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## Gender Differences in Associations Between Body Mass Index and DSM-IV Mood and Anxiety Disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions

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### Abstract

**PURPOSE**—The purpose of this study is to examine gender differences in associations between body mass index (BMI) and affective disorders.

**METHODS**—We used logistic regression to examine the effects of BMI and gender on DSM-IV mood and anxiety disorders in a sample of 40,790 adults.

**RESULTS**—Obesity (BMI  $\geq$  30.0) was associated with increased risk for any mood disorder, major depressive disorder, and dysthymic disorder, in both men and women (odds ratios [ORs], 1.35–1.88). Risk of bipolar I and II disorders was elevated in obese women (ORs, 1.70–2.41) but not men. Overweight (BMI = 25.0–29.9) predicted increased risk for any mood disorder and bipolar I disorder in women but not men (ORs, 1.16–1.44). Obesity was associated with increased odds of any anxiety disorder and specific phobia in men and women (ORs, 1.35–1.79). Obese women were additionally at increased risk for social phobia. Overweight predicted increased risk of social phobia and specific phobia for women but not men (ORs, 1.27–1.37).

**CONCLUSIONS**—Obese individuals of both genders are at increased risk for a range of mood and anxiety disorders, but women who are even moderately overweight experience increased risks for some disorders as well.

### Keywords

Overweight; Obesity; Mood disorders; Anxiety disorders; Sex/gender; Risk

### Introduction

Health risks associated with overweight and obesity are well documented. Diabetes, cardiovascular disease, arthritis, and certain cancers are more prevalent among overweight and obese individuals than among those of normal weight (1–3), and risks for these disorders increase with body mass (2,4,5). Recent evidence suggests increased prevalence of mood and anxiety disorders among individuals who are overweight or obese compared to those with

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weight in the normal range (6). Among those seeking weight loss treatment, rates of depressive and bipolar disorders are elevated (7–9). Conversely, rates of overweight and obesity are elevated among individuals seeking treatment for psychiatric disorders, particularly mood disorders (8,10–12).

Epidemiological studies are the gold standard for establishing comorbidity rates because they are not confounded by treatment seeking status, and they allow for investigation of demographic variables that may influence relationships. Few epidemiological studies examining the relationship between body mass index (BMI) and psychopathology exist. Most find that the risk of major depression significantly increases with BMI even when controlling for demographic characteristics and other risk factors (6,13). Obesity also appears to be associated with increased odds of anxiety disorders (6).

Rates of overweight and obesity differ for men and women. Men are more likely to be overweight (14), but women are more likely to be obese (15). In the population as a whole, women are more likely than men to experience mood or anxiety disorders (16). Relationships between psychiatric disorders and BMI also appear to differ for men and women. In an epidemiological sample divided into obese (BMI  $\geq$  30) and non-obese (BMI  $<$  30) categories, obesity was associated with elevated risk for mood and anxiety disorders in women and men (6). When overweight and obesity are categorized separately, both have been associated with greater likelihood of reporting symptoms of depression or anxiety in women (17,18), but one study found that these relationships did not hold for men (18), and another found they applied to overweight but not obese men (17). Women but not men who report a lifetime history of major depression or bipolar disorder have elevated odds of obesity (19). Adolescent and young adult females classified as obese are more likely to report anxiety disorders than their normal weight counterparts, a relationship not observed in males (20).

Some recent studies suggest that overweight may actually be associated with better mental health among men. Overweight and obese men are less likely to attempt or commit suicide compared to underweight or normal weight men (21,22). In contrast, increased BMI is associated with higher rates of suicidal ideation among women (23).

The purpose of this study was to clarify and corroborate findings of previous studies suggesting interactions between BMI and gender in predicting risk for mood and anxiety disorders using a large, recently collected, representative sample of the United States population. The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) (24) is the largest psychiatric epidemiology study conducted to date. The National Institute on Alcohol and Alcoholism (NIAAA) collected NESARC data from a representative sample of the U.S. population in 2001 and 2002. The primary goals of NESARC were to determine the prevalence of alcohol use and alcohol use disorders and to examine associated physical and emotional disabilities. Self-reported height and weight were obtained from respondents, and a range of mood and anxiety disorders were diagnosed based on DSM-IV criteria. The NESARC sample therefore appeared to be ideally suited to the task of examining associations between BMI and psychopathology, and the large size of the sample allowed for categorization of respondents into normal weight, overweight, and obese groups and for analysis of interactions between BMI and gender.

## Methods

### NESARC Sample

Non-institutionalized civilians aged 18 and over were the target population of NESARC, and participants were drawn from all fifty states and the District of Columbia. African American and Hispanic individuals were over-sampled to each constitute approximately 20 percent of

the total sample. Young adults, aged 18 to 24, were also over-sampled at a 2.25:1 ratio. The sample was later weighted based on characteristics of the sampling methods, to account for the selection of one person from each household and for over-sampling, and to adjust for non-response at the household level. Weights allow the data to be adjusted during analysis to represent the U.S. population on demographic variables including age, sex, race, ethnicity, and region of residence based on the 2000 Decennial Census results.

