Published in final edited form as:

J Clin Psychiatry. 2011 November ; 72(11): 1494–1502. doi:10.4088/JCP.10m06077gry.

Temporal Relationships between Overweight and Obesity and DSM-IV Substance Use, Mood, and Anxiety Disorders: Results from a Prospective Study

Roger P. Pickering, M.S.¹, Risë B. Goldstein, Ph.D.¹, Deborah S. Hasin, Ph.D.^{2,3,4}, Carlos Blanco, M.D.^{2,4}, Sharon M. Smith, Ph.D.¹, Boji Huang, Ph.D., M.D.¹, Attila J. Pulay, M.D.¹, W. June Ruan, M.A.¹, Tulshi D. Saha, Ph.D.¹, Frederick S. Stinson, Ph.D.¹, Deborah A. Dawson, Ph.D.¹, and Bridget F. Grant, Ph.D., Ph.D.¹

¹Laboratory of Epidemiology and Biometry, Division of Intramural Clinical and Biological Research, National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, Bethesda, Maryland, 20892, U.S.A

²New York State Psychiatric Institute, 1051 Riverside Drive, New York, NY 10032

³Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY 10032

⁴Department of Psychiatry, College of Physicians and Surgeons, Columbia University, New York, NY 10032

Abstract

Background—Associations between overweight and obesity and medical conditions have been extensively studied, but little is known about their relationships to psychiatric disorders.

Objective—To present nationally representative findings on the prospective relationships between overweight and obesity and DSM-IV substance use, mood and anxiety disorders.

Design, Setting and Participants—Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions, a nationally representative sample of 34,653 U.S. adults.

Main Outcome Measures—Incidence of DSM-IV substance use, mood and anxiety disorders and changes in BMI status during the 3-year follow-up.

Results—Regression analyses that controlled for a wide array of covariates showed that overweight and obese women were at increased risk for incident major depressive disorder (MDD) during the follow-up period. Overweight men and obese men were at decreased risk of incident drug abuse and alcohol dependence, respectively. Obese women had a decreased risk of incident alcohol abuse and drug dependence. Men with drug dependence and women with specific phobia had a decreased risk of becoming overweight or obese during the follow-up.

Corresponding Author: Bridget F. Grant, Ph.D., Ph.D., Laboratory of Epidemiology and Biometry, Room 3077, Division of Intramural Clinical and Biological Research, National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, MS 9304, 5635 Fishers Lane, Bethesda, MD 20892-9304, Phone #: (301) 443-7370, Fax #: (301) 443-1400, bgrant@willco.niaaa.nih.gov.

Disclaimer: The Views and opinions expressed in this report are those of the authors and should not be construed to represent the views of sponsoring organizations, agencies, or the U.A.S. government.

Corresponding Author Statement: Dr. Bridget Grant attests that all authors had access to the study data, take responsibility for the accuracy of the analyses, and had authority over manuscript preparation and the decision to submit the manuscript for publication.

Conflict of Interest: The authors have no conflicts of interest to report. The funding sources had no role or involvement in this study.

Limitations—The NESARC excluded adolescents and the homeless and weight was self-reported, but highly correlated with external validating data.

Conclusions—Increased risk of MDD among overweight and obese women could be attributed to stigma and greater body dissatisfaction among women in Western cultures. Overweight and obesity may serve as protective factors against developing incident substance use disorders possibly due to shared neural functions in the brain underlying addictions to numerous substances. Results are discussed in terms of their clinical implications including the need to update treatment guidelines for the management of overweight, obesity and MDD.

Introduction

From 1976–1980 to 2003–2004, the prevalence of obesity in the United States (body mass index (BMI) ≥ 30.0) doubled from 15.1% to 32.2% (1). During the same period, the prevalence of overweight and obesity (BMI ≥ 25.0) markedly increased from 45.0% to 66.3% (2, 3). Although associations between overweight and obesity and major medical conditions (4, 5) and their associated disabilities (6) and excess and premature mortality (7), including diabetes mellitus, cardiovascular diseases, and degenerative joint disease have been extensively studied, evidence concerning their relationships to psychiatric disorders is limited.

To date, sixteen cross-sectional and nine prospective surveys using standardized psychiatric assessment interviews, have examined relationships between BMI status and psychopathology. Most cross-sectional studies (8–24) found modest associations (8, 10, 11, 14–23) between overweight and/or obesity and any mood disorder or major depressive disorder (MDD), with some finding the relationship only among women (8, 11, 14–17, 19, 20). Six studies also found associations between overweight and/or obesity and any anxiety disorder (9, 21, 23), including panic disorder (15, 19, 20, 23), specific phobia (8, 19, 20, 22), generalized anxiety disorder (GAD) (15, 19), and social phobia (8, 15, 22).

