0.0001
Other race	-1.12	0.17	-6.72	<0.0001
Caucasian (ref)				
Single	0.11	0.11	1.01	0.3115
Widowed	0.68	0.10	7.15	<0.0001
Married (ref)				
Less than $10,000	-1.00	0.14	-7.29	<0.0001
$20,000-$29,999	0.68	0.10	6.50	<0.0001
$30,000-$39,999	1.40	0.12	11.32	<0.0001
$40,000-$49,999	2.13	0.15	14.39	<0.0001
$50,000-$79,999	2.49	0.15	16.81	<0.0001
$80,000 or More	3.49	0.19	18.36	<0.0001
$10,000-$19,999 (ref)				
Up to 8th grade	-0.98	0.16	-6.27	<0.0001
Some high school	-0.62	0.11	-5.40	<0.0001
Some college or AA	0.39	0.10	4.07	<0.0001
Bachelors degree	1.01	0.14	7.03	<0.0001
Advanced degree	1.60	0.15	11.04	<0.0001
GED or high school diploma (ref)				
Myocardial infarction	-0.97	0.14	-6.91	<0.0001
Coronary artery disease	-2.22	0.12	-18.04	<0.0001
Congestive heart failure	-4.40	0.15	-28.41	<0.0001
Other heart condition	-1.93	0.09	-20.43	<0.0001
Hypertension	-1.32	0.08	-16.59	<0.0001
Diabetes	-2.41	0.09	-25.89	<0.0001
Inflammatory bowel disease	-2.16	0.18	-12.24	<0.0001
Osteoporosis	-2.39	0.10	-24.11	<0.0001
Stroke	-3.09	0.14	-21.48	<0.0001
Arthritis of the hip	-5.17	0.08	-62.40	<0.0001
Arthritis of the hand	-2.20	0.08	-26.45	<0.0001
Fall in the past 12 months	-3.90	0.10	-40.55	<0.0001
Urine leakage in the past 6 months	-1.86	0.08	-23.46	<0.0001
R-square = 0.3311				

TABLE A4 – MODEL 3: ASSOCIATION BETWEEN BMI AND HRQOL (PCS SCORES) ADJUSTING FOR DEMOGRAPHICS, HEALTH CONDITION, AND ADL LIMITATIONS OF MEDICARE HEALTH OUTCOMES SURVEY *2006 COHORT 9 BASELINE*				
Variable	**coeff.**	**SE**	**t Value**	**Pr > |t|**
Intercept	58.29	0.44	133.79	<0.0001
Overweight	-0.43	0.08	-5.67	<0.0001
Obese	-1.75	0.09	-19.25	<0.0001
Normal (ref)				
Age	-0.13	0.01	-23.21	<0.0001
Female	-0.19	0.08	-2.55	0.0109
African American	-0.08	0.13	-0.64	0.5239
Hispanic	0.69	0.15	4.75	<0.0001
Other race	-0.84	0.14	-5.82	<0.0001
Caucasian (ref)				
Single	0.37	0.10	3.71	0.0002
Widowed	0.74	0.08	8.84	<0.0001
Married (ref)				
Less than $10,000	-0.59	0.12	-4.90	<0.0001
$20,000-$29,999	0.39	0.09	4.26	<0.0001
$30,000-$39,999	0.90	0.11	8.37	<0.0001
$40,000-$49,999	1.33	0.13	10.27	<0.0001
$50,000-$79,999	1.65	0.13	12.81	<0.0001
$80,000 or More	2.57	0.17	15.51	<0.0001
$10,000-$19,999 (ref)				
Up to 8th grade	-0.67	0.14	-4.87	<0.0001
Some high school	-0.39	0.10	-3.93	<0.0001
Some college or AA	0.36	0.08	4.31	<0.0001
Bachelors degree	0.84	0.13	6.71	<0.0001
Advanced degree	1.38	0.13	10.91	<0.0001
GED or high school diploma (ref)				

