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# The Relationship between Obesity and Psychiatric Disorders across Ethnic and Racial Minority Groups in the United States

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## Abstract

**Context—**Epidemiologic studies of obesity have not examined the prevalence and relationship of mental-health conditions with obesity for diverse ethnic and racial populations in the United States.

**Objective—**(1) To assess whether obesity was associated with diverse psychiatric diagnoses across a representative sample of non-Latino whites, Latinos, Asians, African-Americans, and Afro-Caribbeans; and (2) to test whether physical health status, smoking, sociodemographic characteristics, and psychiatric comorbidities mediate any of the observed associations.

**Design—**Our analyses used pooled data from the NIMH Collaborative Psychiatric Epidemiology Surveys (CPES). Analyses tested the association between obesity and psychiatric disorders in a diverse sample of Americans (N=13,837), while adjusting for factors such as other disorders, age, gender, socioeconomic status, smoking and physical health status (as measured by chronic conditions and WHO-DAS scores) in different models.

**Results—**The relationship between obesity and last-year psychiatric disorders varied by ethnicity/race. The likelihood of having mood or anxiety disorder was positively associated with obesity for certain racial/ethnic groups, but was moderated by differences in physical health status. Substance-use disorders were associated with decreased odds for obesity in African-Americans.



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**Contributors.** All authors contributed to the research and/or manuscript preparation. All authors have approved the final manuscript. Rosen-Reynoso conducted the literature review and analyzed the data. Chen ran the statistical analysis and co-analyzed the data. Alegria and Roberts assisted in the analysis of data and interpretation of findings and discussion section. Laderman contributed to the overall writing and editing of this manuscript. Alegria is also the Principal Investigator on the NLAAS study.

**Conflict of Interest.** The authors declare no conflict of interest.

**Conclusions—**The role of physical health status (as measured by chronic conditions and WHO-DAS scores) dramatically changes the pattern of associations between obesity and psychiatric disorders, suggesting the important role it plays in explaining differential patterns of association across racial and ethnic groups.

### Keywords

obesity; depression; anxiety; ethnic/racial minority groups

## 1. Introduction

Obesity is an increasingly prevalent public-health problem with significant costs in the form of disease and premature death (Patterson et al, 2004), increased health-care costs (Wee et al, 2005), and social stigmatization (Latner et al, 2005). In addition, obesity causes or exacerbates many health conditions, both independently and in association with other diseases (Patterson et al, 2004). Recent data from the National Health and Nutrition Examination Survey (2003–2004) indicate that approximately 32.2% of adult Americans are obese.(Ogden et al, 2006) Physical complications from obesity have been studied extensively, especially coronary heart disease, certain forms of cancer, and type 2 diabetes (Kopelman, 2000). However, there is much less known about the relationship between obesity and psychiatric disorders, and further, the role that ethnicity might play in impacting this relationship.

Weight is subject to a range of influences. Women are generally found to have higher rates of obesity than men, and many researchers attribute this to biological reasons (James et al, 2004; Halsam & James, 2005). Middle-aged and older adults also have higher rates of obesity (Flegal et al, 2002; Hedley et al, 2004). Further, Latinos and African-Americans residing in the United States have higher rates of obesity than other racial or ethnic groups (Flegal et al, 2002; Hedley et al, 2004). Lower socioeconomic status is associated with obesity for a variety of reasons, including residing in neighborhoods which offer reduced opportunities for exercise and access to fresh healthy foods (Frank et al, 2004: Vandergrift & Yoked, 2004; Ford & Dzewaltowski, 2008).

### 1.2 Obesity and Psychiatric Disorders

Past studies comparing psychological functioning in obese and non-obese people have generated conflicting results, with some studies showing a positive relationship between obesity and psychiatric disorders (Crisp & McGuiness, 1976; Friedman & Brownell, 1995; Carpenter et al, 2000; Roberts et al, 2000; Roberts et al, 2002; ) and other studies finding no association at all (11). A cross-sectional and prospective study of community residents 50 years and older yielded mixed results, with an overall conclusion suggesting an association between obesity and depression (Roberts et al, 2002). Some studies based on community surveys in the United States have found associations between obesity and depressive symptoms (Heo et al, 2006) and measures of psychological distress (Roberts et al, 2002). Some findings indicate sex differences in the relationship between obesity and depression, with positive associations among women and either negative or no association among men (Carpenter et al, 2000; Scott et al, 2008).

With regards to the association between obesity and anxiety, one study found low levels of anxiety in obese middle-aged men and women (Crisp & McGuiness, 1976).. Another study concluded that obesity was related to more symptoms of anxiety in both non-Latino white and African-American women (Reed, 1985). In a recent prospective study of obese women and psychopathology, obesity at baseline was associated with a significant increase in odds for subsequent generalized anxiety disorder (Kasen et al, 2008). Another recent study

reported that obesity was associated with approximately a 25% increase in the odds of lifetime mood and anxiety disorders, and a 25% decrease in the odds of substance-use disorders, with significant variations across certain racial/ethnic groups (Simon et al, 2006).

Scott and colleagues (2008) noted two important findings in their investigation of obesity–mental-disorder relationships among 13 countries: 1) there was an association between obesity (particularly severe obesity) and depressive disorders and anxiety disorders, but not alcohol-use disorders; and 2) the relationship between obesity and psychological disorders was confined to women. Simon and colleagues (2006) recently found that obese non-Latino whites were at increased risk for mood disorders compared to their African-American or Latino counterparts. In addition, obese Latinos were at an increased risk of anxiety disorders as compared to non-Latino white or African-American participants.