Potential NESARC respondents were informed in writing about the nature of the survey, the statistical uses of survey data, the voluntary nature of participation, and Federal laws protecting confidentiality of identifiable survey information. Respondents who consented to participate after receiving this information were interviewed in person by interviewers from the U.S. Census Bureau, who entered responses directly into laptop computers. A total of 43,093 respondents were interviewed, and the response rate was 81%. The research protocol, including informed-consent procedures, received full ethical review and approval from the U.S. Census Bureau and the U.S. Office of Management and Budget.

### **Assessment of Body Mass Index and DSM-IV Psychiatric Disorders**

Body mass index (BMI) was computed from self-reported weight in kilograms divided by self-reported height in meters squared and was available for 41,654 respondents. Respondents were classified into three groups based on established guidelines (25). Those with BMI values of 18.5 to 24.9 were in the normal weight category, respondents with a BMI of 25 to 29.9 were classified as overweight, and respondents with a BMI of 30 or greater were classified as obese. Individuals classified as underweight (BMI < 18.5) were excluded from the current analyses because underweight is associated with other psychopathology already known to increase the risk for mood and anxiety disorders (26,27), leaving data for 40,790 respondents. Although self-reports of height and weight tend to underestimate BMI somewhat (28), they are highly correlated with direct physical measurement (29).

Lifetime and past-year DSM-IV mood and anxiety disorders were assessed using the NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version (AUDADIS-IV). Mood disorders evaluated included major depressive disorder, dysthymic disorder, bipolar I disorder, and bipolar II disorder. Individuals with a lifetime diagnosis of bipolar I or bipolar II disorder were not also diagnosed with lifetime major depressive disorder. Individuals with a lifetime diagnosis of major depressive disorder, bipolar I, or bipolar II disorder who experienced an episode of major depression (or manic or hypomanic episode for bipolar I and II disorders respectively) in the past year were considered to have a past-year diagnosis of their lifetime disorder. Anxiety disorders assessed were generalized anxiety disorder, panic disorder without agoraphobia, panic disorder with agoraphobia, agoraphobia without history of panic disorder, social phobia, and specific phobia. The AUDADIS-IV has fair to good reliability and validity for assessing DSM-IV mood and anxiety disorders (24, 30). Mood or anxiety disorders that were substance-induced or due to a general medical condition or bereavement were not included in our analyses.

### **Statistical Analysis**

Respondents were divided into six categories based on BMI and gender (normal weight men, normal weight women, overweight men, overweight women, obese men, and obese women). Chi-square analysis examined omnibus differences among the six groups on categorical variables, and simple regression analysis was used for continuous variables.

Logistic regression examined the relationship of BMI and mood and anxiety disorders within each gender separately, after controlling for demographic characteristics (age, race/ethnicity, education, marital status, income, region of country, and urban vs. rural residence). In addition,

separate logistic regression analyses assessed effects of interactions between gender and BMI on mood and anxiety disorders.

All analyses were conducted using SUDAAN (31), a software package that adjusts for complex sampling methodology, including weighting, using Taylor series linearization.

## Results

### Demographic Characteristics

Table 1 shows demographic characteristics of the sample stratified by BMI category and gender. All demographic features differed significantly across the six categories. Subsequent analyses therefore controlled for all these demographic features.

### Prevalence of DSM-IV Mood and Anxiety Disorders

Figure 1 and Figure 2 depict lifetime and past-year prevalence of mood and anxiety disorders, adjusted to reflect population demographics, for each gender in the three BMI categories. Women, particularly obese women, tended to have higher rates of mood disorders, both over the lifetime and in the year preceding the interview, than men. Prevalence of anxiety disorders was associated with BMI in both genders, but overall, women had greater increases in prevalence rates with increasing BMI compared to men.

### Relationships Between DSM-IV Mood Disorders and BMI by Gender

Table 2 shows odds ratios (OR) and 95% confidence intervals (CI) resulting from the logistic regression analyses with mood disorders as the dependent variables. Controlling for demographic characteristics, the analyses indicated a significant gender by BMI interaction effect on the likelihood of any lifetime or past-year mood disorder. Overweight and obese women had a greater likelihood of any lifetime mood disorder than normal weight women, while only obese but not overweight men had increased odds of any lifetime mood disorder compared to normal weight men. The odds of any past-year mood disorder were significantly elevated for both men and women in the obese category compared to their normal weight counterparts. This interaction was also significant in that the OR was higher for obese women than for obese men. Obese women and men were more likely to have lifetime and past-year major depressive disorder and dysthymic disorder compared to their normal weight counterparts. Overweight and obese women had increased odds of lifetime and past-year bipolar I disorder; there was no significant relationship between BMI and bipolar I disorder in men. The interaction between BMI and gender was significant for lifetime and past-year bipolar I disorder. Risk of lifetime bipolar II disorder was elevated for obese women. No other significant associations between BMI category and bipolar II disorder were observed, and there was no significant BMI by gender interaction effect.