Most prospective studies (25–33) on obesity and psychopathology have focused on MDD. Longitudinal surveys among cohorts of children or adolescents spanning about 20 years have consistently shown that MDD is associated with an increased risk of later obesity (25–27), though only among women in one study (30). In contrast, one long-term longitudinal survey of women of average age 27 years at baseline (8) found that baseline obesity predicted major depressive disorder 30 years later (28). Prospective studies of much shorter durations (2-to-5 years) conducted among adults aged 50 years and older found the same result (31–33).

Studies examining relationships between substance use disorders and overweight and/or obesity have been mixed. Except for two studies (19,24), no associations were observed between alcohol abuse, dependence, or any alcohol use disorder and overweight and obesity (10, 15, 20–22). Most studies also found no associations with drug abuse (19, 20), drug dependence (15, 19), any drug use disorder (22), or overall substance use disorders (9, 12, 13). One study found an inverse relationship between drug dependence and obesity among men (20), while another found a positive association between substance use disorders and obesity among men (17).

Although much has been learned about relationships between overweight and obesity and psychopathology from prior epidemiologic work, none of these studies were without limitations. For example, some previous studies were restricted by age and/or geography, failed to exclude pregnant women and underweight individuals, did not analyze data by sex or present data on specific psychiatric disorders, failed to differentiate between overweight and obesity and between MDD and bipolar disorder and, by definition, could not discern

temporal relationships between BMI status and psychopathology. Prospective studies have also been limited by long follow-up periods with sporadic measurement of BMI and psychopathology, an exclusive focus on child or adolescent cohorts or individuals over the age of 50 years, and failure to measure a broad range of specific psychiatric disorders that are highly comorbid with one another. The latter limitation, also shared by most cross-sectional studies, is important, as psychiatric comorbidity, a potentially critical confounder of BMI-psychopathology associations, could not be controlled. Other critical factors, e.g., substance use, medical conditions, stress and psychotropic medication use, have also not been controlled.

The absence of a large national prospective survey of U.S. adults on the temporal relationships between BMI status and psychiatric disorders represents a gap in our knowledge in terms of etiology, prevention, intervention and economic costs of each of these conditions. The present study was the first to examine temporal relationships between overweight and obesity and Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV) (34) specific substance use, mood and anxiety disorders within a 3-year national prospective survey of the U.S. population, the Waves 1 and 2 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) (35,36). The analyses importantly controlled for comorbidity at Wave 1 and concurrent comorbidity during the follow-up period, in addition to a battery of sociodemographic and clinical covariates shown to influence BMI-psychopathology associations, including sex.

Methods

Sample

The 2001–2002 Wave 1 of the NESARC is described in detail elsewhere (35, 36). The Wave 1 NESARC surveyed a representative sample of the adult U.S. population 18 years and older, oversampling Blacks, Hispanics and young adults aged 18–24 years. The target population was the civilian population residing in households and group quarters. Face-to-face interviews were conducted with 43,093 respondents, with a response rate of 81.0%.

The 2004–2005 Wave 2 NESARC attempted face-to-face reinterviews with all Wave 1 participants (37). Excluding respondents ineligible for the Wave 2 interview, the Wave 2 response rate was 86.7%, reflecting 34,653 completed interviews. The cumulative response rate at Wave 2 was 70.2%. The mean interval between the two interviews was 36.6 months. Wave 2 NESARC data were weighted to reflect design characteristics of the NESARC and account for oversampling. Wave 2 NESARC weights included a component that adjusted for nonresponse, sociodemographic factors and psychiatric diagnosis, to ensure that the sample Wave 2 approximated the target population, that is, the original sample minus attrition between the two waves. There were no significant differences between the Wave 2 respondents and the target population on sociodemographic characteristics, BMI status or the presence of any lifetime psychiatric disorder (34). Weighted data were then adjusted to be representative of the civilian population of the United States based on the 2000 decennial census.

The research protocol, including informed consent procedures, received ethical review and approval from the U.S. Census Bureau and U.S. Office of Management and Budget.