Overall, there is limited epidemiologic data that addresses the relationship between obesity and psychiatric disorders, especially anxiety and substance-use disorders, across a sample that represents the diverse racial and ethnic groups within the United States.

### 1.3 The Present Study

The present study is a secondary data analysis of the data from the Collaborative Psychiatric Epidemiology Surveys (CPES). The aim of this study is to examine if there is an association between obesity and psychiatric disorders in a representative United States sample, and to test whether those associations extend to specific mental disorders. The research reported here is one of the few studies to specifically look at the relationship between obesity and psychiatric disorders among ethnic or racial minority groups in the United States.

Unlike previous studies in this area, the CPES offers a level of specification that allows us to assess a number of specific disorders [e.g., generalized anxiety disorder (GAD), social phobia, agoraphobia without panic, panic disorder, and post-traumatic stress disorder( PTSD)] and their relationship with obesity, rather than being limited to aggregate disorder categories (such as “anxiety disorders”) or symptoms. The CPES data allow us to examine a potential relationship between psychiatric disorders and obesity, and to adjust for other indicators that may be important moderators, such as smoking and chronic conditions (Jia & Lubetkin, 2009; Lubetkin et al, 2005; Muennig et al, 2006).

In addition, the sample consists not only of English speakers but also of speakers of other languages, which is more representative of the diverse ethnic and racial groups living in the United States. Studies such as this one may further the scientific base and lead to the design of interventions better tailored for ethnic and racial minorities, thereby reducing some of the health disparities for these groups.

It was hypothesized that the relationship between obesity and psychiatric disorders such as depression and anxiety will be a strong positive association across all ethnic/racial groups represented in this study. This relationship may be stronger for females than for males in the sample. Further, it is hypothesized that obesity and substance use disorders will have an inverse relationship across all the ethnic/racial groups represented in this study, even after adjusting for gender, age, household income, smoking and physical status as measured by chronic conditions, and WHO-DAS II scores. Selection of covariates was based on the published literature described above. Covariates examined were age, gender, smoking, chronic conditions, and daily functioning.

# 2. Methods

## 2.1 Participants

The sample for the CPES dataset includes 4,180 whites; 2,554 Latinos; 2,095 Asians; 3,570 African-Americans; and 1,438 immigrants of Afro-Caribbean heritage (Total Sample = 13,837), all adults 18 or older. The sampling frames and sample selection procedures are described in detail elsewhere (Heeringa et al, 2004).

## 2.2 Dataset

The CPES is unique in its ability to provide a large representative sample of diverse ethnic and racial minority groups (Colpe et al, 2004) uniform assessment of psychiatric diagnosis based on standardized measures, such as the Composite International Diagnostic Interview (Kessler & Ustun, 2004); and inclusion of other relevant sociocultural factors. We used the combined data set of the three large epidemiologic studies included in the CPES: the National Latino and Asian American Study (NLAAS) (Alegria et al, 2004), the National Comorbidity Survey Replication (NCS-R) (Kessler & Merikangas, 2004), and the National Survey of American Life (NSAL) (Jackson et al, 2004).

These studies collected epidemiologic information on mental health and substance disorders and service usage among the general population, with a special emphasis on ethnic minority groups in the NLAAS (Latino and Asian subgroups; Alegria et al, 2004) and NSAL (African-Americans and immigrant blacks of Afro-Caribbean heritage; Jackson et al, 2004). Non-Latino white comparisons are from the NCS-R (Kessler & Merikangas, 2004).

The University of Michigan Survey Research Center (SRC) collected data for the NLAAS, NCS-R, and NSAL studies using an adaptation of a multiple-frame approach to estimation and inference for population characteristics. This approach facilitated integration of design-based analysis weights to combine datasets as though they were a single nationally-representative study (Heeringa et al, 2004). Design and methodological information can be found at the CPES website (Heeringa, 2007). The sampling frames and sample selection procedures are described in detail elsewhere (Heeringa, 2007).

**Procedures for Data Collection in Diverse Languages—**Interviews for the studies were conducted by professional interviewers from the SRC. In the NSAL, interviewers were matched with respondents for race and ethnicity; for the NLAAS, interviewers were selected to accommodate the language preferences and match the cultural backgrounds of the sampled respondents. The majority of interviews were completed in person using a computer-assisted instrument. Interviewers attended extensive trainings and completed a training certification. As a measure of quality control, a 10% random sample of each interviewer's completed respondents was re-interviewed by telephone for validation. Informed consent was obtained after all interview procedures were explained to participants. All study methods and protocols were approved by the Institutional Review Boards of the principal investigators' institutions.

## 2.3 Measures

**2.3.1 Demographic Characteristics—**Demographic variables included age, gender, living below poverty level, and household income. Age was coded using four categories: 18–34; 35–49; 50–64; and 65+. Gender was coded using dummy variables (0 = male; 1 = female). Household income was grouped into four categories based on reported household income from the previous year ($0–14,999; $15–34,999; $35–74,999; and $75,000 or more).

**2.3.2 Body Mass Index (BMI)—**BMI was calculated as kg/$m^2$ from self-reported measures of height and weight. For the analysis, individuals with BMI≥30 were categorized as obese and those with BMI<30 as non-obese. We defined respondents as obese if their Body Mass Index (BMI), which was computed as self-reported weight (kg) divided by self-reported height squared ($m^2$), was greater than or equal to 30 kg/$m^2$. In keeping with the most recent published studies on obesity, an individual with a BMI ≥30 was categorized as obese in this study (Simon et al, 2006; Scott et al, 2008). This is also the same criterion used by the World Health Organization (1998) and the National Heart, Lung and Blood Institute (2010).