TABLE A4 (CONTINUED) – MODEL 3: ASSOCIATION BETWEEN BMI and HRQOL (PCS SCORES) ADJUSTING FOR DEMOGRAPHICS, HEALTH CONDITIONS AND ADL LIMITATIONS OF MEDICARE HEALTH OUTCOMES SURVEY *2006 COHORT 9 BASELINE*				
Variable	**coeff.**	**SE**	**t Value**	**Pr > |t|**
Myocardial infarction	-0.83	0.12	-6.73	<0.0001
Coronary artery disease	-1.68	0.11	-15.57	<0.0001
Congestive heart failure	-2.61	0.14	-19.18	<0.0001
Other heart condition	-1.48	0.08	-17.92	<0.0001
Hypertension	-1.10	0.07	-15.90	<0.0001
Diabetes	-1.48	0.08	-18.14	<0.0001
Inflammatory bowel disease	-1.40	0.15	-9.08	<0.0001
Osteoporosis	-1.58	0.09	-18.17	<0.0001
Stroke	-1.31	0.13	-10.36	<0.0001
Arthritis of the hip	-2.92	0.07	-39.43	<0.0001
Arthritis of the hand	-1.48	0.07	-20.35	<0.0001
Fall in the past 12 months	-1.51	0.09	-17.66	<0.0001
Urine leakage in the past 6 months	-0.97	0.07	-13.99	<0.0001
Unable to or difficulty getting in or out of chairs	-2.55	0.11	-22.52	<0.0001
Unable to or difficulty walking	-9.18	0.10	-94.83	<0.0001
Unable to or difficulty dressing	-1.90	0.18	-10.79	<0.0001
Unable to or difficulty eating	0.27	0.23	1.16	0.2452
Unable to or difficulty bathing	-3.93	0.15	-25.55	<0.0001
Unable to or difficulty using toilet	0.24	0.18	1.34	0.1800
R-square = 0.5003				

TABLE A5 – UNADJUSTED CHARACTERISTICS OF MAO BENEFICIARIES WHO RESPONDED TO THE MA-CAHPS BY BMI				
Characteristics	**Normal (%)**	**Overweight (%)**	**Obese (%)**	
Missing				
Office/Clinic Visit (0)	19.1	18.0	12.8	805
Visit (1,2)	42.8	43.9	42.7	2053
Visit (3,4)	21.7	21.5	22.7	1040
Visit (5+)	11.7	13.0	18.2	663
Missing				
Personal Doctor Visit (0)	23.1	18.3	13.2	881
Visit (1,2)	53.3	57.2	56.1	2640
Visit (3,4)	15.8	16.6	18.9	806
Visit (5+)	4.2	5.0	8.2	266
Missing				
Specialists (0)	45.2	44.0	41.3	2075
Specialists (1)	25.1	25.4	23.3	1176
Specialists (2,3)	21.0	21.5	24.4	1049
Specialists (4+)	3.0	3.6	4.8	176
Female **	68.0	51.4	64.9	2878
Age, Mean (SD) **	75.8 (6.6)	74.3 (5.9)	73.3 (5.7)	74.6 (6.2)
African American	5.5	6.9	12.4	376
Caucasian	83.7	84.4	79.7	3940
Hispanic	4.1	4.4	3.9	199
Other race	5.9	3.9	3.4	210
Single	16.8	13.9	19.0	771
Widowed	30.6	25.6	29.3	1344
Married (ref)	52.1	60.1	51.1	2614
Less than $10,000	8.3	8.5	11.2	435
$10,000-$19,999	22.6	20.6	24.9	1066
$20,000-$29,999	17.4	19.0	18.0	864
$30,000-$39,999	10.7	12.1	10.6	534
$40,000-$49,999	6.7	7.6	7.0	340
$50,000-$79,999	8.0	9.0	7.7	395
$80,000 or More	4.9	6.3	3.1	235
Up to 8th grade	5.3	6.1	7.4	295
Some high school	12.7	15.5	16.9	710
GED or high school diploma (ref)	37.8	37.1	40.7	1820
Some college or AA	23.8	22.1	20.8	1062
Bachelors degree	9.3	8.5	6.5	392
Advanced degree	10.3	10.1	7.0	444
* $P < 0.01$ ** $P < 0.001$				

TABLE A6 – UNADJUSTED COEFFICIENTS FOR ASSOCIATION BETWEEN OFFICE/CLINIC VISITS AND BMI
HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007

Variable	DF	COEFF	SE	Chi-Sq.	Pr > ChiSq
Intercept 3	1	-1.91	0.06	1082.97	<0.0001
Intercept 2	1	-0.65	0.05	171.98	<0.0001
Intercept 1	1	1.41	0.05	682.96	<0.0001
Overweight	1	0.06	0.06	0.99	0.32
Obese	1	0.40	0.07	32.07	<0.0001
Normal (ref)					

TABLE A7 – ASSOCIATION BETWEEN OFFICE/CLINIC VISITS AND BMI ADJUSTING FOR SOCIODEMOGRAPHIC CHARACTERISTICS
HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007

