Impact of overweight and obesity on hospitalization: race and gender differences

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Abstract

Objective—To examine associations between weight status and number of all-cause and cause-specific hospitalizations overall, and by race and gender.

Design—Longitudinal cohort study.

Subjects—White and black adults ($n = 15\ 355$) from the Atherosclerosis Risk in Communities Study who were normal weight (body mass index: ≥ 18.5 to $<25.0\ \mathrm{kg m}^{-2}$; $n = 4997$), overweight (≥ 25.0 to $<30.0\ \mathrm{kg m}^{-2}$; $n = 6100$), or obese ($\geq 30.0\ \mathrm{kg m}^{-2}$; $n = 4258$) at baseline.

Measurements—Information on hospitalizations was collected using community and cohort surveillance methods. Negative binomial models adjusted for race, gender, field center, age, physical activity, education level, smoking status, alcoholic beverage consumption and health insurance at baseline. Adjusted numbers of hospitalizations were calculated after setting covariates to the mean value (for continuous variables) or to the average distribution (for categorical variables) observed in the entire cohort and are expressed as the number of hospitalizations per 1000 adults followed over a period of 13 years.

Results—The covariate-adjusted average number of all-cause hospitalizations was 1316 per 1000 normal weight, 1543 per 1000 overweight and 2025 per 1000 obese. Normal weight women had significantly fewer hospitalizations than normal weight men (1173 versus 1515 per 1000), but the increase associated with being obese on the number of all-cause hospitalizations was larger in women than men (791 versus 589 per 1000). There was no significant difference detected between the number of hospitalizations in normal weight whites and blacks, and the increase in hospitalizations with overweight or obesity was also not different. Effects of weight status on several primary causes of hospitalization differed by gender and race group.

Conclusion—Our work suggests that obesity prevention may reduce hospitalizations, a major component of rising healthcare costs. The impact of successful obesity prevention is likely to be larger in women than in men, and similar in blacks and whites.

Keywords

overweight and obesity; number of hospitalizations; negative binomial model; healthcare costs; gender and race differences

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Introduction

Over recent decades, the prevalence of obesity and overweight has risen dramatically in the United States; two-thirds of American adults were overweight or obese in 2003–2004.[1–3] This high prevalence has far-reaching cost implications, in both economic and social terms. It is known that overweight and obesity account for 9.1% ($92.6 billion in 2002 dollars) in annual medical spending,[4] and 5.3–5.7% of health expenditures are attributable to obesity alone.[4,5] The previous analyses of heath expenditures data have aided in the estimation of healthcare costs because of obesity, but they often do not detail the impact of obesity on the components of healthcare costs.

Overweight and obese adults are at an increased risk of several diseases including cardiovascular disease (CVD), diabetes and some types of cancer.[6] Given that these chronic diseases are important causes of hospitalization, it is reasonable to suspect that overweight and obese individuals would be at a greater risk for hospitalization than normal weight individuals. Among the studies that have examined the impact of obesity on hospitalizations, [7–19] nine focused on American populations,[7,9,11–13,15,16,18,19] and five of those used a population-based sample.[9,11,15,16,19] Results have been mixed, with some studies finding positive associations between obesity and hospital admissions[7–9,11–13,15,16,18,19] and others finding no association[10,14] or negative association. [17] Studies measured the effect of obesity on the risk of hospitalizations,[7,9,10,12–14,17,18] length of hospital stay,[8,9,11,16,19] or avoidable risk of hospitalizations and stays.[15] Only three studies measured the effect of obesity on the number of hospitalizations.[9,11,16]

We know of only one study[9] that has examined the different effect of obesity on hospitalizations in blacks separately. American blacks are an important group to examine because, compared to American whites, they have reduced access to outpatient medical care, [20,21] greater risk of hospitalization because of certain comorbidities,[22,23] and longer lengths of hospital stay.[24] Also, black women have a much higher prevalence of obesity compared to white women.[1] Further, to our knowledge, no studies conducted in the United States have examined whether associations between obesity and hospitalizations differ by gender. Women are hospitalized more than men nationwide, but this is largely attributable to pregnancy-related conditions.[25] Gender comparisons in middle-aged adults, in whom pregnancy is less likely, are also of interest. The objectives of this study were to compare the number of hospitalizations across weight status categories (normal weight, overweight and obese) in a community-based sample of adults 45–64 years of age, and to determine whether the relationships differed by gender or by race.