BMI was turned into a categorical variable for two reasons. Some of the research in this area utilizes BMI as a categorical variable, and this would allow readers to compare the present study to other studies (see Roberts et al, 2002; Simon et al, 2006). When the distribution for the various classes of obesity (I, II, III) were run across the various racial/ethnic groups, it was skewed, with the majority of the sample falling between a BMI of 30 and 35.

**2.3.3 World Mental Health WMH-CIDI (Kessler & Ustun, 2004)—**The diagnostic interview of the World Mental Health Survey Initiative version of the WMH-CIDI, a fully structured diagnostic instrument based on criteria of the DSM-IV, was used to evaluate prevalence rates of psychiatric disorders. Past-year prevalence rates of DSM-IV disorders for four composite diagnostic categories covering 11 disorders: depressive disorders (dysthymia, major depressive disorder); anxiety disorders (agoraphobia, social phobia, GAD, PTSD, panic disorder); substance-use disorders (drug abuse, drug dependence, alcohol abuse, alcohol dependence); and “overall” psychiatric disorders (any depressive, anxiety, or substance-use disorders).

We also created three composite variables: any depressive disorder, any anxiety disorder, and any substance-use disorder, which were the aggregates of the individual disorders within each category (e.g., any anxiety disorder consisted of GAD, panic disorder, agoraphobia without panic, social phobia, and PTSD). Trained interviewers from the SRC administered the WMH-CIDI (25). The past-year prevalence rates for psychiatric disorders is used because it has been reported that lifetime prevalence based on recall is markedly underestimated (Mannuzza et al., 2002; Wells & Horwood, 2004).

**2.3.4 Smoking—**Participants were asked whether they were a current smoker, an ex-smoker, or if they had never smoked. We categorized the possible responses into current smoker or ex-smoker/non-smoker.

### Physical Health Status Measures

**2.3.5 World Health Organization Psychiatric Disability Assessment Schedule (WHO-DAS II)—**Functional impairment was measured by the World Health Organization Psychiatric Disability Assessment Schedule (WHO-DAS) (Rehm et al, 1999). For the domains of cognition, mobility, self-care, and social functioning, respondents were asked a question ascertaining the number of days in the past 30 when physical-health or mental-health problems restricted their ability to carry out tasks related to each domain. For example, in the cognition domain, one of the items is “Learning a new task”; the participant can self-rate on a scale from 1 to 5, with 1 being mild difficulty and 5 extreme/constant difficulty.

**2.3.6 Chronic Health Conditions—**We measured the number of chronic medical conditions based on respondents’ lifetime endorsement of any of the following: arthritis or rheumatism; an ulcer in the stomach or intestine; cancer; high blood pressure; diabetes or

high blood sugar; heart attack; stroke; asthma; tuberculosis; any other chronic lung disease; and HIV infection or AIDS. The numbers of conditions were summed and then categorized as none, 1, and 2 or more.. Lifetime indicators of chronic health conditions were utilized because once you have a chronic disease it is typically a health condition that spans through the lifetime of an individual. Chronic conditions, and WHO-DAS are jointly referred to as *physical status* in this paper.

### 2.4 Analyses

We used a chi-square test to compare differences in obesity status among ethnic/racial groups. Logistic regression models were used to assess the association between 12-month psychiatric disorders and obesity. To examine the relationship of obesity on psychiatric disorders, we fitted two sets of models. In the first, we computed odds ratios (ORs) of obesity for 12-month psychiatric disorders while controlling only for age and gender. In the second, we controlled for additional variables such as smoking, chronic health conditions, and WHO-DAS disability assessment measures across the ethnic/racial groups. We adjusted for smoking and physical status (which is measured by both chronic conditions and WHO-DAS) because of growing evidence that these factors may play a role in nutrient intake and weight status (Subar et al, 1990; Gruber & Frakes, 2006; Sneve & Jorde, 2008).

Weighted proportions in Table 1 were used for describing obese and non-obese racial/ethnic subgroups by sociodemographic and clinical characteristics. For the regressions, we report odds ratios and p-value for F-adjusted mean residual test to assess goodness-of-fit. Given the exploratory nature of these analyses, we do not do Bonferroni corrections (Bonferroni, 1936). All inferential procedures accounted for the complex survey design were conducted using Stata statistical software version 10.1.

## 3. Results

### 3.1 Demographic Differences by Obesity and Racial/Ethnic Groups

Table 1 compares the ethnic and racial groups by BMI<30 (non-obese) and BMI ≥30 (obese) to establish whether there are any significant differences in these two groups by sociodemographic and clinical characteristics. In terms of gender differences, the percentage of females who were obese was significantly higher than that of males only for African-Americans ($p \leq 0.01$) and Afro-Caribbeans ($p \leq 0.05$). Across non-Latino whites, Latinos, and African-Americans, the obese respondents were in the middle (35– 49 years of age) age categories ($p \leq 0.001$ for both groups). For Asians, the obese were more likely to be living over the poverty level ($p \leq 0.05$). For Latinos and African-Americans, obese participants were more likely to have household incomes in the middle range of $35,000–74,999 ($p \leq 0.05$; $p \leq 0.01$ respectively) than non-obese participants.

There was variability in the prevalence of obesity across ethnic/racial groups for participants with a past 12-month psychiatric disorder, with rates ranging from the lowest at 8.9% for Asians, to 25.0% for Afro-Caribbeans and 18.1% for African-Americans. Among African-Americans with BMI≥30 (obese), there was a statistically significant association with being a non-smoker ($p \leq 0.005$) which was not the case for non-Latino whites, Latinos, Asians, or Afro-Caribbeans. As compared to the non-obese, individuals who were obese had a higher number of chronic conditions (two or more). This difference in number of chronic conditions was statistically significant across all groups except for Afro-Caribbeans.

