Impact of Obesity on Health-related Quality of Life in Patients with Chronic Illness

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OBJECTIVE: **To determine the association between overweight and obesity and health-related quality of life (HRQOL) in patients with chronic conditions typical of those seen in general medical practice, after accounting for the effects of depression and medical comorbidities.**

DESIGN: **Cross-sectional analysis of data from the Medical Outcomes Study.**

SETTING: **Offices of physicians practicing family medicine, internal medicine, endocrinology, cardiology, and psychiatry in three U.S. cities.**

PATIENTS: **We surveyed 2,931 patients with chronic medical and psychiatric conditions. The patients completed a self-administered questionnaire at enrollment and had complete data on height and weight.**

MEASUREMENTS AND MAIN RESULTS: **Body mass index (BMI), chronic medical conditions, and depression were obtained by structured interview. Health-related quality of life was measured by the SF-36 Health Survey. Patients who were overweight (BMI 25.0–29.9 kg/m^2), patients with class I obesity (BMI 30.0–34.9 kg/m^2), and patients with class II–III obesity (BMI $\geq$ 35 kg/m^2) had significantly lower adjusted physical function scores (by 3.4, 7.8, and 13.8 points, respectively) compared with nonoverweight patients. Patients with class I and class II–III obesity also had significantly lower adjusted general health perceptions scores (by 2.8 and 4.4 points, respectively) and lower adjusted vitality scores (by 4.0 and 7.1 points, respectively), compared with nonoverweight patients. No significant differences between nonoverweight, overweight, and obese patients were observed for the mental health scale. Women with elevated BMI had significantly lower HRQOL scores compared with the scores of obese men in several domains. Additionally, blacks with elevated BMI had significantly lower scores than whites in several domains of HRQOL.**

CONCLUSIONS: **Overweight and obesity have the largest association with physical function measures. Recent national standards, which have lowered the threshold for defining overweight, identify patients who are more likely to have clinically significant reductions in HRQOL and functional impairment.**

KEY WORDS: **obesity; quality of life; health surveys.**
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Obesity has become increasingly prevalent in the United States in recent decades.[1] Data from the Third National Health and Nutrition Education Survey (NHANES III) show that 54.9% of U.S. adults aged 20 years and older are either overweight (body mass index [BMI] 25.0–29.9 kg/m^2) or obese (BMI $\geq$ 30 kg/m^2).[2] Obesity is associated with an increased risk of heart disease, non-insulin-dependent diabetes mellitus, ischemic stroke, certain forms of cancer (e.g., breast, colon), degenerative arthritis, and sleep apnea.[3] Moreover, being overweight has important social and economic consequences, including a lesser likelihood of being married and lower income with long-term follow-up.[4] In 1995, direct and indirect medical costs associated with obesity were estimated to be $51.6 billion (5.7% of U.S. national health expenditures) and $47.6 billion, respectively.[5]

Recent guidelines on obesity specify BMI categories that are associated with disease-specific morbidity and mortality in epidemiologic studies and provide a comprehensive summary of the literature with regard to the clinical management of obesity.[3] The health burden of obesity goes beyond its association with specific disease states, however. Among individuals with class II–III obesity, bodily functions that nonobese people take for granted are disturbed in people who are obese. For example, shortness of breath and specific complaints referable to the digestive tract and musculoskeletal system were reported more frequently by patients with a BMI >30 as compared with patients with a BMI <27.[6] In the RAND Health Insurance Study, 18% of obese subjects reported bodily pain, 18% had restricted their activities because of their weight, and 88% worried about their weight.[7]

The relationship between obesity and health-related quality of life (HRQOL) deserves close scrutiny, as the recent guidelines for obesity have lowered the threshold for defining problematic weight status; this has been estimated to account for a 42% increase in the disease prevalence of overweight and obesity.[8] The objective of this study is to evaluate the revised definitions of overweight and obesity by determining the association between BMI and HRQOL, after accounting for the effects of depression and other comorbidities, in patients with chronic conditions typical of those seen in general medical practice.