Methods

The Atherosclerosis Risk in Communities (ARIC) Study is a prospective investigation of the natural history and etiology of atherosclerosis and CVD in four US communities: Forsyth County, NC; Jackson, MS; the northwestern suburbs of Minneapolis, MN and Washington County, MD. Baseline data were collected between 1987 and 1989 on 15 792 adults 45–64 years of age. The details of the study design have been described previously.[26] This study was approved by the Institutional Review Boards at each field center and this analysis was approved by the University of North Carolina at Chapel Hill Institutional Review Board.

It is standard ARIC protocol to exclude blacks from Washington County, MD or Minneapolis, MN ($n = 55$) and participants who classified their race/ethnicity as other than white or blacks ($n = 48$) because they were too small in number to allow race and center-specific analyses. Participants were also excluded if they were underweight (body mass

index (BMI) $<18.5 \text{ kgm}^{-2}$, $n = 142$) or missing relevant covariates ($n = 192$) at baseline. The analysis dataset included 11 279 whites (5908 women and 5371 men) and 4076 blacks (2536 women and 1540 men).

Participants were weighed without shoes and in a scrub suit to the nearest pound by using a balance beam scale. Their height (without shoes) was measured at baseline to the nearest centimeter by using a metal rule attached to a wall and a standard triangular headboard. The analysis was conducted using three weight status groups: normal weight (BMI≥18.5 to $<25.0 \text{ kgm}^{-2}$), overweight (BMI ≥25.0 to $<30.0 \text{ kgm}^{-2}$) and obese (BMI≥30.0 kgm^{-2}).[27]

Physical activity, education level, smoking status, alcoholic beverage consumption and health insurance status were assessed at baseline by interviewer-administered questionnaires. Physical activity was categorized by tertiles of the Sport During Leisure Time Index.[28] We categorized education as less than high school, high school graduate or at least some college. Cigarette smoking status and alcoholic beverage consumption were categorized as current, former or never. Health insurance was categorized as yes or no.

Information on all hospitalizations of ARIC cohort members after baseline was collected by community and cohort surveillance methods.[29] For the community surveillance, hospital discharge files were searched in the four ARIC communities for all hospitalized myocardial infarction (MI) and chronic heart disease-related deaths. In addition, during annual follow-up interviews, cohort members were asked, 'Have you stayed overnight as a patient in a hospital for any reason since our last contact?' For affirmative responses, hospital discharge indexes in the study area were reviewed. For all hospitalizations of cohort members, the discharge date and *International Classification of Diseases, Ninth Revision-Clinical Modification* (ICD-9-CM) codes were abstracted from the hospital charts. The admission date was not collected for all hospitalizations. The first ICD-9 code per hospitalization was used as the primary cause of hospitalization. Hospitalization data were collected from baseline to December 2002. We set the follow-up time to precisely 13 years for each participant whether they survived to the end of the observation period. We chose 13 years as the round number of years that maximized the available follow-up while keeping the follow-up time uniform. There were 2052 participants who died during the 13 years of follow-up and their mean survival time was 8.3 years. Participants who died were included in the analyses because the purpose of this study was to estimate the effect of baseline BMI status on the total number of hospitalizations over a defined interval.