In addition, we tested for significant differences between participants with BMI<30 (non-obese) and BMI≥30 (obese) on the WHO-DAS measures (Rehm et al, 1999). In this study, obese non-Latino whites were significantly more impaired than their non-obese counterparts in two of the six World Health Organization Psychiatric Disability Assessment Schedule

(WHO-DAS II) domains, specifically mobility and role functioning. Obese Latinos were impaired across four out of the six domains, including cognition, mobility, self-care, and role functioning. Obese African-Americans were significantly more impaired than their non-obese counterparts in the three areas of cognition, mobility, and role functioning. No statistically significant differences were found between obese and non-obese individuals across any of the six domains measured by the WHO-DAS II for the Asian and Afro-Caribbean groups.

### 3.2 Obesity and Depressive Disorders

In the initial chi-square analysis, obese non-Latino whites were more likely to have had any depressive disorder in the past 12 months ($p \leq 0.05$); and once adjustments for age and gender were made (see Table 2) obesity for this group increased the likelihood of complying with the criteria for major depressive episode (OR=1.30), dysthymia (OR=1.42) and any depressive disorder (OR=1.26) in past 12 months. This association was not observed across any of the other racial/ethnic groups. Subsequently, parallel racial/ethnic group analyses examined the association between obesity and 12-month psychiatric disorders while adjusting for sociodemographic characteristics such as age and gender, and physical status variables (smoking, chronic conditions and WHO-DAS), as presented in Table 3. The association between depression and obesity for non-Latino whites no longer remained significant.

### 3.3 Obesity and Anxiety Disorders

The chi-square analysis presented in Table 1 indicates that obese African-Americans were more likely to have any anxiety disorder in the past 12 months ($p \leq 0.05$). The logistic regression analysis, age- and gender-adjusted (as presented in Table 2), shows that the relationship between specific anxiety disorders and obesity is evidenced for non-Latino whites, Latinos, Asians, and African-Americans. More specifically, for non-Latino whites, those with obesity had an increased likelihood of also having panic disorder (OR=1.57), GAD (OR=1.31), or PTSD (OR=1.59) as compared to non-obese, non-Latino whites. Latinos with obesity were more likely to have agoraphobia without panic disorder (OR=2.39) than non-obese Latinos. Obese Asians were approximately three times more likely to have PTSD (OR=3.54) than those without obesity. African-Americans with obesity also had an increased chance (OR=1.45) of having any anxiety disorder in the past 12 months.

When the association between obesity and 12-month psychiatric disorders was examined, while adjusting for sociodemographic characteristics such as age and gender, and physical status variables (smoking, chronic conditions and WHO-DAS), as illustrated in Table 3, only the associations between certain anxiety disorders continued for specific groups. For example, there was an increased likelihood of social phobia (OR=5.34) for Afro-Caribbeans with obesity, and an increased likelihood of any anxiety disorder in the past 12 months (OR=2.80), as compared to Afro-Caribbeans without obesity.

### 3.4 Obesity and Substance-Use Disorders

Unlike depressive and anxiety disorders, being obese indicated a lower risk of alcohol dependence/abuse and any substance abuse only in the African-American group (OR=0.42 for alcohol dependence/abuse and 0.44 for any substance-use disorders), as seen in Table 2. When adjustments for sociodemographic characteristics such as age and gender, and physical status variables (smoking, chronic conditions and WHO-DAS) were made, as presented in Table 3, non-Latino whites with obesity had decreased odds for alcohol dependence/abuse in the past 12 months (OR=0.58). As compared to the non-obese, being obese continued to indicate lower risk for drug dependence/abuse and any substance

disorder in the past 12 months in Asians (OR=0.24). African-Americans with obesity had a decreased likelihood for substance disorder in the past 12 months (OR=0.43) in contrast to non-obese African-Americans. Being obese continued to indicate lower risk for drug dependence/abuse and any substance disorder in the past 12 months in Asians (OR=0.24). African-Americans with obesity had a decreased likelihood for substance disorder in the past 12 months (OR=0.43) in contrast to non-obese African-Americans.

Having obesity indicated an increased likelihood of any psychiatric disorder in the past 12 months for Afro-Caribbeans (OR=2.54). Clearly, for some groups, smoking status, chronic conditions, and functional impairment as measured by WHO-DAS seem to play an important role in the association between obesity and psychiatric disorders.

## 4. Discussion

In this study, significant positive associations between obesity and depression and anxiety disorders were observed. In contrast, substance-use disorders were associated with a significantly lower risk of obesity. These associations were not explained by confounding due to gender or age; however, smoking and physical status made independent contributions to obesity risk.

Our results are consistent with those reported by numerous studies (Noppa & Hallstrom, 1981; Roberts et al, 2002; Kasen et al, 2008; Scott et al, 2008). We also found a relationship between specific anxiety disorders and obesity for non-Latino whites, Latinos, Asians, and African-Americans. Although there is less literature on this relationship, some recent studies have also found evidence of associations between GAD and obesity (Kasen et al, 2008; Scott et al, 2008; Zhao et al, 2009). However, the samples of the previous studies were different from those included in the present study (e.g., the Zhao study examined black, white, Latino, and other; the Scott study sample consisted of respondents from 13 different countries; and the Kasen study sample was predominantly white females).

Our analysis also indicated that a decreased likelihood of substance disorders was related to obesity. Specifically, we found this relationship only among African-Americans when we adjusted for age and gender only, and for non-Latino whites, Asians, and African-Americans when we adjusted for age, gender, smoking, chronic conditions, and functional impairment.