						Odds Ratio Estimates		
Variable	DF	Coeff	SE	Chi-Sq.	Pr > ChiSq	Point Estimate	Lower 95%	Upper 95%
Intercept 3	1	-1.65	0.40	17.41	<0.0001			
Intercept 2	1	-0.40	0.39	1.01	0.3143			
Intercept 1	1	1.68	0.40	18.18	<0.0001			
Overweight	1	0.11	0.07	2.53	0.1119	1.12	0.98	1.28
Obese	1	0.46	0.08	36.58	<0.0001	1.59	1.37	1.85
Normal (ref)						---	---	---
Age	1	-0.01	0.01	1.97	0.1600	0.99	0.98	1.00
Female	1	0.01	0.06	0.04	0.8389	1.01	0.89	1.15
African American	1	-0.08	0.11	0.52	0.4713	0.92	0.74	1.15
Hispanic	1	-0.18	0.15	1.55	0.2127	0.83	0.62	1.11
Other race	1	0.06	0.14	0.19	0.6652	1.06	0.81	1.40
Caucasian (ref)						---	---	---
Single	1	0.20	0.09	5.27	0.0217	1.22	1.03	1.45
Widowed	1	0.16	0.08	4.45	0.0349	1.18	1.01	1.37
Married (ref)						---	---	---
Less than $10,000	1	-0.17	0.11	2.54	0.1108	0.84	0.68	1.04
$20,000-$29,999	1	0.07	0.08	0.64	0.4246	1.07	0.91	1.26
$30,000-$39,999	1	0.12	0.10	1.38	0.2397	1.12	0.93	1.36
$40,000-$49,999	1	0.17	0.12	2.06	0.1515	1.18	0.94	1.49
$50,000-$79,999	1	0.28	0.11	5.88	0.0153	1.32	1.06	1.66
$80,000 or More	1	0.08	0.14	0.33	0.5666	1.09	0.82	1.44
$10,000-$19,999 (ref)						---	---	---
Up to 8th grade	1	-0.03	0.13	0.07	0.7983	0.97	0.75	1.25
Some high school	1	-0.03	0.09	0.09	0.7653	0.97	0.82	1.16
Some college or AA	1	0.14	0.08	3.27	0.0704	1.15	0.99	1.34
Bachelors degree	1	0.27	0.11	5.92	0.0150	1.32	1.06	1.64
Advanced degree	1	0.40	0.11	13.13	0.0003	1.49	1.20	1.85
GED or high school						---	---	---

TABLE A8 – UNADJUSTED COEFFICIENTS FOR ASSOCIATION BETWEEN PERSONAL MD VISITS AND BMI HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007					
Variable	**DF**	**Coeff**	**SE**	**Chi-Sq.**	**Pr > ChiSq**
Intercept 3	1	-3.03	0.08	1554.82	<0.0001
Intercept 2	1	-1.43	0.06	666.24	<0.0001
Intercept 1	1	1.22	0.05	515.01	<0.0001
Overweight	1	0.20	0.07	9.07	0.0026
Obese	1	0.54	0.07	53.01	<0.0001
Normal (ref)					

TABLE A9 – ASSOCIATION BETWEEN PERSONAL MD VISITS AND BMI ADJUSTING FOR SOCIODEMOGRAPHIC CHARACTERISTICS HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007								
						Odds Ratio Estimates		
Variable	**DF**	**Coeff**	**SE**	**Chi-Sq.**	**Pr > ChiSq**	**Point Estimate**	**Lower 95%**	**Upper 95%**
Intercept 3	1	-3.57	0.42	72.27	<0.0001			
Intercept 2	1	-1.97	0.42	22.45	<0.0001			
Intercept 1	1	0.70	0.41	2.86	0.0910			
Overweight	1	0.25	0.07	11.86	0.0006	1.29	1.11	1.48
Obese	1	0.57	0.08	49.80	<0.0001	1.77	1.51	2.07
Normal (ref)						---	---	---
Age	1	0.00	0.01	0.78	0.3778	1.01	0.99	1.02
Female	1	0.08	0.07	1.37	0.2422	1.08	0.95	1.24
African American	1	0.33	0.12	7.57	0.0059	1.39	1.10	1.75
Hispanic	1	0.09	0.15	0.33	0.5637	1.09	0.81	1.47
Other race	1	0.37	0.15	6.17	0.0130	1.45	1.08	1.94
Caucasian (ref)						---	---	---
Single	1	0.05	0.09	0.27	0.6054	1.05	0.88	1.26
Widowed	1	0.15	0.08	3.61	0.0575	1.17	0.99	1.37
Married (ref)						---	---	---
Less than $10,000	1	-0.28	0.11	6.36	0.0117	0.75	0.61	0.94
$20,000-$29,999	1	-0.03	0.09	0.14	0.7061	0.97	0.82	1.15
$30,000-$39,999	1	-0.06	0.10	0.34	0.5598	0.94	0.77	1.15
$40,000-$49,999	1	0.02	0.13	0.02	0.8988	1.02	0.80	1.30
$50,000-$79,999	1	0.01	0.12	0.01	0.9267	1.01	0.80	1.28
$80,000 or More	1	-0.18	0.15	1.48	0.2231	0.83	0.62	1.12
$10,000-$19,999						---	---	---
Up to 8th grade	1	0.21	0.13	2.56	0.1099	1.24	0.95	1.61
Some high school	1	0.21	0.09	4.91	0.0267	1.23	1.02	1.48
Some college or AA	1	-0.03	0.08	0.11	0.7384	0.97	0.83	1.14
Bachelors degree	1	-0.02	0.12	0.03	0.8641	0.98	0.78	1.24
Advanced degree	1	0.20	0.12	2.94	0.0865	1.22	0.97	1.53
GED or high school						---	---	---