We examined all-cause hospitalizations and 11 primary causes of hospitalization. The 11 primary causes of hospitalization were identified by a report by the Agency for Healthcare Research and Quality.[30] The six CVD-related causes included nonhypertensive congestive heart failure (CHF), acute MI, nonspecific chest pain, coronary atherosclerosis, cardiac dysrhythmias and acute cerebrovascular disease. The five non-CVD-related causes included osteoarthritis, back problems, depression, pneumonia and chronic obstructive pulmonary disease (COPD).

Statistical analysis

We modeled the total number of all-cause and cause-specific hospitalizations using the negative binomial model. The likelihood ratio test for the null hypothesis of no over-dispersion was rejected ($P < 0.001$), which implied that the negative binomial model would be preferred to the Poisson model. In addition, based on the Voung's statistic, the negative binomial model was preferred (V value 3.36) over the zero-inflated negative binomial model.[31] Models adjusted for race, field center, gender, age, physical activity, education level, smoking status, alcoholic beverage consumption and health insurance at baseline. For gender and racial group comparisons of differences in the number of hospitalizations

between weight status groups, we added interaction terms between weight status and gender, and between weight status and race, respectively.

Coefficients estimated in the negative binomial models were used to calculate the adjusted number of hospitalizations overall and within strata. The adjusted numbers were obtained after setting covariates to the mean value (for continuous variables) or to the average distribution (for categorical variables) observed in the entire cohort. Age was set to 54 years, and distributions of other covariates were as follows: for race, 73.2% whites, 26.8% blacks; for field center, 23.8% in Mississippi, 25.3% in Maryland, 25.3% in Minnesota, 25.6% in North Carolina; for gender, 45% men, 55% women; for physical activity, 43.5% low (first tertile), 28.2% medium (second tertile), 28.3% high (third tertile); for education, 40.8% less than a high school education, 35.6% high school graduate, 23.6% at least some college; for smoking status, 32.5% formerly smoked, 41.8% currently smokes, 25.7% never smoked; for alcoholic beverage consumption, 19.0% formerly consumed, 25.2% currently consumes, 55.8% never consumed; and for health insurance status, 90.3% had some form of health insurance, 9.7% did not have any health insurance. The differences between the adjusted number of hospitalizations for each category of weight status were calculated by subtracting the estimate in normal weight participants from that of overweight and obese subjects. The bootstrap method was used to estimate confidence intervals.[32] The Wald test was used to calculate probability levels for interactions of gender and race with weight status. STATA software (version 10.0) and the SAS System Windows version 8 were used for analyses.

Results

Table 1 shows baseline characteristics of study participants by weight status group. Eighty-three percent of the normal weight adults studied were White, compared to 75 and 61% of overweight and obese adults, respectively. Women were more likely than men to be in the normal weight and obese categories, whereas more men were in the overweight category. Normal weight adults were most educated and physically active, and also had the greatest proportion of current alcoholic beverage consumers, cigarette smokers and individuals with health insurance.

Number of hospitalizations by weight status

Over the 13 years of follow-up there were a total of 26 513 hospitalizations among 15 355 adults. Crude estimates showed that there were a total of 7060 hospitalizations among the 4997 normal weight adults; a total of 10 280 among the 6100 overweight adults; and a total of 9173 among the 4258 obese adults. The covariate-adjusted average number of all-cause hospitalizations was 1316 per 1000 normal weight adults; 1543 per 1000 overweight adults; and 2025 per 1000 obese adults (Table 2). Note that our modeling strategy standardized the covariates to common levels. For example, in this calculation of the adjusted number of hospitalizations in each weight status category, the proportion of men and women was standardized to be consistent in all the weight status categories using the gender distribution of the entire cohort.

Compared to normal weight adults, obese adults had more hospitalizations for all CVD-related outcomes and for all non-CVD-related outcomes except depression, pneumonia and COPD. COPD were notable in that overweight participants had fewer hospitalizations for this cause than normal weight adults.