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METHODS

Sample and Data Collection

The data for these analyses were derived from the Medical Outcomes Study (MOS), a 4-year observational study of health outcomes for patients with chronic medical and psychiatric conditions. Details on study design and objectives have been extensively reported [9–14] and are briefly summarized here. The MOS was conducted in three cities: Boston, Mass; Chicago, Ill; and Los Angeles, Calif. In each city, patients and physicians were sampled from five different practice settings differing in organization, physician-specialty mix, and payment arrangement. From these health care systems, 523 clinicians trained in family practice, general internal medicine, cardiology, endocrinology, psychiatry, and clinical psychology were sampled. Study participants were English-speaking adults who had had an office visit with an enrolled MOS clinician during 9-day screening periods in February to November 1986. Patients completed a brief, standardized, self-report questionnaire which gathered information on chronic disease, depressive symptoms, sociodemographic characteristics, and general health status.

Data from standardized physician-completed forms identified patients with five MOS tracer conditions (hypertension, diabetes, congestive heart failure, recent myocardial infarction, and depression).[9–14] A two-stage process, involving a short form of the Center for Epidemiologic Studies (CES)-D[15] included in the patient questionnaire and the National Institute of Mental Health Diagnostic Interview Schedule (DIS),[12] identified patients with depression and staged severity.[12,15] Current depressive disorder was defined based on *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* criteria for lifetime major depression or dysthymia and having had an unremitted episode of major depression or period of dysthymia during the last 12 months; patients with depressive symptoms who did not satisfy this definition were considered to have subthreshold depression.[16]

Medical conditions comorbid to the tracer conditions were identified using data from the MOS health examination. The health examination (standardized medical history and clinical examination) was independently conducted by specially trained MOS medical staff.[10,17–19] These comorbidities included anemia, cardiopulmonary disorders, obstructive airway disease, cancer, gastrointestinal disorders, genitourinary disorders, rheumatologic disorders, and dermatologic conditions.[20]

There were 3,445 panel-eligible patients with at least one of the MOS tracer conditions who completed a self-administered baseline patient assessment questionnaire by mail administration after enrollment into the study.[17,21,22] The sample for the cross-sectional analysis reported here includes 2,931 patients who had complete data on height and weight. The 514 patients with missing data on BMI were younger (45.6 vs 54.9 years) and were more likely to be female (73% vs 60%), white (87% vs 78%), and unmarried (47% vs 61%), compared with patients with complete data. These patients also were less likely to have medical conditions such as hypertension (24% vs 67%) and diabetes (7% vs 20%), but were more likely to have clinical depression (43% vs 10%).

Measures of HRQOL

The SF-36 is a 36-item, generic quality-of-life measure that assesses 8 domains: (1) physical functioning; (2) role limitation due to physical-health problems (role physical); (3) bodily pain; (4) general health perceptions; (5) vitality; (6) social functioning; (7) role limitations due to emotional-health problems (role emotional); and (8) mental health. The physical function and role physical scales best distinguish between groups differing in severity of chronic medical conditions and have the most pure interpretation with regard to physical health; the mental health and role-emotional scales best distinguish between groups differing in severity of psychiatric disorders and have the most pure interpretation with regard to mental health.[21] Social function, vitality, and general health perceptions scales measure both physical and mental health status.[21] All health measures were scored on scales of 0 to 100, with higher scores indicating better health. Evidence of the reliability and validity of the SF-36 across diverse patient groups has been demonstrated.[21–23]

Because the general health perceptions scale of the SF-36 scale is multidimensional and represents multiple aspects of health perceptions,[9] we examined more detailed subscales of the MOS-149 that measure different aspects of general health perceptions (current health, health distress). We also examined fatigue and energy subscales of the vitality scale to better characterize observed differences in vitality.