The finding of the relation between obesity and a decreased likelihood of substance abuse is also supported by the results of Simon et al. (2006), who found this relationship among black, Hispanic, white, and other race/ethnicity groups. Recent research indicates that addictive drugs, like addictive foods, can activate circuitry in the brain that is involved in reward, motivation, and decision-making (Volkow & Wise, 2005). Specifically, clinical studies have indicated that the dopamine system is involved in both compulsive food intake and drug addictions (Wang et al, 2001; Volkow & Wise, 2005). However, researchers are careful to warn that addiction and obesity are multifactorial disorders that have not only genetic components but also environmental and developmental ones (Volkow & Wise, 2005).

Alcohol abuse is also associated with malnutrition and tissue injury. The aetiology of malnutrition due to alcohol abuse is beyond the scope of this paper; however, it is important to note that many studies have reported that alcoholics have grossly deficient diets, and that alcohol causes specific metabolic changes that may account for lower chances of obesity (Morgan & Levine, 1988). The negative association between substance-use disorders and obesity may be attributable to the effect substances have on caloric intake and appetite, or to another factor that is not captured by the current analysis.

Moreover, the same patterns have been observed in individuals with lifetime histories of substance-use disorder (lifetime disorder not active in the last 12 months), as well as those with active past-year substance-use disorders (Simon et al, 2006). Recently, one study concluded that obesity is associated with a lower risk of substance use-disorder across African-American, Latino, and non-Latino white groups (Simon et al, 2006). Further investigation into this specific area, particularly for African-Americans (the group in our study showing the most statistically significant negative relationship between substance-use disorder and obesity), may help us to understand better the behavioral and/or biological mechanisms involved in this variation.

These findings suggest an alternative pathways model in which reaction to environmental and personal stress in African-Americans may result in coping styles which are manifested either in binge or compulsive eating and less physical activity, or in increased self-medication with licit and illicit substances. It is possible that compulsive eating is just an alternative coping mechanism to substance use, both of which may be attempts to deal with distress and hardship in African-American communities. Understanding why this pattern does not replicate for other ethnic/racial minority groups might be critical to the identification of preventive strategies for these public-health problems.

Body image and body satisfaction may be one relevant factor affecting our results as unobserved variables. There are data, mostly from women, indicating different norms for body composition, body satisfaction, and body esteem across ethnic groups, with minorities adhering less to Euro-American norms and considering heavier weight as more desirable (Domel et al, 1992; Kumanyika, 1993; Melnyk & Weinstein, 1994). Further, recent studies on the relationship between obesity and psychiatric disorders (particularly depression) have found that weight-related stigma may play a crucial role in explaining this association (Chen et al, 2007; Puhl & Heuer, 2009). The role of weight stigma should not be underestimated, as individuals who are obese are more susceptible to social disadvantage and psychological problems because of stereotyping, prejudice, discrimination, and stigmatization in the United States (Puhl & Heuer, 2009).

The association between obesity, psychiatric disorders, and physical status is complex. Any single condition (obesity, depression, or another chronic condition) may lead to reduced physical activity or increased food consumption, which can result in higher risk for obesity, increased symptoms of depression, limited daily functioning, and/or complications of a chronic illness (Babyak et al, 2000; Paluska & Schwenk, 2000). Depression may increase the risk for weight gain as it has been found to lead to binge eating (French et al, 1999), especially for white females. Many psychotropic medications with antipsychotic (e.g., clozapine), mood-stabilizing (e.g., valproate products), and antidepressant (e.g., amitriptyline) properties are associated with weight gain (Sachs et al, 1999; Vanina et al, 2002; Schwartz et al, 2004; Allison et al, 1999).

Our results show that smoking may play a significant role in the relationship between depression and weight gain, with smoking serving to lower weight gain (Klesges et al, 1988). In the current study, among non-Latino whites and African-Americans with a BMI≥30 (obese), there was a statistically significant difference between current smokers and non-smokers, with more obese participants being non-smokers ($p \leq 0.05$ and $p \leq 0.005$ respectively).

When differences in smoking status, age, gender, number of chronic conditions, and level of impairment were adjusted for, the association between depression and obesity disappeared for all groups. However, it is important to note that when these adjustments were made, an association between obesity and both social phobia and any anxiety disorder emerged for

Afro-Caribbeans. There could be several factors explaining this finding. It is possible that for the Afro-Caribbean group, smoking status, chronic conditions, and functional impairment as measured by the WHO-DAS are more highly correlated with socioeconomic status (SES) than for the other ethnic/racial groups, and what is actually being measured has more to do with SES than with health and impairment. Further research with this specific group will be necessary to understand this finding.

Impairment, as measured by scores on the WHO-DAS II, was greatest in the Latino group, with significant differences between obese and non-obese across four out of the six domains. Comparisons of obese versus non-obese respondents on the WHO-DAS II dimensions provide additional evidence of broad-based impairment associated with obesity. When adjustments for age, gender, smoking, chronic conditions, and WHO-DAS II were made, the relationship with depressive disorders disappeared across all racial/ethnic groups, suggesting that it is the lower functioning associated with depression that seems to be related to obesity.

Our findings of the relationship between obesity and WHO-DAS II are in agreement with most of the recent studies conducted in this area. Obesity can be associated with functional limitations due to difficulties in performing certain movements and an increased likelihood of being sedentary. Disability can also lead to weight gain because of a lack of physical activity or through changes in eating behavior. It is still unknown if weight problems are a cause or a consequence of disability, and it is quite possible that both mechanisms co-occur (Rimmer, 2005). Further longitudinal studies are needed to clarify this point. It would be interesting to consider other parameters such as mobility impairment, as this alone may be an important risk factor for disability and might be confounding the relationship between BMI and psychiatric conditions.