Gender differences in the impact of weight status on number of hospitalizations

Crude estimates showed that the 8444 women had a total of 13 194 hospitalizations whereas the 6911 men had a total of 13 319 hospitalizations. After adjustments for covariates,

including BMI, men had more hospitalizations than women (1683 versus 1444 per 1000 persons $P < 0.001$). As shown in Table 3, among adults who were normal weight, women had fewer hospitalizations than men (1173 versus 1515, per 1000 adults, $P < 0.001$). However, the increase associated with being overweight or obese on the number of all-cause hospitalizations was larger in women than men. Overweight women had 285 more hospitalizations per 1000 than normal weight women, whereas overweight men had only 139 more hospitalizations per 1000. For obesity, the same comparisons yielded differences of 791 in women and 589 in men.

Among the primary causes of hospitalization, normal weight women had fewer hospitalizations than normal weight men for acute MI, coronary atherosclerosis and acute cerebrovascular disease. Compared to normal weight adults of the same gender, obesity was associated with greater increases in the number of hospitalizations in women than in men for nonspecific chest pain. The gender interaction was border line for coronary atherosclerosis with the difference between admissions higher in obese men than women.

Racial differences in the number of hospitalizations by weight status

Before adjustments, the 11 279 white participants had a total of 18 977 hospitalizations whereas the 4076 black participants had a total of 7536 hospitalizations. Normal weight whites had a similar number of hospital admissions given the same distribution of covariates (Table 4). Race differences were generally not seen among the normal weight for the causes examined. Two exceptions were CHF, which was associated with more hospitalizations in blacks than whites, and osteoarthritis, which was associated with more hospitalizations in normal weight whites compared to blacks.

The increase in the all-cause number of hospitalizations with overweight or obesity was not different by race. Also, few race differences were detected for specific causes of hospitalization. Overweight was associated with a greater number of hospitalizations for cardiac dysrhythmias in whites, and a greater number for pneumonia in blacks. The directions of these trends were also observed in the obese, but the race interaction was not statistically significant. Confidence intervals were wider in blacks than whites, likely because of the smaller number of blacks in the analysis.

Discussion

Our results showed that, among adults 45–64 years of age at baseline, overweight and obese adults had more hospitalizations than normal weight adults. This was seen for all of the CVD-related causes we examined as well as osteoarthritis and back problems. Patterns varied depending on gender, race and cause of hospitalization.

This study estimated the cumulative burden of increased hospitalization associated with overweight and obesity. We did not control for factors that may mediate the effects of overweight or obesity on hospitalizations, such as comorbidities or mortality.[33] We recognize that obesity increases mortality rates[34,35] and mortality from specific causes such as CVD,[36–39] stroke[36,40–43] and breast and colon cancer.[44,45] Increased mortality early in the study follow-up could reduce the number of hospitalizations observed; however, our results show that the effect of obesity on mortality was not so acute as to reverse its impact on the total number of hospitalizations.

Other studies[9,12,15,16,18,19] have also found a positive association between obesity and hospital admission or length of stay. One of these studies[12] examined the association between current self-reported body weight and past hospital admission in 17 118 Health Maintenance Organization (HMO) members 20–75 years of age in Northern California, 76%

of whom were white. The second study examined a cohort of 17 643 adults 31–64 years of age in Chicago, 87% of whom were white.[18] Four studies[9,15,16,19] have used nationally representative data from the National Health and Nutrition Examination Survey I Epidemiological Follow-Up Study: three examining adults age 25 years or older at baseline[9,15,19] and one examining individuals 41–77 years of age.[16] All found a positive association between obesity and hospitalization or length of stay; Schafer and Ferraro[16] also investigated the association of duration of obesity and found that more years of obesity led to longer stays. Ferraro and Shippee[9] showed that black adults generally had longer hospital stays than white, but they found no racial difference in admissions. Studies conducted in Europe[46] and Australia[14] examined associations between obesity or chronic disease and use of hospital outpatient or emergency units, but did not examine the association between obesity and inpatient hospitalizations. Luchsinger *et al.*[11] examined associations between weight status and specific causes of hospitalization in individuals 65–100 years of age in the United States. They found that obesity was associated with hospitalization for CVD, but none of the other nine causes they examined (infectious disease, malignancy, endocrinological disease, hematological disease, central nervous system disease, respiratory disease, gastrointestinal disease, genitourinary disease and musculoskeletal disease).