The SF-36 scores for the MOS sample were compared with normative data that were generated from a national survey.[24] The normative sample was randomized to mail or telephone administration of the SF-36. To circumvent the known biases associated with mode of administration effects,[24] we limited the normative sample to the 1,690 subjects who completed the SF-36 by mail (as did the MOS sample). Because the demographics of the normative sample differed from those of the MOS sample, multiple linear regression was used to calculate a predicted score for the normative sample based on the average age, education and gender and racial composition of the MOS sample.

Measures of Obesity

Body mass index was calculated from height and weight, as reported by patients at the time of the initial MOS screening questionnaire. Self-reported weight has been demonstrated to be a valid measure of body mass[25]; in the RAND Health Insurance Study, the correlation between self-reported weight and actual weight was .98 to

.99.[26] We used the following BMI categories recently adopted by the National Institutes of Health and the World Health Organization: overweight (BMI 25.0–29.9 kg/m^2), class I obesity (BMI 30.0–34.9 kg/m^2), class II obesity (BMI 35.0–39.9 kg/m^2), and class III obesity (BMI ≥ 40 kg/m^2).[3,27,28] These BMI categories have been demonstrated to correlate with increased risks of chronic obesity-related diseases, physical impairment, and absence from work.[29] Because of the relatively small numbers of patients in classes II and III, these groups have been consolidated for analysis.

Measures of Potential Confounders

All data on sociodemographic (age, gender, race, education, income, and marital status) and health habit variables (smoking, alcohol use, and exercise frequency) were obtained from questionnaire responses elicited upon entry into the study. Alcohol and smoking status were assessed using a 3-point scale (e.g., no history of drinking, past drinker, current drinker). Using a 6-point Likert scale, with responses ranging from "daily or almost daily" to "almost never or never," frequency of exercise was assessed with the question "How often do you exercise?"

Statistical Analysis

We used multiple linear regression to identify the association between BMI categories and HRQOL at baseline. We adjusted for sociodemographic characteristics, health habits, MOS tracer conditions, disease severity of the tracer conditions,[13] a count of 16 other comorbidities,[18] musculoskeletal conditions related to obesity (including osteoarthritis, hip impairment, and back pain with or without sciatica), and study location. In order to account for nonlinear effects, we included three dummy variables for age: 40 to 55, 56 to 65, and more than 65 (age less than 40 was the holdout category). Race was coded as Caucasian, black, and other (includes Hispanics and Asians). Income was dichotomized at 200% of the 1985 poverty line. We included dummy variables for education (less than 12 years, exactly 12 years; more than 12 years was the holdout category) and exercise (at least 4 times a week, less than once a week; 1 to 3 times a week was the holdout category). Because of the relatively small number of type 1 diabetics in the analytic sample (n = 77), both type 1 and type 2 patients were consolidated into a single disease category.

We report the average deviation in HRQOL values for overweight, obesity (class I and class II–III), and a comparison condition (congestive heart failure [CHF]). This condition was selected because it is representative of a condition with predominant effects on physical functioning.[11] The deviations in HRQOL associated with CHF were obtained from HRQOL models that adjusted for BMI category and other covariates described above. Because all patients in the current study had one of the five MOS tracer conditions, we used the subgroup of nonoverweight patients (BMI < 25 kg/m^2) with mild hypertension[13] as the reference group. We constructed a series of regression models and examined the change in average deviation in HRQOL associated with obesity with the addition of groups of covariates (sociodemographics, health habits, medical conditions, musculoskeletal conditions related to obesity, and depression) to a base model including only obesity and study location variables. We analyzed two-way interaction terms to explore possible effect modification of the association between obesity and HRQOL by gender,[29,30] race, and income.