Our study had several limitations. First, the cross-sectional design prevented inferring a temporal relation between obesity and psychiatric disorders. Prospective studies will ultimately be needed to clarify these temporal relations. We have no way of distinguishing the direction of the relationship between obesity and psychiatric disorders or the possibility that unmeasured common causes (e.g., medications) led to an association between them. Furthermore, we considered past-year psychiatric disorders, rather than past-month psychiatric disorders, which might have yielded different results. For instance, Onyike and colleagues (2003) found higher odds of obese participants having past-month depression than of having past-year depression.

The BMI measure is based on self-reported measures of height and weight. Self-reported measures of height and weight have resulted in underestimates of the prevalence of obesity in other studies (Stewart et al, 1987; Hill & Roberts, 1998; Yun et al, 2006). The correlation between measured and reported obesity is high in general, but prevalence of obesity using self-reports is lower than using measured values (Kuczmarski et al, 2001). However, we feel that the magnitude of the observed associations between obesity and psychiatric disorders is not likely to be substantially reduced using measured BMI, nor is it likely that there is evidence of differential reporting of BMI by ethnic/racial groupings.

We did not look at BMI as a continuous variable, which might have yielded more specific results at each BMI score (Scott et al, 2008). Instead, we examined broadly by obese and non-obese status. The reason this type of analysis was not possible with this dataset because the distribution for our sample on the three different classes of obesity were skewed with the majority of individuals falling in Class I, BMI 30–34.9. Ideally, in addition to these data, some common anthropometric indicators of obesity and fat distribution such as a skinfold test and body circumference measure would have yielded more accurate and comprehensive data regarding weight status. The CPES dataset did not include data on diet, exercise, or

body image which might have provided further explanation of the relationship between obesity, psychiatric disorders, and physical status.

Notwithstanding these limitations, is showing multiple obesity–psychiatric-disorder covariations by racial/ethnic groups, rather than a single pattern of association. Future research, prevention, and treatment of obesity may need to be applied defined on an ethnicity-specific basis, as most of the previous models based on non-Latino white populations may be inappropriate or limited. Differences could also be due to similar risk and protective factors operating differently across the racial/ethnic groups (Roberts et al, 2000), including the role of physical health status. There is a lack of information about how the same risk and protective factors affect the mental health of different ethnic/racial minorities (Lincoln et al, 2003). This is an area that warrants further exploration. Moreover, increased attention to how functional impairments occur in and affect diverse racial/ethnic groups may help to address the relationship that functional impairment may play as a risk factor for obesity and psychiatric co-morbidities.

**Research Highlights**

- The relationship between obesity and last-year psychiatric disorders varied by ethnicity/race.
- The likelihood of having mood or anxiety disorder was positively associated with obesity for certain racial/ethnic groups, but was moderated by differences in physical health status.
- Substance-use disorders were associated with decreased odds for obesity in African-Americans.
- The role of physical health status changes the pattern of associations between obesity and psychiatric disorders.

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**Table 1**

Sociodemographic characteristics by Obesity and Ethnic Racial groups.

| | Non-Latino White N=4112 | | Latino N=2529 | | Asian N=2079 | | African American N=3336 | | Afro-Caribbean N=1370 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % |
| Gender | | | | | | | | | | |
| Men | 46.7 | 49.8 | 51.7 | 52.7 | 47.9 | 46.2 | 49.1 | 37.0 | 54.9 | 38.4 |
| | 53.3 | 50.2 | 48.3 | 47.3 | 52.1 | 53.8 | 50.9 | 63.0* | 45.1 | 61.6* |
| Women Age | | | | | | | | | | |
| 18–34 | 29.6 | 21.0 | 52.1 | 41.8 | 39.6 | 37.4 | 39.3 | 30.9 | 39.7 | 40.4 |
| 35–49 | 29.5 | 33.3 | 27.6 | 36.0 | 31.8 | 37.7 | 32.0 | 37.5 | 30.4 | 40.1 |
| 50–64 | 20.4 | 31.3 | 12.5 | 15.2 | 18.0 | 17.3 | 17.3 | 21.0 | 18.7 | 14.3 |
| 65+ | 20.5 | 14.4 | 7.8 | 7.0 | 10.6 | 7.7 | 11.4 | 10.7 | 11.2 | 5.2 |
| Below Poverty Level | | | | | | | | | | |
| No | 91.0 | 91.2 | 72.2 | 75.7 | 81.8 | 88.2 | 76.5 | 76.0 | 85.0 | 87.0 |
| Yes | 9.1 | 8.8 | 27.8 | 24.4 | 18.2 | 11.8 | 23.5 | 24.0 | 15.0 | 13.0 |
| Household Income | | | | | | | | | | |
| − | 13.0 | 12.0 | 28.4 | 24.6 | 19.1 | 11.5 | 25.2 | 24.1 | 14.0 | 12.8 |
| 14,999 | | | | | | | | | | |
| 15− | 20.0 | 19.9 | 28.3 | 30.0 | 13.3 | 10.7 | 33.5 | 33.2 | 34.2 | 32.6 |
| 34,999 | | | | | | | | | | |
| 35− | 35.3 | 38.9 | 26.1 | 32.2 | 28.0 | 32.7 | 29.8 | 34.7 | 36.3 | 37.5 |
| 74,999 | | | | | | | | | | |
| 75+ | 32.0 | 29.3 | 17.2 | 13.5 | 40.0 | 45.1 | 11.5 | 8.1 | 15.5 | 17.2 |
| Current Smoker | | | | | | | | | | |
| No | 74.0 | 77.4 | 79.9 | 81.1 | 86.0 | 91.3 | 69.9 | 76.3** | 85.5 | 86.6 |
| Yes | 26.1 | 22.7 | 20.1 | 18.9 | 14.0 | 8.7 | 30.1 | 23.7 | 14.5 | 13.4 |

