Racial/Ethnic Differences in Body Mass Index, Morbidity and Attitudes toward Obesity among U.S. Adults

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Objective: To describe racial/ethnic differences by gender in body mass index (BMI), to examine the relationship between existence of current morbidity and BMI, and to assess racial/ethnic disparities in attitudes and perceptions toward obesity.

Design and Setting: Cross-sectional random-digit telephone survey of a representative sample of noninstitutionalized U.S. adults aged ≥18 years in 2005 (N=1,000, 62% response rate and 82% cooperation rate).

Results: The prevalence of overweight or obesity in 2005 among U.S. adults was 63%. Racial disparities in obesity were observed among women, not among men. The mean BMI of non-Hispanic black women was 29.8, significantly (P<0.01) higher than that of non-Hispanic white women (26.7). Eighteen percent of the respondents reported having serious morbidities, with 8.5% reporting diabetes. A dose-response relationship was observed between BMI groups and existence of morbid conditions. Twenty-seven percent of obese respondents (BMI ≥30) and 55% of extremely obese respondents (BMI ≥40) reported such conditions. Race (blacks versus whites) was not a significant predictor for any of the six different attitudes and perceptions toward obesity in fully adjusted logistic models.

Conclusions: There is no evidence of plateau or decrease in the prevalence of overweight or obesity and diabetes among U.S. adults. Racial disparities between blacks and whites persist among women. A modification of attitudes and perceptions might not have significant effects on people's behavior that can influence the prevalence of overweight and obesity.

Key words: obesity ■ race/ethnicity ■ body mass index ■ comorbidity

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INTRODUCTION

A recent study that used the National Health and Nutrition Examination Survey (NHANES) data estimated that, in 2001–2002, 65.7% [standard error (SE)=0.6] of U.S. adults aged ≥20 years were either overweight or obese and 30.6% (SE=1.1) were obese.[1] A notable finding in this study was the continued increases[2-4] in the prevalence of overweight and obesity since 1980 up to 1999–2000 were not observed in 2001–2002, which indicates that the increasing trend in the prevalence of overweight and obesity might have reached its plateau. One of the objectives of Healthy People 2010 is to reduce the prevalence of obesity among adults to <15%.[5] With only five years left until the year 2010, this study was conducted primarily to update the prevalence estimates of overweight and obesity by race/ethnicity and gender, using a nationally representative sample in 2005. We hypothesized that the prevalence of overweight and obesity had not increased since 2001.

Racial/ethnic disparities in overweight and obesity are well documented in many studies,[1,2,6-10] with the racial/ethnic disparities being more pronounced and consistent among women.[2,8-10] Also, age,[1-4,11-14] education,[3,4,6,7] existence of morbid conditions[11-13,15-19] and marital status[7] have shown significant associations with different levels of overweight and obesity measured by body mass index (BMI). Special attention on age variable is warranted, as age has a quadratic relationship with overweight and obesity (i.e., BMI increases with age up until a point and then it decreases).[3,4,12] To date, however, little research has examined such factors as mediators of racial/ethnic disparities in BMI among a representative sample of U.S. adults. We examined the effect of race/ethnicity on BMI among U.S. adults by gender, adjusting for both linear and quadratic effect of age, education, serious morbidity and marital status.

Overweight and obesity have been linked to an increased incidence of type-2 diabetes mellitus, coronary heart disease, stroke, hypertension, osteoarthritis and various types of cancer,[12,16-21] leading to excess mortality[11,15] and decline in overall health.[10,13] The majority of these studies, however, largely focus on single health outcomes,[16,19,20] population subgroups[19,20] and data obtained in or before 1990s.[11,12,15-21] This study was undertaken to provide prevalence estimates of serious morbid conditions by BMI groups among U.S. adults in 2005 and to examine the odds ratio (OR) of each BMI group for experiencing serious

morbid conditions after adjusting for race/ethnicity, gender, age group, education, household income, marital status, employment and smoking status. In addition, we assessed demographic correlates associated with different attitudes and perceptions toward obesity, as attitudes and perceptions are a precursor to health behavior.[22] Whereas attitudes toward obesity were assessed among physicians,[23] internal medicine residents[24] and fitness professionals,[25] little research has examined such attitudes among the general public. A recent qualitative study reports distinctive features of African-American subculture with regard to obesity.[26] We hypothesized that race/ethnicity would contribute significantly to the prediction of different attitudes and perceptions toward obesity after adjusting for gender, age group, education, household income, marital status, employment, body mass index and smoking status.

METHODS

Data Collection

An independent professional survey institute in Florida was contracted to perform a random-digit dialing (RDD) telephone survey to collect data from a nationally representative sample of noninstitutionalized civilian residents aged ≥18 years. The sampling frame, consisting of all U.S. households with telephones, was truncated to include only residential exchanges and working blocks. A block was defined to be working if ≥1 listed residential telephone number was found within the block. After the primary nationwide RDD sample was taken randomly from the sampling frame, phone numbers with Hispanic surnames and from areas with high percentages of African Americans were additionally selected randomly from the national list to produce reliable estimates for non-Hispanic blacks and Hispanics. The telephone interview was administered both in English and in Spanish from March 8, 2005 to April 19, 2005. The individuals within a household were randomly selected to complete the interview using a randomization procedure built into the computer-assisted telephone interviewing (CATI) software, "Interviewer" (Voxco, Montreal, Canada), which is well suited for bilingual interviewing. The mean duration of the interview was 10 minutes. The design and all procedures for this study were approved by the institutional review board of the investigators' university.