RESULTS

Forty-six percent of male patients were overweight, and 16% and 6% had class I and class II–III obesity, respectively; in female patients, 28% were overweight, 19% had class I obesity, and 16% had class II–III obesity. Obese patients were more likely to be female (60%) and nonwhite (77% black), and were more likely to have lower adjusted income and less education (Table 1). The proportion of patients with full-time or part-time employment was comparable across BMI categories. With regard to health habits, obese patients were less likely to be current smokers but were more likely not to exercise regularly (less than once a week). As expected, hypertension, diabetes, and noninflammatory musculoskeletal conditions (including back pain, hip impairment, and osteoarthritis) were more prevalent in obese patients. A U-shaped relationship between BMI and depression was observed, in which the prevalence of clinical and subthreshold depression was highest in nonoverweight patients and patients with class II–III obesity (Table 1). The mean number of patient-reported comorbidities was 1.5 in patients with class II–III obesity versus 1.2 in nonoverweight patients (P = .005).

Obesity had the largest effects on physical measures. As shown in Table 2, patients with overweight, class I obesity, and class II–III obesity had significant lower physical function scores (by 3.4, 7.8, and 13.8 points, respectively) compared with nonoverweight patients with mild hypertension. For comparison, patients with CHF had physical function scores that were 15.4 points lower on average. Lesser, but significant, declines in role-physical function and bodily pain were noted in overweight and obese patients.

Significant differences in the two scales that draw upon both physical and mental status for class I and class II–III obesity were also demonstrated. In our main analysis, patients with class I and class II–III obesity had general health perceptions scores that were lower (by 2.8 and 4.4 points, on average) compared with nonoverweight patients with mild hypertension; stratification by gender demonstrated that this reduction in general health perceptions

Table 1. Patient Characteristics for Total Body Mass Index Category

	Analysis Sample $N = 2,931$	Not Overweight (<25.0) $n = 1,052$	Overweight (25.0–29.9) $n = 1,012$	Class I Obesity (30–34.9) $n = 520$	Class II–III Obesity (≥35.0) $n = 347$	*P* Value*
Demographics						
Mean age, y (SD)	54.9 (15)	53.5 (17)	56.7 (14)	55.7 (14)	52.1 (14)	.0001
Men, %	40	38	52	37	19	.0001
Nonwhite, %	22	21	20	25	31	.0001
Income, mean adjusted 1985 household, $ (SD)	22,786 (16,387)	23,442 (18,174)	24,144 (15,845)	21,050 (14,315)	19,462 (14,373)	.0001
Years of education, mean (SD)	13.2 (3.0)	13.5 (3.0)	13.2 (3.1)	13.0 (2.9)	13.0 (2.8)	.002
Employed (full- or part-time), %	54	54	54	55	54	.98
Married, %	60	55	69	58	58	.0001
Health habits						
Current smoker, %	26	30	26	22	22	.001
Exercise frequency						.0001
≥4 times/wk	27	32	29	20	18	
1–3 times/wk	39	38	40	42	32	
<1 time/wk	34	30	31	38	50	
Clinical conditions, %						
Hypertension	67	55	72	78	70	.0001
Diabetes mellitus (type 1 or 2)	20	15	19	26	31	.0001
Recent myocardial infarction	4	4	4	3	2	.28
Congestive heart failure	7	7	6	6	9	.31
Musculoskeletal conditions	29	25	29	28	40	.0001
Clinical depression	10	13	6	9	11	.0001
Subthreshold depression	20	25	16	17	21	.0001
Mean no. of comorbidities (SD)	1.3 (1.1)	1.2 (1.1)	1.2 (1.1)	1.3 (1.1)	1.5 (1.3)	.005

**Differences between obesity categories were assessed using the χ^2 test for categorical variables and the Kruskal-Wallis test for continuous variables.*

was limited to women (see below). In analyses of health perceptions subscales (from the MOS-149), patients with class I and class II–III obesity had significantly lower perceptions of current health (by 3.8 and 5.2 points, respectively) and had increased health distress scores (by 2.2 and 3.8 points, respectively), compared with nonoverweight patients ($P < .05$). To put these results in context, patients with CHF had decreased current health scores (by 14.5 points) and increased health distress scores (by 6.0 points), compared with nonoverweight patients ($P < 0.05$). The health distress measure captures a broad range of negative emotions, such as frustration, despair, and discouragement related to one's health.