Gender differences in the associations between weight status and total number of hospitalizations have not been well studied in the United States. Zizza *et al.*[47] have shown that in North Carolina, women were much more likely than men to be admitted for surgery as a treatment for obesity. We did not specifically study bariatric surgery, but did find statistically significant gender differences in the impact of overweight or obesity on several causes of hospitalization. Merrill and Elixhauser[25] examined all-cause hospitalizations by gender and found that women beyond childbearing years were less likely to be hospitalized than men. In our cohort, 45–64 years of age at baseline, we found a difference in the overall number of hospitalizations between women and men, as well as differences in the patterns of admission by weight status categories. Normal weight men were more likely to be hospitalized compared to normal weight women, and this was, in part, because of increased admissions for CVD-related causes in normal weight men. In contrast, the increases in overall admissions associated with elevated weight status were lower in men than in women. More work is needed to explain the gender differences observed here.

Although other studies have included blacks in the study sample, they have not investigated whether the impact of weight status on the number of hospitalizations differed by race. In our study, we found no race differences in the effect of overweight or obesity overall and for most of the primary causes of hospitalization examined in this study. Also, overall there was no difference in the impact of overweight or obesity on the number of hospitalizations. It is likely that unmeasured factors related to social advantage and healthcare access had some impact on racial differences in hospitalizations. There were differences by race in the number of hospitalizations for osteoarthritis among normal weight individuals. The reduced number of hospitalizations in blacks is consistent with the reduced risk of osteoarthritis that has been observed in blacks compared to whites in other studies.[48–50]

We acknowledge several caveats of this study. The causality of weight status on the number of hospitalizations cannot be determined from this observational study. For example, our finding that, compared to normal weight, overweight adults have fewer hospitalizations for COPD, may be because of disease-induced weight loss before the collection of the baseline weight measures rather than a protective effect of excess weight. Also, BMI does not distinguish between fat and muscle mass; at a given BMI, the average level of adiposity and the variation in adiposity levels differ across sex and racial groups.[51,52] We acknowledge that our study population may not represent the US population although our data are from community-based samples. The majority of our study sample reported having health

insurance, including Medicare or a medical plan, such as an HMO. Thus, our estimates may not represent uninsured groups or populations with low socioeconomic status. Also, we only studied participants within the age span of 45–64 years at baseline.

Strengths of our work are that we used longitudinal data from four communities in different geographic regions in the United States. The large number of blacks in the sample allowed separate analyses within this group. It is also a strength that we examined results by gender and race, and that body weight and height were objectively measured rather than from self-report. Last, the longitudinal nature of our data allowed weight status to precede hospitalizations so that antecedent–consequence uncertainty was reduced.

Hospital care consumes the largest share (30%) of health expenditure in the United States.[53] In 2004, the average cost per all-cause hospital discharge was $9603 for 45–64-year-olds and $10 102 for 65–84-year-olds.[54] Overweight and obesity prevention could reduce hospitalizations, but our results suggest that per 1000 overweight or obese adults, the impact of successful prevention on the overall number of hospitalizations is likely to be larger in women than in men, and similar in blacks and whites. With clear evidence that overweight and obesity produce health problems and increase the number of hospitalizations, continued research to define successful treatment and prevention methods is essential.