The survey resulted in 1,000 complete interviews, 24 break-offs, 189 refusals, 86 noninterviews due to language barrier, 1,211 answering messages, 361 fax/data lines, 1,264 nonworking/disconnected numbers and 296 government/business numbers. The response rate (RR 3) and cooperation rate (COOP 3), calculated by standards established by the American Association for Public Opinion Research,[27] were 62% and 82%, respectively. The formulas used were RR 3 = complete interviews / [(complete interviews + partial interviews) + (refusal and break-offs + noncontacts + other) + e (unknown household + unknown other)] and COOP 3 = complete interviews / [(complete interviews + partial interviews) + refusal and break-offs]. The e, an estimated proportion of cases of unknown eligibility that are eligible, was estimated to be 0.10.

Outcome Measures

We used data on self-reported weight and height to calculate body mass index (BMI), defined as weight in kilograms divided by the square of height in meters. We categorized BMI into underweight (<18.5), normal (18.5–<25), overweight (25–<30), obesity (30–<40; obesity classes 1 and 2) and extreme obesity (≥40; obesity class 3).[28,29] Self-reported weight and height were assessed by asking respondents, "About how much do you weigh without shoes?" and "About how tall are you without shoes?"

Existence of morbid conditions was assessed by asking respondents, "Do you have any serious health problems such as cancer, heart disease or diabetes?" The answer was coded "yes" or "no." The respondents who said "yes" were asked to report the conditions. We did not focus on single health outcomes because of three reasons: 1) Obese patients may have multiple comorbidities; 2) There may be diseases whose associations with obesity have not been documented; and 3) Subgroup analysis by individual morbidity could lead to unstable estimates due to lack of statistical power for this sample.

Respondents were asked to rate their extent of agreement to six attitudinal and perceptional statements related to obesity, such as "Obese people can lose weight by

Table 1. Prevalence of overweight and obesity in adults by gender and racial/ethnic group—United States, 2005

	Total	Non-Hispanic Whites	Non-Hispanic Blacks	Hispanics
Overweight and Obesity (BMI ≥25) Prevalence, % (SE)[a]				
Men and Women	63.31 (1.70)	64.16 (2.17)	66.83 (3.77)	59.74 (4.35)
Women	57.63 (2.25)	55.98 (2.91)	68.62 (4.36)	54.48 (5.72)
Men	71.86 (2.49)	76.60 (2.94)	64.23 (6.66)	68.58 (6.04)
Obesity (BMI ≥30) Prevalence, % (SE)[a]				
Men and Women	23.92 (1.45)	20.88 (1.81)	35.59 (3.70)	24.43 (3.52)
Women	23.99 (1.85)	19.28 (2.29)	41.46 (4.59)	26.19 (4.69)
Men	23.83 (2.34)	23.31 (2.96)	27.10 (6.04)	21.47 (5.19)

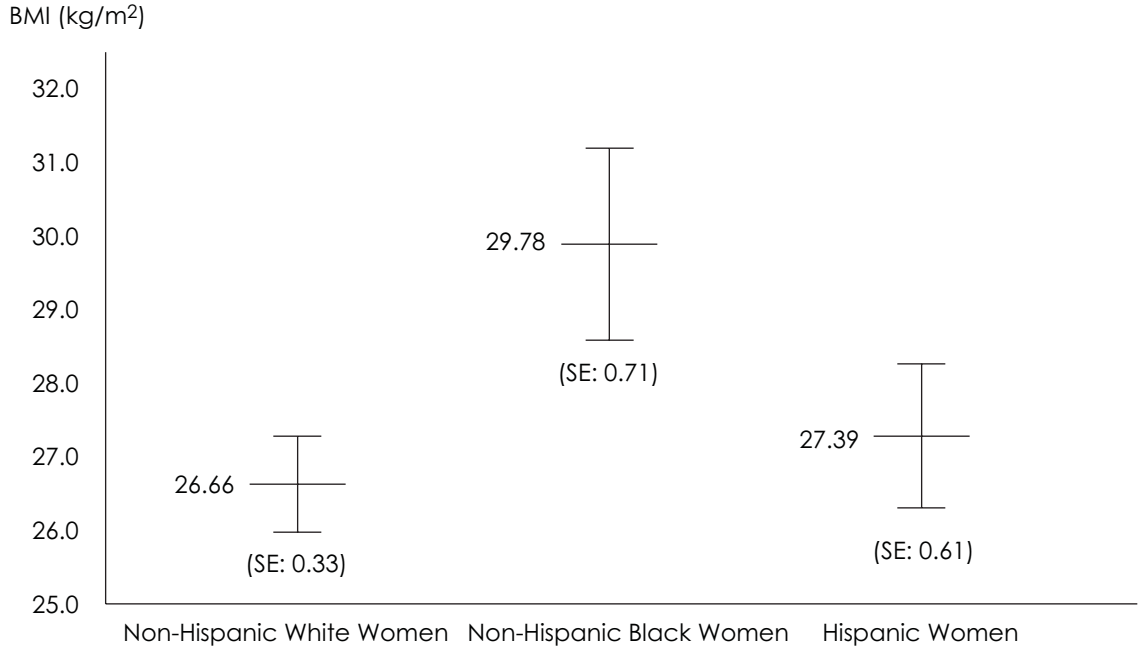
a: Weighted percentages and standard errors. Pregnant women were excluded.