### Relationships Between DSM-IV Anxiety Disorders and BMI by Gender

Table 3 shows ORs and 95% CIs resulting from the logistic regression analyses with anxiety disorders as the dependent variables. After controlling for demographic characteristics, significant interaction effects between gender and BMI category were observed for any lifetime and past-year anxiety disorder, for lifetime social phobia, and for lifetime and past-year specific phobia.

Among women, both overweight and obesity were associated with greater likelihood of any lifetime or past-year anxiety disorder, but only obesity was associated with greater odds of any lifetime or past-year anxiety disorder among men. The likelihood of lifetime and past-year social phobia was also elevated for overweight and obese women relative to normal weight women with increasing odds for these anxiety disorders as BMI increased. There was no

significant increase in the odds of social phobia with increasing BMI among men. Odds of lifetime and past-year specific phobia were higher in overweight and obese women, and in obese but not overweight men, relative to those in the normal weight category.

Odds of lifetime generalized anxiety disorder increased with BMI in both men and women. Panic disorder without agoraphobia was associated with overweight in men and obesity in both genders; the interaction between BMI and gender was not significant. Panic disorder with agoraphobia and agoraphobia without panic disorder were not associated with BMI in either gender.

## Discussion

This study found that obesity was associated with many DSM-IV mood and anxiety disorders in both genders and that gender interacted with BMI to increase risk of certain disorders. Women who were either overweight or obese had increased odds of any lifetime mood disorder and of lifetime and past-year bipolar II disorder, whereas overweight men were not at elevated risk for any lifetime or past-year mood disorder. Similar interactions between gender and BMI were noted to affect the risk for anxiety disorders, with overweight women more often evidencing anxiety disorders, especially social and specific phobias, than their normal weight counterparts. For obese persons of either gender, odds of almost all mood and anxiety disorders were elevated.

Being overweight or obese could contribute to depression or anxiety, and could do so differently in men and women. For example, weight-related stigma and discrimination are more severe for women than for men (32,33). Women who are overweight, even moderately so, are more likely to be dissatisfied with their weight and to experience social disadvantages compared to normal weight women (34,35). Forty-four percent of men in the NESARC sample were overweight, and only 33% were in the normal weight category, making overweight the “normal” condition for men. In contrast, 30% of women were overweight, and 57% were of normal weight. Overweight may thus be more deviant for women than men. The specific finding that overweight and obese women, but not men, are at increased risk for social phobia is consistent with these observations. Overweight and obese women may fear social situations more than their male counterparts because they anticipate being negatively evaluated based on weight, more so than men.

Conversely, mood and anxiety disorders could lead to weight gain. Women are more likely than men to eat in response to negative emotions (36), a coping strategy that could contribute to weight gain. Atypical depression, a condition more frequently observed in women (37,38) is associated with increased appetite, increased sleep (which could reduce activity levels) and weight gain (39). An episode of major depression may thus be more likely to contribute to weight gain in women compared to men. Although NESARC did not include a specific diagnostic category of atypical depression, the specific symptoms of increased appetite and increased sleep were assessed. Among respondents with a diagnosis of any lifetime mood disorder, women were more likely than men to endorse increased appetite (34% vs. 23%,  $\chi^2(1)=96.50$ ,  $p<.001$ ) and increased sleep (47% vs. 42%,  $\chi^2(1)=21.03$ ,  $p<.001$ ). Although overweight women were not at significantly increased risk for major depressive disorder than normal weight women, their likelihood of experiencing a lifetime episode of major depression was increased (OR [CI] = 1.12 [1.01–1.24]). Among NESARC respondents meeting DSM-IV criteria for bipolar I disorder, men were more likely to report only manic episodes; 74.15% of women and 56.7% of men had experienced an episode of major depression. It therefore appears that elevated risk for bipolar I disorder in overweight women could be driven largely by their higher rates of depressive episodes..



Another plausible connection between mood and anxiety disorders and weight gain may be use of psychoactive medications, including selective serotonin reuptake inhibitors, lithium, and atypical antipsychotics and anticonvulsants, that are frequently associated with weight gain (40–43). Although NESARC respondents were asked if a doctor had ever prescribed medication for symptoms of each mood and anxiety disorder assessed, specific medications were not recorded, and respondents were not asked to provide a time frame for or duration of medication use. Medication use could have contributed to the observed associations, but this database does not allow for accurate assessment of relationships between medication use and weight gain.

The results of this study replicate findings from smaller studies showing gender differences in relationships between BMI and mood and anxiety disorders. Some limitations of this study should be noted. The design is cross-sectional, precluding determination of the direction of causality between elevated BMI and psychiatric disorders. Further research exploring the casual pathways between the observed relationships is needed.

A second limitation is use of self-reported height and weight to calculate BMI, which may result in underestimates (28,44,45). However, the proportions of respondents in each category were consistent with those observed in an epidemiological sample from the same year using objective measurements (46), so any potential underestimation appears to have been equally distributed across BMI and gender categories. The fact that all NESARC interviews were conducted in person rather than by telephone as has been done in some epidemiological studies (17,19) may have enhanced the accuracy of self-reports.