| | Non-Latino White N=4112 | | Latino N=2529 | | Asian N=2079 | | African American N=3336 | | Afro-Caribbean N=1370 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % |
| Number of Chronic Conditions | | | | | | | | | | |
| 0 | 48.1 | 33.5 | 68 | 49.6 | 63.3 | 43 | 50.9 | 33.0 | 54.2 | 36 |
| 1 | 26.4 | 29 | 20.2 | 27.1 | 23.9 | 33.9 | 26.6 | 29.2 | 28.1 | 37.3 |
| 2+ | 25.5 | 37.5** | 11.8 | 23.3** | 12.8 | 23.1** | 22.5 | 37.9** | 17.7 | 26.7 |
| Any 12 month Depressive Disorder | | | | | | | | | | |
| No | 91.6 | 89.7 | 91.2 | 91.1 | 95.1 | 94.6 | 93.5 | 92.3 | 92.5 | 89.1 |
| Yes | 8.42 | 10.3* | 8.9 | 8.9 | 4.9 | 5.4 | 6.5 | 7.7 | 7.5 | 10.9 |
| Any 12mo Anxiety Disorder | | | | | | | | | | |
| No | 86.6 | 85.3 | 91.3 | 88.6 | 93.7 | 92.6 | 90.7 | 86.1 | 91.6 | 83.5 |
| Yes | 13.4 | 14.7 | 8.7 | 11.4 | 6.3 | 7.4 | 9.3 | 14* | 8.4 | 16.5 |
| Any 12 mo Substance Disorder | | | | | | | | | | |
| No | 96 | 97.4 | 97 | 97.6 | 98.7 | 98.6 | 96.2 | 98.4 | 95.8 | 99.3 |
| Yes | 4.1 | 2.6 | 3.1 | 3.1 | 2.4 | 1.4 | 3.8 | 1.6 | 4.2 | .75 |
| Any Disorder | | | | | | | | | | |
| No | 80.3 | 78.8 | 84.3 | 84.2 | 90.1 | 91.1 | 84.7 | 81.9 | 86.6 | 75.1 |
| Yes | 19.7 | 21.2 | 15.8 | 15.8 | 9.9 | 8.9 | 15.3 | 18.1 | 13.4 | 25 |
| WHO-DAS Disability Assessment Days | .23 | .33 | .27 | .35 | .11 | .28 | .64 | .98 | 1.3 | .34 |
| out-mental reason | .91 | 1.1 | .54 | 1.1* | .63 | .56 | 1.0 | 2.3** | 2.6 | 1.6 |
| Cognition | 4.2 | 8.3** | 1.6 | 5.2** | 1.2 | 2.2 | 3.7 | 6.2** | 2.5 | 3.2 |

| | Non-Latino White N=4112 | | Latino N=2529 | | Asian N=2079 | | African American N=3336 | | Afro-Caribbean N=1370 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % | BMI<30 % | BMI≥30 % |
| Mobility | | | | | | | | | | |
| Self-care | .87 | 1.4 | .37 | 1.8** | .34 | .41 | .81 | 1.2 | 1.3 | .65 |
| | .53 | .79 | .33 | .66 | .45 | .19 | .82 | 1.2 | 1.4 | .70 |
| Social functioning | | | | | | | | | | |
| Role functioning | 9.3 | 13.5** | 6.2 | 12.0** | 5.7 | 8.0 | 14.3 | 17.9** | 10.1 | 14.5 |

* p<.05

** p<.01



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**Table 2**

Odds Ratios of past 12 month Psychiatric Disorder by BMI for each Ethnic Racial Group Age and Gender Adjusted.

| | Non-Latino White | | Latino | | Asian | | African American | | Afro-Caribbean | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N=4112 | | N=2529 | | N=2079 | | N=3336 | | N=1370 | |
| | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI |
| Depression | | | | | | | | | | |
| Major Depressive Episode | 1.30 | (1.04-1.62)* | 1.06 | (0.80-1.42) | 1.01 | (0.49-2.07) | 1.08 | (0.79-1.48) | 1.82 | (0.50-6.70) |
| Dysthymia | 1.42 | (1.02-2.00)* | 0.79 | (0.41-1.52 | 1.72 | (0.54-5.45) | 1.63 | (0.94-2.82) | 0.39 | (0.05-3.02) |
| Any Depressive Disorder Anxiety | 1.26 | (1.02-1.56)* | 1.03 | (0.76-1.38) | 1.10 | (0.60-2.02) | 1.14 | (0.82-1.57) | 1.83 | (0.50-6.68) |
| Agoraphobia without panic | 0.75 | (0.36-1.58) | 2.39 | (1.30-4.38)* | 2.92 | (0.42-20.28) | 1.74 | (0.84-3.59) | 2.25 | (0.25-20.16) |
| Panic Disorder | 1.57 | (1.12-2.21)* | 1.09 | (0.58-2.06) | 1.24 | (0.43-3.60) | 1.56 | (0.99-2.48) | 0.30 | (0.04-2.38) |
| GAD | 1.31 | (1.01-1.71)* | 0.81 | (0.46-1.41) | 0.90 | (0.29-2.77) | 1.53 | (0.85-2.75) | 1.61 | (0.36-7.18) |
| Social Phobia | 1.05 | (0.86-1.29) | 1.34 | (0.89-2.03) | 1.01 | (0.47-2.19) | 1.15 | (0.70-1.90) | 2.49 | (0.70-8.86) |
| PTSD | 1.59 | (1.17-2.17)* | 1.08 | (0.55-2.11) | 3.54 | (1.32-9.49)* | 1.51 | (0.93-2.46) | 0.81 | (0.17-3.89) |
| Any Anxiety Disorder | 1.10 | (0.91-1.33) | 1.35 | (0.95-1.91) | 1.18 | (0.65-2.15) | 1.45 | (1.02-2.05)* | 2.01 | (0.73-5.53) |
| Substance Abuse/Dependence Disorder | | | | | | | | | | |
| Alcohol Dependence/Abuse | 0.60 | (0.33-1.06) | 0.92 | (0.43-1.96) | 2.15 | (0.74-6.31) | 0.42 | (0.18-0.96)* | 0.11 | (0.00-2.28) |
| Drug Dependence/Abuse | 1.04 | (0.43-2.51) | 0.74 | (0.25-2.19) | 0.37 | (0.10-1.28) | 0.46 | (0.14-1.53) | 0.23 | (0.01-4.64) |
| Any Substance Disorder | 0.72 | (0.36-1.42) | 0.74 | (0.40-1.36) | 1.16 | (0.35-3.92) | 0.44 | (0.21-0.92)* | 0.21 | (0.02-2.58) |