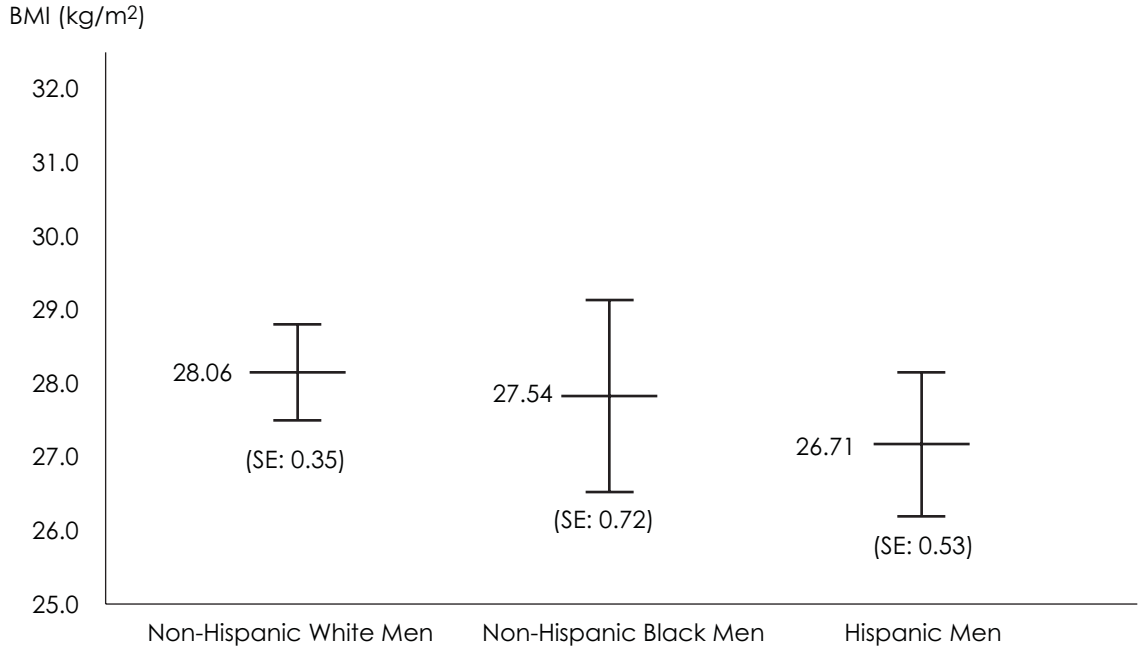
watching their eating habits," "There is difference in life expectancy between those who are obese and who are not," and "Obese people can do something about their weight" (Table 5). Five options were presented to the respondents from "strongly agree" to "strongly disagree," which were collapsed into two categories for analysis.

Data Analysis and Statistical Methods

Data were analyzed using the SAS (release 9.1; SAS Institute, Cary, NC) and SUDAAN (release 9.0; Research Triangle Institute, Research Triangle Park, NC) software programs. Sampling weights were calculated that took into account unequal probabilities of selection resulting from the sample design, from unequal numbers of adults and landlines in a household, and from planned oversampling of non-Hispanic black and Hispanic population. All analyses reflected differential probabilities of selection. SEs and odds ratios (ORs) were calculated utilizing SUDAAN software. Out of 1,000 complete surveys, 12 pregnant women and seven other respondents who lacked race/ethnicity

Figure 1. Racial/ethnic differences in body mass index among U.S. adults, 2005





BMI indicates body mass index, measured as weight in kilograms divided by the square of height in meters.

information were dropped from the analyses, reducing the sample size to 981 (553 non-Hispanic whites, 205 non-Hispanic blacks, 193 Hispanics and 30 others). The prevalence of overweight and obesity was examined by PROC DESCRIPT and CROSSTAB, the effect of race/ethnicity on BMI by REGRESS, and the effect of BMI on morbidity and correlates of obesity attitudes by LOGISTIC.

RESULTS

The prevalence of overweight and obesity and mean BMI in 2005 among U.S. adults by gender and race/ethnicity are shown in Table 1 and Figure 1. As shown in Table 1, whereas 68.6% of black women were overweight or obese, 56.0% of white women and 54.5% of Hispanic women were overweight or obese. The racial difference among women was more pronounced when the proportions of obesity alone were compared. Whereas 41.5% of black women were obese, 19.3% of white women and 26.2% of Hispanic women were obese. For men, whites were more overweight than the other two racial/ethnic groups, and blacks were more obese than the others. When the BMI levels rather than BMI groups were examined by gender and race/ethnicity, the racial/ethnic disparities in obesity were observed among women, not among men as shown in Figure 1. The mean BMI of black women was 29.8, significantly ($P<0.01$) higher than that of white women (26.7).