Finally, other psychiatric conditions that could have impacted the observed relationships were not evaluated. For instance, eating disorders were not assessed by NESARC, and binge eating disorder, which is slightly more prevalent in women (47), could have contributed to both weight gain and mood and anxiety symptoms (48). Psychotic disorders were not formally evaluated in NESARC, but only a small proportion of respondents in the entire sample (<1%) endorsed a history of a psychotic disorder, with similar rates in men and women ( $\chi^2(1)=.32$ ,  $p=.57$ ), so unreported use of antipsychotic medications associated with weight gain is unlikely to have influenced our results significantly.

The greatest strength of this study is its use of a large epidemiologic sample carefully evaluated and diagnosed using DSM-IV criteria for mood and anxiety disorders. The sample was randomly selected, the response rate was high, and groups traditionally underrepresented in studies of physical and mental health risk factors were over-sampled to ensure adequate representation. The size of the sample also allowed for examination of separate overweight and obese BMI categories, facilitating identification of gender-based risk patterns that might not have emerged had broader categories (e.g., obese vs. not obese or overweight vs. normal weight) been used.

In summary, results of this study indicate that overweight and obesity are associated with mood and anxiety disorders, and the association emerges at the level of overweight for women, while associations between psychiatric conditions usually do not emerge until the level of obesity for men. Targeting obese individuals and overweight women for mood and anxiety disorder screening could aid in identifying and treating these conditions. Since pharmacological treatments for mood and anxiety disorders are often associated with weight gain, special treatment considerations may be indicated in this population already subject to increased weight-related health risks.

Among individuals seeking weight loss treatment, many are likely to meet criteria for current or lifetime mood or anxiety disorders, but few have sought psychiatric treatment (49). This study's findings highlight the need to consider the effect of mood and anxiety disorders when

designing weight loss interventions. Overweight and obese individuals may carry psychological burdens that interfere with their ability to adhere to diet and exercise programs, and understanding the relationship between mood and anxiety disorders and elevated BMI may be crucial to improving these health interventions.

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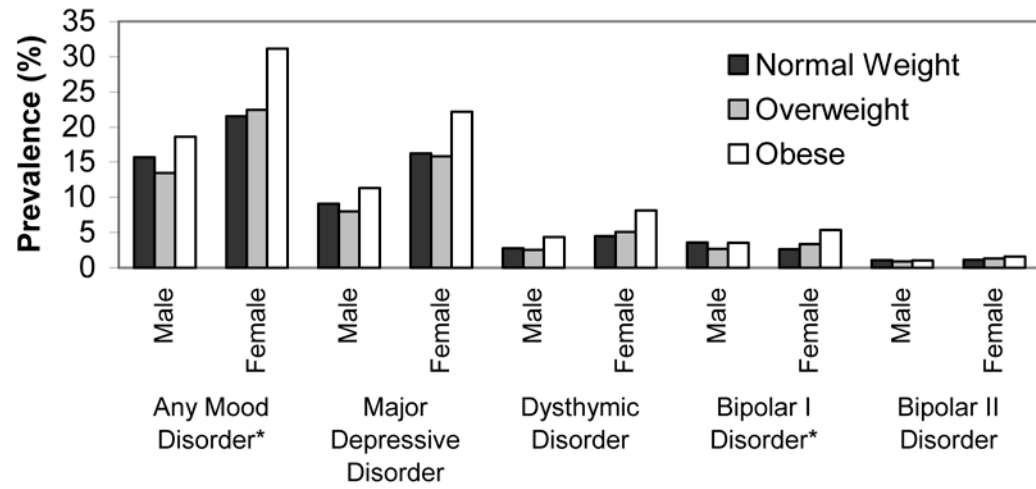


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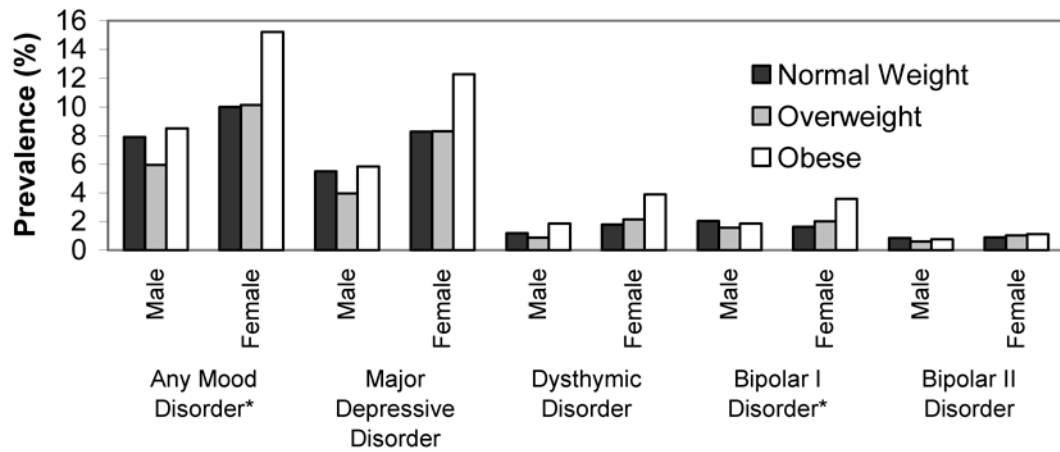
## ABBREVIATIONS

BMI, Body Mass Index; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> Edition; NESARC, National Epidemiologic Survey on Alcohol and Related Conditions; OR, Odds Ratio.