Patients with class I and class II–III obesity had reduced vitality scores (4.0 and 7.1 points lower on average), compared with nonoverweight patients (Table 2). These results were consistent across both the energy and fatigue subscales of the vitality scale (data not shown). In comparison, patients with CHF had vitality scores that were 8.5 points lower (on average) than nonoverweight patients. No significant declines in social function were noted for any category of obesity.

After adjustment for clinical depression and depressive symptoms, no significant differences in mental health were observed for any category of obesity in our main analysis. We obtained similar results with or without adjustment for depression in the model (Table 3), and with use of a 10-item measure of psychological well-being and a 13-item measure of psychological distress (from the MOS-149) instead of the SF-36 5-item measure of mental health. Given that the reference group in our analysis (nonoverweight patients with mild hypertension) had a relatively high prevalence of depression (Table 1), we also repeated the analysis using overweight patients as the reference category; as before, no association between obesity and mental health was found after adjustment for covariates. However, we did observe significantly reduced role-functioning due to emotions in MOS patients with overweight and class II–III obesity (Table 2).

The effects of controlling for covariates on the differences in HRQOL associated with obesity are shown in Table 4 (for selected SF-36 scales). Specifically, the addition of health habit variables to physical function and vitality models reduces the strength of association between class II–III obesity and these domains by 9% and 13%, respectively. Adjustment for medical conditions and depression further reduces the association between class II–III obesity and physical function and vitality by 12% and 13%, respectively (no significant changes were noted for overweight or class I obesity).

Table 2. Average Adjusted Deviation in Health-Related Quality of Life (HRQOL) Domains for Patients with Obesity*

	Mean Score		Average Deviation from Reference Group (SE)*			
HRQOL Domain	General Population† (*n* = 1,690)	Reference Group (SE)‡ (*n* = 649)	Overweight (*n* = 1,012)	Class I Obesity (*n* = 520)	Class II–III Obesity (*n* = 347)	CHF (*n* = 216)
Physical function	75.5	78.9 (22)	−3.4 (1.0)§	−7.8 (1.2)§	−13.8 (1.4)§	−15.4 (1.7)§
Role-physical	70.0	62.2 (40)	−3.2 (1.7)‖	−4.6 (2.0)¶	−8.4 (2.4)§	−15.2 (2.9)§
Pain	69.8	72.8 (22)	−2.6 (1.0)¶	−4.5 (1.2)§	−7.0 (1.4)§	1.0 (1.8)
General health perception	67.5	61.3 (21)	−1.7 (0.9)	−2.8 (1.1)¶	−4.4 (1.3)§	−11.4 (1.6)§
Vitality	58.4	58.2 (21)	−1.4 (0.9)	−4.0 (1.1)§	−7.1 (1.3)§	−8.5 (1.5)§
Social	79.3	86.3 (19)	−1.6 (0.9)	−1.7 (1.1)	−2.1 (1.3)	−7.0 (1.6)§
Role-emotional	76.9	75.6 (36)	−3.7 (1.6)‖	−2.5 (2.0)	−5.6 (2.3)‖	−4.4 (2.8)
Mental health	74.6	75.3 (17)	−0.6 (0.7)	−0.4 (0.9)	−0.2 (1.1)	−0.3 (1.3)

**Relative to nonoverweight patients with mild hypertension (reference group). These values correspond to coefficients for obesity and comparison condition in HRQOL regression models, which are statistically controlled for demographic factors, health habits, tracer conditions and tracer severity, patient-reported comorbidities, and study location. All HRQOL values were scored on a scale of 0 to 100. For example, overweight patients experienced a 3.4-point decrement in physical functioning (on average), compared with the reference group. Body mass index categories are defined as follows: overweight (25–29.9), class I obesity (30–34.9), class II–III obesity (≥35). SE indicates standard error; CHF, congestive heart failure.*

†*Adjusted mean for each HRQOL domain for subjects in the general U.S. population. Predicted scores for the normative sample were based on the average age, gender, racial composition, and education status of the Medical Outcomes Study (MOS) sample.*

‡*Mean and SE for each HRQOL domain in the MOS reference group. Adjusted for age, gender, racial composition, and education status.*

§$P \leq .001$.