Before proceeding to the linear regression model of BMI, we used the PROC DESCRIPT procedure of SUDAAN to estimate means and standard errors by each of the model covariates to check the univariate relationships with BMI (Table 2). A gradual decrease in BMI was observed among women as their years of education increased (≤12 years, some college and ≥ college graduate), whereas such a relationship was not observed for men. For both men and women, respondents who reported serious health problems showed higher BMI levels than those who did not, although statistical significance was established for white men and women and black women. The BMI showed a quadratic pattern with age. Interestingly, women showed their highest levels of BMI at 58–67 years of age and men at 38–47 years of age regardless of their race/ethnicity.

As shown in Table 3, BMI was regressed on race/ethnicity, education, morbid conditions, marital status and age, primarily to examine the contribution of race/ethnicity on the prediction of BMI while controlling for the remaining variables in the model. Given the quadratic pattern of BMI over age, we included terms for both linear and quadratic age in the linear regression model. Centered age, defined as age in years less weighted mean age, was used for the linear and quadratic age.[30] Race/ethnicity was a significant predictor of BMI only for women (Wald $F=6.59$, $P=0.001$), whereas existence of morbid conditions and quadratic age were significant predictors of BMI for both men and women.

A total of 186 respondents (18%, SE=1.25) reported

Table 2. Body mass index in adults by gender, age group, education, morbid conditions and marital status—United States, 2005

	Women			Men		
	Whites	Blacks	Hispanics	Whites	Blacks	Hispanics
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Age Group						
18–27 years	24.69 (1.19)	25.97 (1.30)[c]	25.25 (1.03)[c]	25.56 (0.54)[c]	26.16 (1.26)	25.54 (1.02)
28–37 years	25.82 (0.54)[b]	31.89 (2.50)[b]	28.40 (1.76)	28.43 (0.66)	27.12 (1.31)	26.96 (0.88)
38–47 years	27.53 (1.01)	28.80 (1.60)	27.79 (1.28)	28.94 (0.58)[c]	30.04 (1.79)	28.11 (1.38)
48–57 years	26.34 (0.70)	29.29 (1.27)	27.89 (1.12)	28.62 (0.87)	25.69 (0.82)	26.59 (1.10)
58–67 years	27.95 (0.95)[b]	33.21 (1.71)[b,c]	33.45 (2.31)[c]	27.97 (0.91)	28.63 (1.31)	26.14 (1.71)
68–77 years	26.53 (0.76)	31.63 (1.85)	25.55 (1.66)[c]	27.79 (1.60)	26.75 (2.24)	27.59 (0.98)
78–94 years	26.87 (0.94)	24.80 (0.90)[c]	23.94 (1.82)[c]	26.38 (0.68)[c]	25.45 (1.04)	–
Education						
≤ Some high school	29.26 (1.95)	29.53 (3.22)	28.11 (0.94)[c]	29.86 (1.78)	27.66 (1.92)	25.54 (1.01)
High-school graduate	28.12 (0.78)	31.03 (1.16)	27.62 (1.37)	26.77 (0.48)	27.47 (1.25)	26.69 (0.80)
Some college	26.34 (0.51)	30.74 (1.60)	27.49 (1.00)	28.94 (0.73)	27.43 (0.95)	26.67 (1.66)
≥ College graduate	25.31 (0.43)	27.77 (0.89)[b]	23.93 (1.05)[b,c]	28.14 (0.57)	27.75 (1.16)	27.91 (1.02)
Morbid Conditions						
Yes	29.21 (0.91)	34.11 (1.70)[c]	29.26 (1.53)	30.81 (1.18)[c]	29.17 (1.30)	28.26 (1.87)
No	26.05 (0.34)	28.18 (0.68)[c]	27.15 (0.65)	27.41 (0.30)[c]	27.20 (0.83)	26.34 (0.54)
Marital Status						
Married[a]	26.74 (0.38)[b]	30.14 (0.96)[b]	27.58 (0.75)	28.33 (0.39)	28.30 (1.07)	27.46 (0.68)
Widowed	26.94 (0.82)	29.24 (1.05)	27.23 (1.91)	25.81 (1.30)	27.12 (0.99)	29.31 (1.57)
Never married	25.47 (1.44)	29.49 (1.43)	26.85 (1.19)	27.87 (0.90)	26.22 (0.92)	25.69 (0.81)

SE: standard error; a: Includes married, divorced or separated; b: Significant contrasts between different race/ethnicity groups within gender at the .05 level; c: Significant contrasts between the category with the highest BMI and other categories of each variable within race/ethnicity and gender at the 0.05 level.

having serious health problems. Among them, 86 (8.5%, SE=0.91) reported diabetes. Other reported conditions among the obese respondents (BMI ≥30) included heart disease, cancer, arthritis, hypertension, thyroid disorders, stroke, lung disease, asthma and kidney disease. A dose-response relationship was observed between BMI groups and existence of morbid conditions. Whereas 12.7% (SE=1.88) of the respondents with normal weight reported existence of morbid conditions, 27.4% (3.32) of obese respondents and 55.3% (8.48) of extremely obese respondents reported such conditions. As shown in Table 4, the obese (adjusted OR=3.61) and extremely obese (adjusted OR=9.71) respondents were more likely than those with normal weight to report morbid conditions, after adjusting for race/ethnicity, gender, age group, education, household income, marital status, employment and smoking status.