| | Non-Latino White | | Latino | | Asian | | African American | | Afro-Caribbean | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N=4112 | | N=2529 | | N=2079 | | N=3336 | | N=1370 | |
| | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI | Odds Ratio | 95% CI |
| Any Disorder | 1.12 | (0.95-1.33) | 1.22 | (0.89-1.68) | 0.89 | (0.59-1.35) | 1.16 | (0.90-1.49) | 2.23 | (0.74-6.77) |

*p<.05

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**Table 3**

Odds Ratios of past 12 month Psychiatric Disorder by BMI for each Ethnic Racial Group Age, Gender, Smoking, and Physical Status Adjusted.

| | Non-Latino White | | Latino | | Asian | | African American | | Afro-Caribbean | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N=4112 | | N=2529 | | N=2079 | | N=3336 | | N=1370 | |
| **Past 12-month Psychiatric Disorder** | **Odds Ratio** | **95% CI** | **Odds Ratio** | **95% CI** | **Odds Ratio** | **95% CI** | **Odds Ratio** | **95% CI** | **Odds Ratio** | **95% CI** |
| Depression | | | | | | | | | | |
| Major Depressive Episode | 1.10 | (0.90-1.36) | 0.74 | (0.53-1.04) | 0.91 | (0.42-1.94) | 0.85 | (0.60-1.22) | 1.85 | (0.61-5.64) |
| Dysthymia | 1.09 | (0.72-1.66) | 0.57 | (0.26-1.27) | 2.30 | (0.81-6.58) | 1.19 | (0.65-2.21) | 0.45 | (0.06-3.08) |
| Any Depressive Disorder | 1.08 | (0.87-1.33) | 0.72 | (0.51-1.02) | 1.00 | (0.53-1.90) | 0.91 | (0.63-1.31) | 1.87 | (0.62-5.67) |
| Anxiety | | | | | | | | | | |
| Agoraphobia without panic | 0.60 | (0.30-1.21) | 1.93 | (0.91-4.09) | 2.91 | (0.48-17.60) | 1.25 | (0.53-2.98) | 0.78 | (0.05-11.07) |
| Panic Disorder | 1.28 | (0.89-1.86) | 0.86 | (0.46-1.61) | 1.57 | (0.41-6.07) | 1.10 | (0.64-1.88) | 0.63 | (0.13-3.00) |
| GAD | 1.05 | (0.78-1.41) | 0.56 | (0.30-1.05) | 0.60 | (0.27-1.34) | 1.28 | (0.69-2.37) | 3.00 | (0.95-9.48) |
| Social Phobia | 0.88 | (0.69-1.12) | 0.93 | (0.57-1.50) | 0.92 | (0.39-2.18) | 0.95 | (0.53-1.70) | 5.34 | (1.84-15.48)* |
| PTSD | 1.21 | (0.87-1.68) | 0.80 | (0.42-1.54) | 2.81 | (0.81-9.77) | 1.25 | (0.75-2.08) | 1.43 | (0.54-3.80) |
| Any Anxiety Disorder | 0.90 | (0.71-1.14) | 0.98 | (0.70-1.39) | 1.02 | (0.53-1.96) | 1.22 | (0.81-1.83) | 2.80 | (1.34-5.83)* |
| Substance Abuse/Dependence Disorder | | | | | | | | | | |
| Alcohol Dependence/Abuse | 0.58 | (0.33-1.01)* | 0.69 | (0.26-1.84) | 1.84 | (0.62-5.48) | 0.42 | (0.16-1.06) | 0.52 | (0.02-16.82) |
| Drug Dependence/Abuse | 1.01 | (0.38-2.69) | 0.67 | (0.24-1.89) | 0.24 | (0.06-0.94)* | 0.43 | (0.13-1.48) | 0.24 | (0.00-24.69) |
| Any Substance Disorder | 0.70 | (0.36-1.37) | 0.57 | (0.27-1.20) | 0.91 | (0.35-2.35) | 0.43 | (0.19-0.96)* | 0.37 | (0.02-5.87) |
| Any Psych Disorder | 0.96 | (0.79-1.17) | 0.91 | (0.65-1.27) | 0.78 | (0.52-1.18) | 0.98 | (0.71-1.36) | 2.54 | (1.22-5.30)* |

*p<.05