‖$P \leq .05$.

¶$P \leq .01$.

We tested the a priori hypothesis that the lower HRQOL scores associated with obesity may be more pronounced in women compared with men. In tests for interaction, we found that women with elevated BMI had significantly lower scores in physical function, role-physical (class II–III obesity), bodily pain (overweight, class I obesity), general health perception, vitality (overweight, class II–III obesity), social function (class II-III obesity), and mental health (overweight), compared with the reductions observed in obese men (Table 4). We also explored interactions between African American race and obesity, and found that African Americans had significantly lower scores in vitality (overweight), social function (class II–III obesity), role-emotional function (overweight), and mental health (class

Table 3. The Effect of Adding Specific Variable Groups on the Average Decrement in Health-Related Quality of Life Domains Associated with Class I and Class II–III Obesity at Baseline*

	Physical Function		Vitality		Mental Health	
Model	Class I Obesity	Class II–III Obesity	Class I Obesity	Class II–III Obesity	Class I Obesity	Class II–III Obesity
(1) Obesity only†	−8.3	−17.1	−3.3	−10.4	1.5	−1.3
(2) Obesity + sociodemographics‡	−7.5	−17.3	−3.7	−9.4	0.7	0.3
(3) Obesity + sociodemographics + health habits§	−7.0	−15.7	−3.2	−8.2	0.8	0.7
(4) Obesity + sociodemographics + health habits + medical‖	−7.1	−13.0	−3.0	−5.8	0.9	1.7
(5) Obesity + sociodemographics + health habits + medical + depression¶	−7.8	−13.8	−4.0	−7.1	−0.4	−0.2
Adjusted R-squared (model 5)		0.35		0.23		0.32

**Groups of related variables were added to a base model including obesity variables alone.*

†*Includes overweight, class I obesity, and class II–III obesity (results are shown only for class I and class II–III obesity). Average deviations are statistically significant at the* $P < .01$ *level for all physical function and vitality models only.*

‡*Sociodemographic variables include age, sex, race, education, income, and marital status.*

§*Health habits include alcohol use, smoking status, and exercise frequency.*

‖*Medical condition variables include medical tracer conditions (hypertension, myocardial infarction, congestive heart failure, diabetes mellitus), including severity status, number of comorbid medical conditions (see test), and musculoskeletal conditions (back pain, hip impairment, and osteoarthritis).*

¶*Depression variables include current depressive disorder and subthreshold depression.*

Table 4. Effect Modification of the Association Between Body Mass Index and Obesity by Gender*

	Overweight		Class I Obesity		Class II–III Obesity	
HRQOL Domain	Male (n = 527)	Female (n = 485)	Male (n = 194)	Female (n = 326)	Male (n = 66)	Female (n = 281)
Physical function	−0.6	−5.0†	−1.9	−10.7†	−4.1	−16.3†
Role-physical	−2.1	−3.4	−2.1	−5.5	1.4	−10.6†
Pain	0.0	−4.3†	−1.8	−5.8†	−5.1	−7.6
General health perception	1.0	−3.3†	1.1	−4.6†	0.2	−5.9†
Vitality	0.4	−2.8†	−2.6	−4.9	−3.0	−8.4†
Social	0.2	−2.9	−1.8	−1.5	3.9	−3.4†
Role-emotional	−4.1	−4.0	−7.2	0.0	−2.4	−6.2
Mental health	1.2	−2.1†	−0.1	−0.7	1.7	−1.2

**The adjusted average deviation in health-related quality of life (HRQOL) domains associated with overweight and obesity is shown separately for males and females. The reference group is comprised of nonoverweight Medical Outcome Study patients with mild hypertension.*
†P ≤ .05 for the interaction term between gender and body mass index category.