### Lifetime Mood Disorders



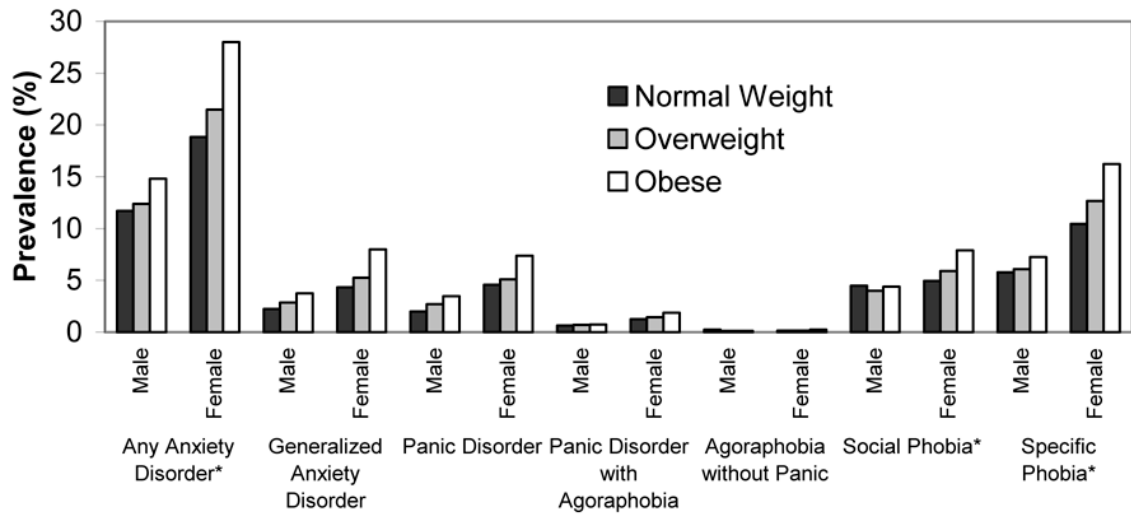
### Past-Year Mood Disorders



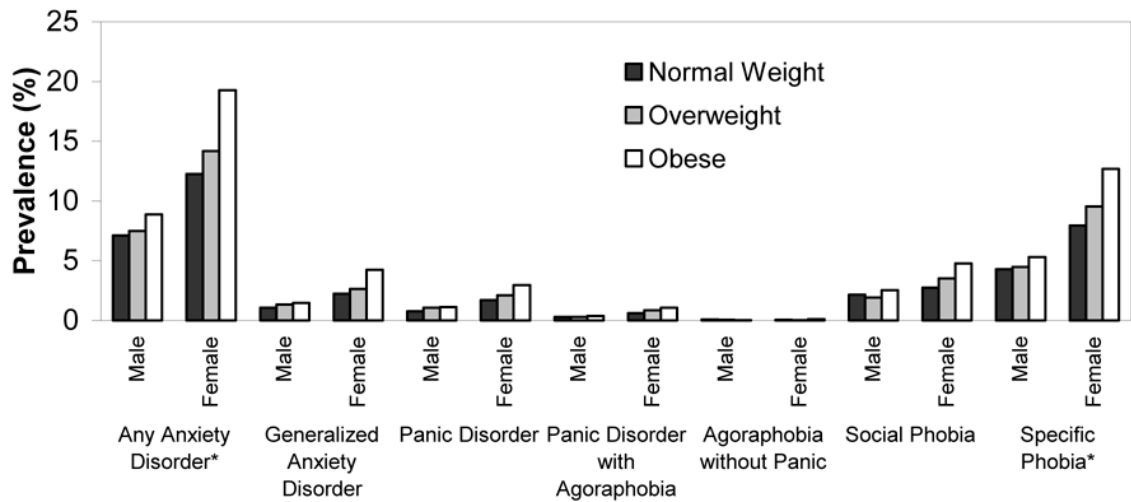
**Figure 1. Prevalence of lifetime and past-year mood disorders by BMI and gender**

\*Indicates a significant effect of the interaction between gender and BMI.

### Lifetime Anxiety Disorders



### Past Year Anxiety Disorders



**Figure 2. Prevalence of lifetime and past-year anxiety disorders by BMI and gender.**  
 \*Indicates a significant effect of the interaction between gender and BMI.