Acknowledgments

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Table 1

Baseline characteristics by weight status, the ARIC study 1987–1989

Variables	Normal weight (*n* = 4997)	Overweight (*n* = 6100)	Obese (*n* = 4258)
Body mass index (kgm^{-2}, mean (s.d.))	22.7 (1.6)	27.3 (1.4)	34.5 (4.4)
Age (years, mean (s.d.))	54.1 (5.8)	54.3 (5.7)	54.0 (5.7)
Race			
White (%)	4133 (83)	4560 (75)	2586 (61)
Black (%)	864 (17)	1540 (25)	1672 (39)
Gender			
Women (%)	3109 (62)	2703 (44)	2632 (62)
Men (%)	1888 (38)	3397 (56)	1626 (38)
Education (%)			
<High school	904 (18)	1409 (23)	1314 (31)
High school graduate	2132 (43)	2437 (40)	1695 (40)
At least some college	1961 (39)	2254 (37)	1249 (29)
Physical activity (%)			
Low	1243 (25)	1630 (27)	1466 (35)
Medium	2139 (43)	2623 (43)	1922 (45)
High	1615 (32)	1847 (30)	870 (20)
Alcohol consumption (%)			
Current	3133 (63)	3562 (58)	1881 (44)
Former	816 (16)	1152 (19)	946 (22)
Never	1048 (21)	1386 (23)	1431 (33)
Smoking (%)			
Current	1643 (33)	1491 (24)	823 (19)
Former	1406 (28)	2167 (36)	1410 (33)
Never	1948 (39)	2442 (40)	2025 (48)
Health insurance (%)			
Yes	4640 (93)	5548 (91)	3670 (86)
No	357 (7)	552 (9)	588 (14)

Table 2

Adjusted[a] number of all-cause and primary cause hospitalizations per 1000 adults over 13 years of follow-up, the ARIC study 1987–2002

Cause of hospitalizations	Weight status groups					
	Normal weight (*n* = 4997)		Overweight (*n* = 6100)		Obese (*n* = 4258)	
	Hospitalizations	(95% CI)	Hospitalizations	(95% CI)	Hospitalizations	(95% CI)
All-cause hospitalizations	1316	(1257, 1375)	1543	(1480, 1606)	2025	(1937, 2113)
Cardiovascular disease-related primary causes						
Congestive heart failure	29	(22, 36)	43	(30, 55)	76	(62, 91)
Acute myocardial infarction	60	(51, 69)	82	(72, 92)	102	(89, 116)
Nonspecific chest pain	49	(42, 57)	64	(56, 71)	70	(61, 80)
Coronary atherosclerosis	100	(85, 115)	152	(131, 172)	177	(156, 198)
Cardiac dysrhythmias	48	(41, 56)	51	(43, 58)	67	(56, 79)
Acute cerebrovascular disease	41	(34, 47)	53	(46, 60)	59	(49, 68)
Noncardiovascular disease-related primary causes						
Osteoarthritis	9	(4, 15)	26	(21, 31)	73	(63, 83)
Back problems	27	(21, 33)	40	(34, 46)	56	(46, 65)
Depression	8	(5, 10)	8	(5, 10)	10	(6, 15)
Pneumonia	33	(27, 39)	28	(23, 32)	37	(31, 44)
Chronic obstructive pulmonary disease	14	(9, 19)	7	(4, 9)	10	(6, 14)

Abbreviation: 95% CI, 95% confidence interval.

[a]Models were adjusted for gender, race, field center, age, physical activity, education level, smoking status, alcoholic beverage consumption and health insurance at baseline.

Table 3

Adjusted[a] number of hospitalizations over 13 years of follow-up by weight status and gender per 1000 persons, the ARIC study 1987–2002