I–III obesity), compared with the reductions found in Caucasian patients (Table 5). Interactions between income and obesity were not significant.

DISCUSSION

Using categories for overweight and obesity based on recent National Institutes of Health guidelines, the current study extends the results of previous studies by quantifying the associations between BMI and HRQOL in a large sample of patients receiving medical care in a variety of clinical settings. The major findings are that overweight and obese patients have significantly lower HRQOL across physical health measures, and that overweight and obese patients have significantly lower HRQOL across physical, health perceptions, and vitality measures, compared with nonoverweight patients after adjustment for demographics, health habits, medical conditions, and depression. It is noteworthy that the reduction in physical function associated with class II–III obesity approaches that seen for CHF. We also found greater decreases in HRQOL across most domains for women, compared with men, and greater decreases in HRQOL (especially mental health measures) for blacks, compared with Caucasians. The latter findings should be confirmed in future studies.

Other investigators have reported that obesity has a prominent effect on physical function measures.[29–32] In an analysis of 10,308 British civil servants, Stafford et al. reported a significant linear trend between increasing BMI and poor physical functioning (as defined by the lowest quartile of SF-36 physical function scores) in both men and women at baseline.[30] In this study, the odds ratios of poor physical functioning were 2.35 and 3.73 for men and women with BMI >29 kg/m^2 (compared with subjects with BMI <21 kg/m^2), after adjustment for demographic and lifestyle factors. Although these investigators used a reference category with a lower BMI cutoff (<21 kg/m^2), which would tend to magnify the associations between obesity and HRQOL, the strong association between obesity and impaired physical function was similar to that found in the current study. Because of their increased weight, patients with high BMI are more likely to be limited in basic activities of daily living, including walking several blocks, bending, kneeling, and stooping[29,32] and

Table 5. Effect Modification of the Association Between Body Mass Index and Obesity by Race*

	Overweight		Class I Obesity		Class II–III Obesity	
HRQOL Domain	Caucasian (n = 792)	Black (n = 138)	Caucasian (n = 381)	Black (n = 93)	Caucasian (n = 232)	Black (n = 85)
Physical function	−3.3	−5.6	−7.8	−7.1	−14.9	−12.0
Role-physical	−2.6	−7.2	−3.8	−8.2	−8.5	−11.6
Pain	−1.7	−5.1	−4.6	−0.8	−5.4	−7.1
General health perception	−1.6	−4.4	−1.6	−4.0	−4.6	−3.6
Vitality	−0.2	−6.8†	−2.7	−6.4	−6.6	−8.7
Social	−1.2	−3.1	−0.7	−5.3	−0.7	−6.3†
Role-emotional	−1.9	−9.8†	−1.7	−4.7	−4.9	−11.0
Mental Health	0.0	−3.3	−0.4	−4.3†	1.2	−4.9†

**The adjusted average deviation in health-related quality of life (HRQOL) domains associated with overweight and obesity is shown separately for Caucasians and blacks. The reference group is comprised of nonoverweight Medical Outcome Study patients with mild hypertension.*
†P ≤ .05 for the interaction term between race and body mass index category.

are more likely to report exertional shortness of breath, which may reflect poor physical conditioning.