In addition, we assessed demographic correlates associated with different attitudes and perceptions toward obesity (Table 5). Of the total respondents, 35% (SE=1.62) agreed with the statement, "Obesity is a major burden to society in

Table 3. Regression of body mass index on race/ethnicity, education, morbid conditions, marital status and age among U.S. adults

	Women				Men			
	Beta	**SE**	**t**	**P Value**	**Beta**	**SE**	**t**	**P Value**
Race/Ethnicity								
Black	2.73	0.76	3.57	<0.001	-0.07	0.75	-0.90	0.93
Hispanic	0.29	0.82	0.36	0.72	-1.02	0.66	-1.55	0.12
White		Reference				Reference		
Education								
≤ Some high school	3.17	1.11	2.85	0.005	0.61	0.98	0.62	0.54
High school graduate	2.85	0.71	4.01	<0.001	-0.56	0.62	-0.90	0.37
Some college	1.74	0.61	2.84	0.005	0.81	0.70	1.15	0.25
≥ College graduate		Reference				Reference		
Morbid Conditions								
Yes	3.41	0.80	4.23	<0.001	3.25	0.95	3.43	<0.001
No		Reference				Reference		
Marital Status								
Married[a]	-0.54	1.13	-0.48	0.63	0.08	0.89	0.09	0.93
Widowed	-1.17	1.33	-0.88	0.38	-1.31	1.30	-1.00	0.32
Never married		Reference				Reference		
Age (Linear)[b]	0.04	0.02	1.73	0.08	-0.01	0.02	-0.41	0.68
Age (Quadratic)	-0.00	0.00	-2.75	0.007	-0.00	0.00	-3.28	0.001

SE: standard error; a: Includes married, divorced or separated; b: Centered (years of age less weighted mean age)

Table 4. Multivariate logistic regression of morbidity[a] among U.S. adults, 2005

	Unadjusted OR (95% CI)	**Adjusted OR[b] (95% CI)**
Race/Ethnicity		
Black	1.18 (0.79, 1.76)	1.20 (0.67, 2.15)
Hispanic	0.55 (0.33, 0.90)[c]*	1.25 (0.60, 2.61)[c]
White	1.00	1.00
Gender		
Men	0.86 (0.61, 1.21)	1.35 (0.80, 2.29)
Women	1.00	1.00
Age Group		
18–33 years	0.06 (0.03, 0.12)[c]***	0.05 (0.01, 0.18)[c]***
34–49 years	0.17 (0.10, 0.28)***	0.17 (0.07, 0.42)***
50–65 years	0.56 (0.37, 0.84)**	0.54 (0.27, 1.09)
>65 years	1.00	1.00
BMI (kg/m^2)		
18.5–<25.0	1.00	1.00
25.0–<30.0	1.26 (0.81, 1.96)	1.48 (0.79, 2.78)
30.0–<40.0	2.59 (1.62, 4.13)***	3.61 (1.81, 7.21)***
≥40.0	8.48 (4.00, 18.0)[c]***	9.71 (3.66, 25.8)[c]***

OR: odds ratio; CI: confidence interval; a: Morbidity is defined as existence of diabetes, heart disease, cancer, arthritis, hypertension, thyroid disorders, stroke, lung disease, asthma or kidney disease; b: Adjusted for education, household income, marital status, employment and smoking status in addition to all variables shown in the table; c: These estimates should be interpreted with caution as they are considered statistically unreliable due to small sample size; * P<0.05, ** P<0.01, *** P<0.001

terms of healthcare costs." Although Hispanic participants were less likely than whites to agree with the statement (P<0.001) in bivariate logistic regression, it was no longer significant after adjusting for gender, age group, education, household income, marital status, employment, body mass index and smoking status. College graduates (adjusted OR= 1.97) and those with >$75,000 household income (adjusted OR=2.18) were more likely than high-school graduates and those with <$25,000, respectively, to agree with such a perception. For the statements, "Obese people can do something about their weight" and "Obese people have a higher chance of getting various forms of cancer," 77% (SE=1.45) and 51% (1.72) of the total respondents, respectively, agreed with the statements. None of the nine predictors submitted to the two logistic models, except race/ethnicity, were statistically significant at the 0.05 level. Hispanic respondents were less likely to believe that obese people can control their weight (adjusted OR=0.35) and more likely to report their perception of increased susceptibility to cancer by obese people (adjusted OR=1.86) after adjusting for all the variables in the models. For the statements, "There is a difference in life expectancy between those who are obese and who are not" and "Obesity is a serious health problem in the United States," 61% (SE=1.67) and 91% (1.02) of the total respondents, respectively, agreed with the statements. Education was a significant predictor (P<0.05) for both adjusted logistic models. College graduates were more likely to agree with both statements than high-school graduates. Men were less likely (adjusted OR=0.46) than women to agree with "Obesity is a serious health problem in the United States."