Table 1  
Demographic characteristics by body mass index (BMI) category and sex

	Normal Weight BMI 18.50–24.99		Overweight BMI ≥ 25.00–29.99		Obese BMI ≥ 30.00		Statistic
	Male	Female	Male	Female	Male	Female	
N	5957	10246	7822	6784	4215	5766	
Age <sup>a</sup> *	41.99 (0.30)	44.14 (0.27)	45.68 (0.27)	48.21 (0.33)	45.13 (0.27)	47.57 (0.30)	F(5, 65) = 75.90, P < .001 $\chi^2(20) = 105.10,$ P < .001
Race-ethnicity*							
African American	9.86 (0.76)	7.66 (0.76)	9.15 (0.58)	13.26 (0.90)	12.07 (0.87)	19.52 (1.11)	
American Indian	1.91 (0.26)	1.92 (0.23)	1.94 (0.21)	2.01 (0.26)	2.64 (0.37)	2.77 (0.35)	
Asian	7.36 (1.16)	5.95 (0.74)	3.43 (0.44)	3.09 (0.46)	1.68 (0.34)	1.76 (0.33)	
Hispanic/Latino	11.67 (1.19)	9.63 (1.02)	12.48 (1.37)	13.28 (1.69)	12.20 (1.56)	11.70 (1.36)	
White*	69.20 (2.02)	74.84 (1.63)	73.01 (1.55)	68.37 (1.86)	71.42 (1.73)	64.24 (1.70)	$\chi^2(10) = 97.48,$ P < .001
Education							
Less than high school	16.08 (0.67)	11.97 (0.50)	14.97 (0.68)	17.25 (0.92)	16.64 (0.93)	20.05 (0.85)	
High school graduate	27.40 (0.88)	27.65 (0.73)	28.16 (0.90)	30.25 (0.74)	31.41 (0.93)	33.41 (0.85)	
Some college or higher	56.51 (1.05)	60.38 (0.81)	56.87 (0.94)	52.50 (0.96)	51.95 (1.10)	46.54 (0.95)	
Marital status*							
Married/living with partner	54.48 (0.84)	58.95 (0.74)	69.80 (0.62)	62.00 (0.83)	70.58 (0.97)	56.90 (0.82)	
Widowed	2.80 (0.25)	9.20 (0.32)	2.52 (0.17)	11.31 (0.43)	1.55 (0.18)	11.22 (0.47)	
Divorced/separated	8.88 (0.38)	11.48 (0.37)	9.59 (0.36)	12.16 (0.44)	9.87 (0.48)	14.74 (0.51)	
Single (never married)	33.84 (0.90)	20.36 (0.68)	18.09 (0.57)	14.53 (0.63)	18.01 (0.86)	17.13 (0.59)	
Income							
\$10,000 per year or less	9.53 (0.46)	11.41 (0.45)	5.85 (0.35)	11.13 (0.49)	5.79 (0.44)	12.82 (0.57)	
\$10,001–\$25,000	20.40 (0.74)	20.13 (0.55)	17.21 (0.59)	24.65 (0.65)	17.24 (0.75)	25.71 (0.70)	
\$25,000–\$50,000	31.90 (0.84)	28.39 (0.63)	31.75 (0.73)	30.29 (0.61)	33.27 (1.01)	32.66 (0.83)	
Over \$50,000*	38.18 (1.08)	40.06 (1.02)	45.18 (0.99)	33.93 (0.98)	43.69 (1.25)	28.81 (0.91)	$\chi^2(15) = 29.66,$ P < .050
Region of country*							
Northeast	18.79 (3.71)	20.20 (3.61)	21.03 (3.47)	20.34 (3.58)	17.90 (2.84)	18.11 (3.06)	
Midwest	22.10 (3.30)	22.58 (3.39)	22.95 (3.13)	22.47 (3.24)	25.67 (3.13)	24.65 (3.24)	
South	34.22 (3.47)	33.92 (3.43)	34.53 (3.26)	35.96 (3.38)	36.73 (3.10)	37.37 (3.15)	
West	24.89 (4.18)	23.30 (3.76)	31.49 (3.42)	21.24 (3.62)	19.70 (3.10)	19.86 (3.18)	
Urban vs. Rural*							
Urban	82.54 (1.65)	81.74 (1.62)	80.00 (1.67)	80.04 (1.75)	76.66 (1.82)	78.20 (1.77)	
Rural	17.46 (1.65)	18.26 (1.62)	20.00 (1.67)	19.96 (1.75)	23.34 (1.82)	21.80 (1.77)	$\chi^2(5) = 35.20,$ P < .001

Values represent percentages (unless otherwise noted) and numbers in parentheses are standard errors.

<sup>a</sup>Values represent means.

\* Indicates significant group differences.