Our finding that overweight and obese women rate their overall health more negatively than nonoverweight women has importance for the health care system because measures of general health perceptions are among the best predictors of utilization of medical and mental health services.[9,33] This finding was confirmed by more detailed general health perceptions subscales that showed worse perception of current health and increased health distress, compared with nonoverweight subjects. In addition, decreases in vitality were especially prominent in obese women. Other investigators have also shown lower SF-36 scores for general health perceptions and vitality in patients seeking treatment for obesity (mean BMI, 38.1 kg/m^2),[31] and an increased risk of poor general health perceptions in overweight women (odds ratio, 1.42) but not in overweight men.[32] The effects of obesity on general health perceptions may be mediated in part by poor self-image, which is exacerbated by negative attitudes of peers, family members, health professionals,[34,35] and potential employers toward obese persons,[36,37] and powerful societal messages to be thin.[3]

Our main analysis did not demonstrate a significant difference in mental health between overweight/obese and nonoverweight subjects. This lack of association was observed when more detailed mental health subscales were used, and whether or not the mental health was adjusted for clinical (and subthreshold) depression. The lack of significant differences in mental health between obese and nonobese subjects has been reported previously in U.S. community-based studies.[38,39] Furthermore, weight gain was not associated with significant changes in mental health in a large prospective study of U.S. nurses.[40] In contrast, other investigators have identified an increased prevalence of anxiety and depressive symptoms in very obese subjects (BMI $\geq$ 34).[41] There are several possible explanations for these different results. Decreased mental health scores were reported in patients who were dissatisfied with their weight and were actively seeking treatment for obesity,[31,42] which could reflect selection bias. Also, there could be a higher BMI threshold for impairment in mental health, relative to physical health measures. Finally, there are differences in racial composition across study samples. The association between obesity and mental health may be more salient in populations with a greater proportion of blacks (as suggested by the presence of effect modification in this study).

The limitations of this study deserve comment. First, this analysis is based on cross-sectional data. While we cannot rule out the possibility that decreased HRQOL leads to overweight and obesity (i.e., reverse causality), the causal relationship between obesity and diminished HRQOL is supported by recent longitudinal studies.[30,40] In particular, analysis of prospective data from the Nurse's Health Study demonstrated that weight gain was significantly associated with decreased physical function, vitality, and bodily pain, regardless of baseline weight.[40]

A second limitation is that this analysis was not designed to determine whether the association between BMI and HRQOL is mediated by obesity-related medical conditions, such as hypertension, diabetes, and osteoarthritis. Our analysis argues against this possible explanation, however, because the results were similar whether or not we adjusted for obesity-related complications (Table 4). Third, the SF-36 is a generic health measure. Obesity-specific measures may complement measures such as the SF-36 in capturing more subtle differences in health among patients with mild obesity and reductions in aspects of mental health unique to obesity.[43,44] In addition, the skewed distributions of some of the SF-36 scales, particularly social, role-emotional, and role-physical function, may have attenuated the β coefficients for obesity in our models because of the restricted variability and range for these measures. Fourth, there may be residual confounding of the relationship between obesity and HRQOL related to misclassification of comorbidities. Although some comorbidities were based on patient self-report, the tracer conditions and their severity were identified by the patient's physician (clinician's questionnaire) and by two-stage psychiatric interview. Fifth, we did not have data on drugs utilized for treatment of obesity-related chronic conditions, such as hypertension, that may have measurable effects on HRQOL.[45] Sixth, data were missing on BMI for 15% of MOS patients. Because these patients were more likely to have clinical depression, it is possible that their exclusion reduced the likelihood of detecting significant differences in mental health across BMI category. Finally, we did not adjust *P* values for multiple comparisons. Given that we checked three interaction terms for each SF-36 domain (total 24) in each test for interaction, approximately one statistically significant interaction would have been expected on the basis of chance alone.

What are the implications of these findings? Our results support recent national standards for obesity by demonstrating that even modest levels of overweight are associated with significant reductions in HRQOL. We believe that these national standards provide a useful target for clinicians in working with their patients to set realistic goals for weight loss. In addition to providing advice on weight loss and treating obesity-related complications, clinicians should be alert for functional impairment in overweight and obese patients, especially women and African Americans. The inverse association between obesity and HRQOL is another compelling reason to redouble our efforts to attain Healthy People 2000 goals pertaining to overweight.[46]

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