DISCUSSION

These data affirm previous findings[2,8] that the racial/ethnic disparities in obesity exist only among women, with 41% of black women aged ≥18 years obese as compared with 19% for white women. Also, our results show a gradual decrease in BMI as the respondent's years of education increase only among women and a differential quadratic pattern with age between men and women. These findings indicate the need for a gender-specific approach to the obesity epidemic as well as efforts to reduce racial disparities in obesity among women. Informational strategies to address obesity might not be as effective in men as in women given the different relationship of years of education with BMI between men and women. In terms of population segments at increased risk of morbidities and mortalities due to obesity, more resources and research may need to be devoted to women aged late 50s and 60s and men aged 30s and 40s than other age groups.

Table 5. Demographic correlates associated with attitudes and perceptions toward obesity among U.S. adults, 2005

	Total (N=981)	Obesity is a major burden to society in terms of healthcare costs			Obese people can do something about their weight		
	Number[a] (%)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)
Race/Ethnicity							
Black	205 (21)	35 (3.7)	0.80 (0.55, 1.15)	0.98 (0.59, 1.63)	84 (2.6)	1.40 (0.90, 2.19)	1.44 (0.80, 2.59)
Hispanic	193 (20)	20 (3.0)	0.38*** (0.25, 0.56)	0.75 (0.42, 1.31)	63 (3.9)	0.44*** (0.30, 0.65)	0.35*** (0.20, 0.61)
White	553 (56)	41 (2.2)	1.00	1.00	79 (1.8)	1.00	1.00
Gender							
Men	377 (38)	35 (2.6)	1.00 (0.75, 1.33)	0.75 (0.51, 1.11)	78 (2.3)	1.09 (0.78, 1.51)	1.14 (0.73, 1.80)
Women	604 (62)	35 (2.1)	1.00	1.00	76 (1.9)	1.00	1.00
Education							
≤ Some HS	113 (12)	8 (2.7)	0.22*** (0.11, 0.46)	0.25* (0.08, 0.76)	65 (4.8)	0.53* (0.32, 0.89)	0.99 (0.46, 2.14)
HS	301 (31)	29 (2.8)	1.00	1.00	78 (2.7)	1.00	1.00
Some college	267 (27)	40 (3.2)	1.58* (1.09, 2.30)	1.61* (1.01, 2.58)	77 (2.7)	0.94 (0.61, 1.44)	0.90 (0.52, 1.55)
≥ College	295 (30)	48 (3.1)	2.27*** (1.59, 3.23)	1.97** (1.22, 3.20)	80 (2.4)	1.15 (0.75, 1.78)	1.68 (0.92, 3.06)
Income							
<$25,000	202 (28)	26 (3.3)	1.00	1.00	78 (3.0)	1.00	1.00
$25,000–<$50,000	219 (30)	31 (3.3)	1.28 (0.82, 2.01)	1.02 (0.59, 1.77)	78 (3.0)	0.98 (0.61, 1.60)	0.82 (0.45, 1.48)
$50,000–<$75,000	145 (20)	36 (4.3)	1.57 (0.96, 2.57)	1.02 (0.55, 1.89)	82 (3.6)	1.27 (0.70, 2.30)	0.96 (0.43, 2.13)
≥$75,000	167 (23)	53 (4.0)	3.18*** (2.01, 5.02)	2.18* (1.15, 4.11)	78 (3.4)	0.98 (0.58, 1.64)	0.51 (0.24, 1.10)

One variable that showed a significant association with BMI regardless of gender was the existence of serious morbid conditions. The mean BMI who reported serious morbid conditions was higher than that of the respondents showing lack of serious morbid conditions across gender and race/ethnicity. The dose-response relationship between BMI groups and morbidity not only is in line with previous findings that reported increased incidents of specific morbid conditions among the obese individuals[12,16-21] but also indicates the independent, additive effect of obesity on incidence of morbidity. We compared the prevalence of diabetes with that published in a study[3] that used data from the Behavioral Risk Factor Surveillance System (BRFSS), the telephone interview survey conducted by the Centers for Disease Control and Prevention (CDC). The prevalence of diabetes among the respondents aged ≥18 in our study was 8.5% (SE=0.91), whereas it was 7.3% (0.12) and 7.9% (0.11), respectively, in the studies that were based on the BRFSS in 2000 and 2001.[3,31] These estimates indicate the prevalence of diabetes may have continued to increase between 2001 and 2005 among U.S. adults.