TABLE A10 – UNADJUSTED COEFFICIENTS FOR ASSOCIATION BETWEEN NUMBER OF SPECIALISTS SEEN AND BMI HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007					
Variable	**DF**	**Coeff**	**SE**	**Chi-Sq.**	**Pr > ChiSq**
Intercept 3	1	-3.28	0.09	1425.65	<0.0001
Intercept 2	1	-1.06	0.05	412.01	<0.0001
Intercept 1	1	0.07	0.05	1.77	0.1838
Overweight	1	0.06	0.07	0.86	0.3543
Obese	1	0.21	0.07	8.82	0.0030
Normal (ref)					

TABLE A11 – ASSOCIATION BETWEEN NUMBER OF SPECIALISTS SEEN AND BMI ADJUSTING FOR SOCIODEMOGRAPHIC CHARACTERISTICS HOS *2006 COHORT 9 BASELINE* MERGED WITH MA-CAHPS 2007								
						Odds Ratio Estimates		
Variable	**DF**	**Coeff**	**SE**	**Chi-Sq.**	**Pr > ChiSq**	**Point Estimate**	**Lower 95%**	**Upper 95%**
Intercept 3	1	-3.23	0.42	60.15	<0.0001			
Intercept 2	1	-0.96	0.41	5.50	0.0191			
Intercept 1	1	0.21	0.41	0.25	0.6156			
Overweight	1	0.10	0.07	1.85	0.1741	1.10	0.96	1.27
Obese	1	0.34	0.08	18.38	<0.0001	1.40	1.20	1.64
Normal (ref)						---	---	---
Age	1	-0.00	0.01	0.74	0.3887	1.00	0.99	1.01
Female	1	-0.11	0.07	2.90	0.0887	0.89	0.79	1.02
African American	1	-0.34	0.12	7.72	0.0055	0.71	0.56	0.90
Hispanic	1	-0.04	0.15	0.08	0.7800	0.96	0.71	1.29
Other race	1	-0.01	0.15	0.00	0.9592	0.99	0.75	1.32
Caucasian (ref)						---	---	---
Single	1	0.06	0.09	0.48	0.4868	1.06	0.89	1.27
Widowed	1	0.14	0.08	3.25	0.0714	1.15	0.99	1.35
Married (ref)						---	---	---
Less than $10,000	1	-0.10	0.11	0.79	0.3739	0.90	0.72	1.13
$20,000-$29,999	1	0.12	0.09	1.99	0.1583	1.13	0.95	1.34
$30,000-$39,999	1	0.07	0.10	0.43	0.5115	1.07	0.88	1.31
$40,000-$49,999	1	0.16	0.12	1.82	0.1772	1.18	0.93	1.49
$50,000-$79,999	1	0.11	0.12	0.93	0.3353	1.12	0.89	1.41
$80,000 or More	1	0.08	0.15	0.33	0.5668	1.09	0.82	1.44
$10,000-$19,999 (ref)						---	---	---
Up to 8th grade	1	-0.29	0.14	4.36	0.0368	0.75	0.57	0.98
Some high school	1	-0.26	0.09	7.60	0.0058	0.77	0.64	0.93
Some college or AA	1	0.35	0.08	19.88	<0.0001	1.42	1.22	1.66
Bachelors degree	1	0.50	0.11	19.45	<0.0001	1.65	1.32	2.06
Advanced degree	1	0.68	0.11	37.83	<0.0001	1.98	1.59	2.46
GED or high school diploma						---	---	---