Cause of hospitalizations	Gender	Number of hospitalizations		Overweight		Obese	
		Normal weight	(95% CI)	Mean difference from normal weight	Gender interaction P-value	Mean difference from normal weight	Gender interaction P-value
All-cause hospitalizations	Women	1173	(1104, 1243)	285	0.02	791	0.002
	Men	1515	(1409, 1621)	139		589	
Cardiovascular disease-related primary causes							
Congestive heart failure	Women	24	(16, 31)	12	0.66	39	0.86
	Men	38	(25, 51)	15		59	
Acute myocardial infarction	Women	42	(33, 51)	14	0.76	31	0.75
	Men	95	(75, 114)	39		62	
Nonspecific chest pain	Women	44	(35, 53)	20	0.18	34	0.02
	Men	57	(45, 69)	7		5	
Coronary atherosclerosis	Women	62	(49, 76)	46	0.05	65	0.07
	Men	178	(146, 210)	52		90	
Cardiac dysrhythmias	Women	44	(35, 54)	−3	0.20	14	0.60
	Men	54	(41, 67)	11		26	
Acute cerebrovascular disease	Women	34	(26, 41)	14	0.35	17	0.63
	Men	51	(40, 62)	9		19	
Noncardiovascular disease-related primary causes							
Osteoarthritis	Women	11	(4, 18)	15	0.24	80	0.68
	Men	8	(2, 13)	18		48	
Back problems	Women	26	(19, 32)	17	0.27	25	0.79
	Men	30	(20, 39)	8		34	
Depression	Women	8	(5, 11)	5	0.03	6	0.26
	Men	8	(3, 12)	−3		0	
Pneumonia	Women	32	(23, 40)	−8	0.28	7	0.44
	Men	36	(27, 44)	−2		1	
Chronic obstructive pulmonary disease	Women	13	(8, 18)	−7	0.35	−3	0.63
	Men	15	(8, 23)	−8		−5	

Abbreviation: 95% CI, 95% confidence interval.

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[a]Models were adjusted for race, field center, age, physical activity, education level, smoking status, alcoholic beverage consumption and health insurance at baseline.

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Table 4

Adjusted[a] number of hospitalizations over 13 years of follow-up by weight status and race per 1000 persons, the ARIC study 1987–2002

Cause of hospitalizations	Race	Number of hospitalizations		Overweight		Obese	
		Normal weight	(95% CI)	Mean difference from normal weight	Race interaction P-value	Mean difference from normal weight	Race interaction P-value
All-cause hospitalizations	White	1334	(1257, 1411)	231	0.99	712	0.88
	Black	1270	(1089, 1452)	218		702	
Cardiovascular disease-related primary causes							
Congestive heart failure	White	21	(15, 28)	13	0.12	39	0.30
	Black	72	(34, 111)	7		82	
Acute myocardial infarction	White	62	(50, 74)	24	0.78	37	0.37
	Black	57	(31, 83)	18		57	
Nonspecific chest pain	White	43	(36, 51)	13	0.89	16	0.48
	Black	72	(41, 103)	19		43	
Coronary atherosclerosis	White	105	(87, 123)	64	0.23	90	0.36
	Black	89	(49, 129)	25		50	
Cardiac dysrhythmias	White	53	(41, 65)	10	0.05	27	0.24
	Black	40	(18, 61)	−11		5	
Acute cerebrovascular disease	White	39	(31, 48)	9	0.29	15	0.48
	Black	45	(27, 62)	24		28	
Noncardiovascular disease-related primary causes							
Osteoarthritis	White	15	(10, 19)	17	0.33	74	0.27
	Black	4	(−1, 9)	12		41	
Back problems	White	33	(25, 42)	14	0.68	30	0.53
	Black	17	(5, 28)	11		24	
Depression	White	7	(4, 10)	2	0.10	4	0.27
	Black	12	(0, 24)	−6		−1	
Pneumonia	White	36	(27, 45)	−12	0.004	1	0.19
	Black	27	(12, 42)	14		13	
Chronic obstructive pulmonary disease	White	14	(9, 20)	−6	0.11	−4	0.98
	Black	14	(1, 28)	−10		−4	

Abbreviation: 95% CI, 95% confidence interval.

[a]Models were adjusted for gender, field center, age, physical activity, education level, smoking status, alcoholic beverage consumption and health insurance at baseline.