The morbid conditions reported by obese respondents included thyroid disorders, asthma, kidney disease and lung disease in addition to the diseases more commonly associated with obesity.[12,16-21] These diseases might be idiosyncratic to the individuals, irrelevant to their body weight except thyroid disorders. One of the common symptoms of underactive thyroid or hypothyroidism includes weight gain.[32] Thus, some of the obese respondents might have gained weight because of undersecretion of thyroid hormones. Epidemiologists and other health professionals may need to examine the extent to which thyroid disorders contribute to the obesity epidemic as well as any association between the reported diseases in this study and obesity.

We hypothesized that the prevalence of overweight and obesity had not increased since 2001, given the finding of Hedley and colleagues who used NHANES data.[1] In our study, using data collected in 2005, 63.3% of adults were either overweight or obese and 23.9% were obese. It is inappropriate to compare these self-reported estimates with those based on measured weight and height information in NHANES. NHANES does not use telephone interviews like the BRFSS. This is clearly indicated by the discrepancy of obesity estimates among different types of national health surveys. The prevalence of obesity among adults in 2001 was 20.9% based on the BRFSS and 22.5% based on the CDC's National Health Interview Survey (NHIS), the face-to-face confidential interviews conducted in households, whereas it was 30.6% based on the 2001–2002 NHANES.[1,3,33] Part of this discrepancy appears to be ascribed to the respondents' tendency to underestimate their weights and overestimate their heights.[34,35] However, the discrepancy is substantially reduced in the prevalence estimates of overweight or obesity, i.e., 58.0% based on the 2001

Table 5. continued

	Total (N=981)	Obese people can lose weight by watching their eating habits			Obese people have a higher chance of getting various forms of cancer		
	Number[a] (%)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)
Race/Ethnicity							
Black	205 (21)	79 (3.3)	1.67* (1.08, 2.56)	1.27 (0.72, 2.24)	48 (3.9)	1.12 (0.79, 1.60)	1.17 (0.74, 1.87)
Hispanic	193 (20)	79 (3.2)	1.73* (1.12, 2.65)	1.37 (0.74, 2.53)	68 (3.8)	2.55*** (1.74, 3.74)	1.86* (1.10, 3.13)
White	553 (56)	69 (2.0)	1.00	1.00	46 (2.3)	1.00	1.00
Gender							
Men	377 (38)	72 (2.6)	0.97 (0.71, 1.32)	0.91 (0.60, 1.38)	51 (2.8)	1.03 (0.78, 1.36)	1.17 (0.81, 1.71)
Women	604 (62)	73 (1.9)	1.00	1.00	50 (2.2)	1.00	1.00
Education							
≤ Some HS	113 (12)	83 (4.0)	1.69 (0.91, 3.12)	1.81 (0.74, 4.40)	65 (5.2)	1.98** (1.18, 3.31)	1.78 (0.88, 3.60)
HS	301 (31)	74 (2.8)	1.00	1.00	49 (3.1)	1.00	1.00
Some college	267 (27)	68 (2.9)	0.76 (0.52, 1.13)	0.60* (0.36, 0.98)	48 (3.3)	0.96 (0.67, 1.37)	0.85 (0.53, 1.35)
≥ College	295 (30)	70 (2.8)	0.81 (0.55, 1.20)	0.81 (0.49, 1.36)	50 (3.1)	1.04 (0.74, 1.47)	1.09 (0.68, 1.75)
Income							
<$25,000	202 (28)	75 (3.3)	1.00	1.00	53 (3.7)	1.00	1.00
$25,000–<$50,000	219 (30)	72 (3.2)	0.89 (0.56, 1.40)	1.25 (0.72, 2.16)	47 (3.6)	0.76 (0.51, 1.14)	0.78 (0.48, 1.29)
$50,000–<$75,000	145 (20)	71 (4.0)	0.85 (0.51, 1.42)	1.39 (0.74, 2.62)	50 (4.5)	0.87 (0.55, 1.38)	1.03 (0.59, 1.82)
≥$75,000	167 (23)	71 (3.6)	0.82 (0.51, 1.33)	1.31 (0.68, 2.52)	49 (4.1)	0.83 (0.54, 1.28)	0.97 (0.52, 1.82)