**Table 2**  
Odds ratios (ORs) of DSM-IV mood disorders by body mass index (BMI) category for males and females

	Male		Male Only		Female		Female Only		Interaction	
	Overweight BMI=25.00– 29.99	Obese BMI ≥ 30.00	F (df=2)	Obese BMI ≥ 30.00	Overweight BMI=25.00–29.99	Obese BMI ≥ 30.00	F (df=2)	Obese BMI ≥ 30.00	F (df=2)	F (df=2)
Any mood disorder										
Lifetime, OR	0.94	1.39	18.15, <i>p</i> < .001	1.16	1.16	1.79	77.23, <i>p</i> < .001	1.79	6.47, <i>p</i> < .005	
(95% C.I.)	(0.83–1.07)	(1.21–1.60)*		(1.05–1.28)*	(1.63–1.97)*					
Past Year, OR	0.90	1.33	9.56, <i>p</i> < .001	1.13	1.13	1.75	36.17, <i>p</i> < .001	1.75	3.62, <i>p</i> < .050	
(95% C.I.)	(0.76–1.07)	(1.10–1.59)*	(0.98–1.31)	(1.52–2.01)*						
Major depressive disorder										
Lifetime, OR	0.91	1.35	11.86, <i>p</i> < .001	1.04	1.04	1.58	43.93, <i>p</i> < .001	1.58	1.83, <i>p</i> = .168	
(95% C.I.)	(0.78–1.07)	(1.14–1.59)*		(0.93–1.17)	(1.43–1.75)*					
Past Year, OR	0.85	1.31	7.34, <i>p</i> = .001	1.02	1.02	1.49	13.07, <i>p</i> < .001	1.49	0.85, <i>p</i> = .430	
(95% C.I.)	(0.68–1.06)	(1.03–1.67)*		(0.85–1.22)	(1.25–1.76)*					
Dysthymic disorder										
Lifetime, OR	1.02	1.77	11.51, <i>p</i> < .001	1.17	1.17	1.88	31.76, <i>p</i> < .001	1.88	0.70, <i>p</i> = .500	
(95% C.I.)	(0.79–1.31)	(1.35–2.34)*		(0.98–1.40)	(1.60–2.20)*					
Past Year, OR	0.87	1.85	7.05, <i>p</i> < .005	1.22	1.22	2.10	18.32, <i>p</i> < .001	2.10	1.31, <i>p</i> = .276	
(95% C.I.)	(0.59–1.29)	(1.24–2.76)*		(0.90–1.65)	(1.62–2.73)*					
Bipolar I disorder										
Lifetime, OR	0.91	1.20	2.21, <i>p</i> = .118	1.44	1.44	2.24	28.24, <i>p</i> < .001	2.24	8.75, <i>p</i> < .001	
(95% C.I.)	(0.71–1.17)	(0.93–1.55)		(1.11–1.86)*	(1.80–2.78)*					
Past Year, OR	0.97	1.15	0.55, <i>p</i> = .578	1.41	1.41	2.41	16.47, <i>p</i> < .001	2.41	6.16, <i>p</i> < .005	
(95% C.I.)	(0.70–1.30)	(0.80–1.64)		(1.04–1.82)*	(1.84–3.17)*					
Bipolar II disorder										
Lifetime, OR	1.10	1.46	2.74, <i>p</i> = .072	1.44	1.44	1.70	4.98, <i>p</i> < .010	1.70	0.65, <i>p</i> = .527	
(95% C.I.)	(0.71–1.70)	(1.06–2.01)		(1.00–2.08)*	(1.20–2.39)*					
Past Year, OR	1.03	1.34	0.61, <i>p</i> = .548	1.48	1.48	1.56	2.71, <i>p</i> = .074	1.56	0.75, <i>p</i> = .477	
(95% C.I.)	(0.61–1.74)	(0.76–2.35)		(0.97–2.26)	(1.03–2.37)					

Wald F values report effect of BMI on likelihood of mood disorder within sex and the interaction of BMI and sex on likelihood of mood disorder. Odds ratios (ORs) obtained using normal weight as reference group. Normal weight and male gender are comparators for interactions. Analyses control for age, level of education, race/ethnicity, income, marital status, region of country, and urban vs. rural residence.

\* Indicates that Wald F is significant, and OR is significantly different from 1.00 within that gender.