Table 5. continued

	Total (N=981)	There is a difference in life expectancy between those who are obese and who are not			Obesity is a serious health problem in the United States		
	Number[a] (%)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)	% (SE)[b]	Unadjusted OR (95% CI)	Adjusted[c] OR (95% CI)
Race/Ethnicity							
Black	205 (21)	52 (3.9)	0.59** (0.41, 0.84)	0.63 (0.40, 1.00)	90 (2.4)	0.84 (0.45, 1.56)	0.80 (0.37, 1.71)
Hispanic	193 (20)	57 (4.0)	0.72 (0.50, 1.04)	1.31 (0.78, 2.20)	88 (2.8)	0.67 (0.36, 1.22)	1.23 (0.47, 3.17)
White	553 (56)	65 (2.1)	1.00	1.00	92 (1.2)	1.00	1.00
Gender							
Men	377 (38)	62 (2.7)	1.05 (0.79, 1.39)	0.89 (0.61, 1.30)	87 (1.9)	0.49** (0.31, 0.79)	0.46* (0.25, 0.86)
Women	604 (62)	61 (2.1)	1.00	1.00	93 (1.1)	1.00	1.00
Education							
≤Some HS	113 (12)	37 (5.3)	0.51** (0.31, 0.85)	0.46* (0.23, 0.90)	86 (4.1)	0.92 (0.44, 1.93)	2.23 (0.64, 7.77)
HS	301 (31)	54 (3.1)	1.00	1.00	87 (2.1)	1.00	1.00
Some college	267 (27)	65 (3.1)	1.57* (1.09, 2.25)	1.51 (0.96, 2.38)	92 (1.9)	1.70 (0.94, 3.10)	1.72 (0.82, 3.60)
≥College	295 (30)	76 (2.6)	2.69*** (1.86, 3.88)	2.54*** (1.54, 4.18)	96 (1.1)	3.93*** (1.94, 7.98)	4.26** (1.77, 10.2)
Income							
<$25,000	202 (28)	51 (3.7)	1.00	1.00	88 (2.5)	1.00	1.00
$25,000–<$50,000	219 (30)	64 (3.4)	1.73** (1.15, 2.60)	1.44 (0.89, 2.34)	89 (2.2)	1.07 (0.56, 2.06)	1.30 (0.63, 2.68)
$50,000-<$75,000	145 (20)	65 (4.4)	1.80* (1.12, 2.91)	1.26 (0.70, 2.26)	94 (2.0)	1.91 (0.85, 4.29)	1.76 (0.73, 4.24)
≥$75,000	167 (23)	75 (3.4)	2.91*** (1.84, 4.60)	1.33 (0.71, 2.52)	94 (1.8)	2.15 (0.96, 4.81)	1.22 (0.46, 3.20)

OR: odds ratio; CI: confidence interval; a: Unweighted frequencies. They may not add up to the total due to missing values; b: Weighted percentages and standard errors; c: Adjusted for age group, marital status, employment, body mass index, and smoking status in addition to all variables shown in the table; *P<0.05, ** P<0.01, *** P<0.001

BRFSS, 58.1% based on the 2001 NHIS, and 65.7% based on the 2001–2002 NHANES.[1,3,33] This indicates that estimates of overweight or obesity in self-reported studies are stable across different national surveys (58.0% vs. 58.1%), which justifies comparisons of self-reported measures of overweight or obesity between different national surveys and across different years. It also indicates that underestimation of weight or overestimation of height in self-reported studies mostly occur among obese or extremely obese individuals rather than among overweight individuals.

Because of similarity in terms of the data collection method and target population, comparison of our estimates with the BRFSS estimates would be more reasonable than with other survey estimates, although caution is warranted in the comparisons as the sampling scheme is not identical. The most recent prevalence estimates of obesity and overweight or obesity, respectively, among adults aged ≥18, published in a peer-reviewed journal based on the BRFSS data, were 19.8% and 56.4% in 2000, and 20.9% and 58.0% in 2001, compared with 23.9% and 63.3% in our study.[3,31] These data suggest that the hypothesis of no increase in the prevalence of overweight and obesity since 2001 is not tenable. Our finding of a higher prevalence of diabetes in 2005 compared with the estimates in 2000 and 2001 also questions the tenability of this hypothesis.

Another hypothesis we set forth prior to the study was that race/ethnicity would contribute significantly to the prediction of different attitudes and perceptions, if any, toward obesity in a fully adjusted model given the significant racial/ethnic disparities in obesity reported in literature.[1,2,6-10] Although race/ethnicity was a significant predictor of five out of six different attitudes and perceptions toward obesity in the unadjusted models, it was still significant only in two adjusted models—Hispanics were more likely than whites to believe that obese people cannot do anything about their weight and have a higher chance of getting various forms of cancer. No different odds for blacks compared with whites were significant for any of the attitudinal and perceptional statements related to obesity. Given the observed significant racial/ethnic disparities among women, which is in line with the literature,[2,8-10] we conducted the same logistic regression analyses for women only to find no statistical differences in the results from those using the entire respondents.

The findings of this study should be interpreted in light of the following limitations. First, causal relationships

should not be inferred from the present findings since this study used a cross-sectional survey design. Second, some of subgroup analyses yielded large SEs because of small cell sizes. These estimates should be interpreted with caution as they are considered statistically unreliable. Third, the attitudinal measures in this study may not have fully captured respondents' attitudes and perceptions toward obesity. Lastly, like all other survey studies, the statistics calculated from the sample are subject to measurement errors. Despite these limitations, this study contributes to the literature by providing health professionals with important implications in designing individual or community interventions to help reduce the prevalence of overweight and obesity among U.S. adults. Unlike many other health behaviors, attitudes and perceptions either do not work as a precursor to people's behaviors that influence their overweight problems or their effect size is too weak to affect such multifaceted behaviors, compared with other determinants of obesity such as genetic, physiological, social, economic, environmental and cultural factors.[36-41] A modification of attitudes and perceptions among the minority population might not have significant effects on their behavior that can influence the prevalence of overweight and obesity. More research is warranted to reveal the mechanisms by which racial disparities persist in obesity, especially among women.

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