**Table 3**  
Odds ratios (ORs) of DSM-IV anxiety disorders by body mass index (BMI) category for males and females

	Male		Male Only		Female		Female Only		Interaction	
	Overweight BMI=25.00– 29.99	Obese BMI ≥ 30.00	F (df=2)	Obese BMI ≥ 30.00	Overweight BMI=25.00– 29.99	Obese BMI ≥ 30.00	F (df=2)	Obese BMI ≥ 30.00	F (df=2)	F (df=2)
Any anxiety disorder										
Lifetime, OR	1.10	1.35	10.57, <i>p</i> <.001	1.76	1.24	1.76	56.41, <i>p</i> <.001	1.76	6.23, <i>p</i> <.005	
(95% C.I.)	(0.96–1.25)	(1.18–1.53)*		(1.12–1.38)*	(1.12–1.38)*	(1.58–1.96)*		(1.58–1.96)*		
Past Year, OR	1.14	1.36	7.06, <i>p</i> <.005	1.79	1.26	1.79	42.17, <i>p</i> <.001	1.79	4.02, <i>p</i> <.050	
(95% C.I.)	(0.99–1.33)	(1.16–1.61)*		(1.11–1.43)*	(1.11–1.43)*	(1.58–2.03)*		(1.58–2.03)*		
Generalized anxiety disorder										
Lifetime, OR	1.35	1.77	6.88, <i>p</i> <.005	2.00	1.29	2.00	30.04, <i>p</i> <.001	2.00	0.51, <i>p</i> =.604	
(95% C.I.)	(1.02–1.80)*	(1.30–2.40)*		(1.08–1.54)*	(1.08–1.54)*	(1.67–2.39)*		(1.67–2.39)*		
Past Year, OR	1.44	1.53	2.31, <i>p</i> =.107	1.53	1.27	1.53	13.40, <i>p</i> <.001	1.53	1.20, <i>p</i> =.309	
(95% C.I.)	(0.96–2.16)	(1.00–2.34)		(0.97–1.67)	(0.97–1.67)	(1.53–2.65)*		(1.53–2.65)*		
Panic disorder without agoraphobia										
Lifetime, OR	1.37	1.81	6.69, <i>p</i> <.005	1.81	1.17	1.72	17.66, <i>p</i> <.001	1.72	0.76, <i>p</i> =.474	
(95% C.I.)	(1.06–1.78)*	(1.30–2.50)*		(1.42–2.07)*	(0.95–1.44)	(1.42–2.07)*		(1.42–2.07)*		
Past Year, OR	1.54	1.64	2.42, <i>p</i> =.097	1.64	1.35	1.84	7.65, <i>p</i> =.001	1.84	0.60, <i>p</i> =.552	
(95% C.I.)	(1.01–2.34)	(0.96–2.79)		(0.96–2.79)	(1.00–1.81)	(1.35–2.52)*		(1.35–2.52)*		
Panic disorder with agoraphobia										
Lifetime, OR	1.28	1.30	0.49, <i>p</i> =.614	1.30	1.18	1.52	2.89, <i>p</i> =.063	1.52	0.36, <i>p</i> =.700	
(95% C.I.)	(0.75–2.19)	(0.70–2.42)		(0.86–1.63)	(0.86–1.63)	(1.07–2.16)		(1.07–2.16)		
Past Year, OR	1.21	1.69	0.81, <i>p</i> =.450	1.69	1.51	1.84	3.26, <i>p</i> <.050	1.84	0.27, <i>p</i> =.761	
(95% C.I.)	(0.61–2.42)	(0.74–3.84)		(0.95–2.39)	(0.95–2.39)	(1.12–3.01)*		(1.12–3.01)*		
Agoraphobia without panic disorder										
Lifetime, OR	0.48	0.55	0.85, <i>p</i> =.431	0.55	1.03	1.51	0.54, <i>p</i> =.585	1.51	0.90, <i>p</i> =.412	
(95% C.I.)	(0.15–1.55)	(0.14–2.20)		(0.38–2.79)	(0.38–2.79)	(0.65–3.53)		(0.65–3.53)		
Past Year, OR	0.57	0.47	0.28, <i>p</i> =.753	0.47	0.58	1.47	1.08, <i>p</i> <.345	1.47	0.50, <i>p</i> =.612	
(95% C.I.)	(0.09–3.65)	(0.05–4.69)		(0.10–3.33)	(0.10–3.33)	(0.36–5.96)		(0.36–5.96)		
Social phobia										
Lifetime, OR	0.93	1.02	0.33, <i>p</i> =.723	1.02	1.27	1.70	16.12, <i>p</i> <.001	1.70	6.64, <i>p</i> <.005	
(95% C.I.)	(0.73–1.19)	(0.80–1.30)		(1.07–1.52)*	(1.07–1.52)*	(1.41–2.06)*		(1.41–2.06)*		
Past Year, OR	0.98	1.28	1.83, <i>p</i> =.169	1.28	1.37	1.81	12.11, <i>p</i> <.001	1.81	2.37, <i>p</i> =.101	
(95% C.I.)	(0.72–1.33)	(0.92–1.78)		(1.05–1.77)*	(1.05–1.77)*	(1.42–2.30)*		(1.42–2.30)*		
Specific phobia										
Lifetime, OR	1.12	1.33	5.71, <i>p</i> <.010	1.33	1.30	1.74	38.33, <i>p</i> <.001	1.74	4.43, <i>p</i> <.050	
(95% C.I.)	(0.94–1.32)	(1.12–1.59)*		(1.16–1.47)*	(1.16–1.47)*	(1.53–1.97)*		(1.53–1.97)*		
Past Year, OR	1.12	1.32	3.39, <i>p</i> <.050	1.32	1.29	1.76	30.96, <i>p</i> <.001	1.76	3.21, <i>p</i> <.050	
(95% C.I.)	(0.92–1.35)	(1.07–1.64)*		(1.12–1.49)*	(1.12–1.49)*	(1.53–2.03)*		(1.53–2.03)*		

Wald F values report effect of BMI on likelihood of mood disorder within sex and the interaction of BMI and sex on likelihood of mood disorder. Odds ratios (ORs) obtained using normal weight as reference group. Normal weight and male gender are comparators for interactions. Analyses control for age, level of education, race/ethnicity, income, marital status, region of country, and urban vs. rural residence.

\* Indicates that Wald F is significant, and OR is significantly different from 1.00 within that gender.