Body mass index

Body mass index was defined using standards developed by the National Heart, Lung and Blood Institute: healthy weight, BMI of 18.5–24.9 kg/m²; overweight, BMI of 25.0–29.9 kg/m²; and obesity, BMI ≥ 30.0 kg/m². Similar to previous studies, height and weight were self-reported in the NESARC. Self-reported weight correlates highly with measured weight

($r = 0.86$), and is largely independent of height ($r \approx -0.03$) (38). Validation studies suggest that any bias in self-reported BMI is unlikely to affect conclusions about associations in epidemiologic studies, especially those conducted over time (39–42). In ancillary analyses, correlation coefficients were computed to examine associations between the Wave 1 NESARC BMI data and comparable data from the combined 1999–2002 National Health and Nutrition Examination Survey (43) that measured actual height and weight, by sex, five race-ethnic groups, and four age groups. Correlations of BMI were 0.76 for healthy weight, 0.85 for overweight, 0.84 for obesity.

Psychiatric disorders

The diagnostic interview was the Alcohol Use Disorder and Associated Disabilities Interview Schedule—DSM-IV Version (AUDADIS-IV) (44, 45). Axis I disorders were assessed identically in the Wave 1 and Wave 2 versions of the AUDADIS-IV except for the time frames. In Wave 1, these time frames were: (1) the year preceding the interview; and (2) the past, including all but the year preceding the interview. In Wave 2, the time frames were: (1) the year preceding the Wave 2 interview; and (2) the intervening period, about 2 years, between the Wave 1 interview and the year preceding the Wave 2 interview. Thus, in the Wave 2 interview, the entire time between Waves 1 and 2 was covered for each respondent.

In Waves 1 and 2, DSM-IV specific drug abuse and dependence diagnoses were aggregated to yield diagnoses of any drug abuse and any drug dependence. Mood disorders included DSM-IV major depressive disorder (MDD) and bipolar I disorder. Anxiety disorders included DSM-IV panic disorder (with and without agoraphobia), social and specific phobias and GAD. AUDADIS-IV methods to diagnose these disorders are described in detail elsewhere (46–51). All AUDADIS-IV mood and anxiety disorder diagnoses excluded disorders that were substance-induced or due to general medical conditions.

Past-year and prior-to-past-year diagnoses of attention-deficit/hyperactivity disorder (ADHD) and post-traumatic stress disorder were assessed in Wave 2 and served only as control variables in the analyses. DSM-IV lifetime personality disorders (PDs) also served as control variables. PDs measured at Wave 1 (described in detail elsewhere (52)) included avoidant, dependent, obsessive-compulsive, paranoid, schizoid, histrionic and antisocial. Borderline, schizotypal and narcissistic PDs were measured at Wave 2.

The good to excellent test-retest reliability and validity of AUDADIS-IV substance use disorders, mood, anxiety, PD and ADHD diagnoses are documented in clinical and general population samples (47–63).

Other covariates

Sociodemographic variables included sex, age, race-ethnicity, marital status, education, income, urbanicity, and region of the country. Fourteen stressful life events occurring during the year prior to the Wave 1 interview were summed to produce a scale of 0, 1 and 2+ events. Respondents were asked whether a doctor or other health care professional had told them that they had any of eleven medical conditions in the year preceding the Wave 1 interview. The number of medical conditions was summed into a scale of 0, 1 or 2+ conditions.

When substance use and substance use disorders served as covariates, three-level mutually exclusive variables were constructed for respondents' lifetimes, and for the year, preceding the Wave 1 interview: (1) no alcohol use/disorder, alcohol use/no alcohol use disorder and alcohol use disorder; (2) no drug use/disorder, drug use/no drug use disorder, and drug use disorder; and (3) no nicotine use/dependence, nicotine use/no nicotine dependence, and

nicotine dependence. For the period between Wave 1 and 2, we used any alcohol use, any other drug use, and any nicotine use as covariates. Whether the respondents were prescribed medication for the target mood or anxiety disorder of interest and for any other mood or anxiety disorder during the follow-up period were also covariates in the multivariable analyses.

Statistical analyses

In order to determine the temporal relationship between BMI status and psychopathology, three sets of multivariable analyses were conducted. In the first set of multivariable linear logistic regression analyses, BMI status (normal weight, overweight or obese) was the major exposure variable predicting each incident specific psychiatric disorder occurring during follow-up, controlling for Wave 1 sociodemographic characteristics, lifetime mood, anxiety and PD comorbidity and alcohol, drug, and nicotine use and disorders at Wave 1, and Wave 1 past-year medical conditions and stressful life events. Incidence rates were also calculated for each psychiatric disorder developing for the first time during the 3-year follow-up. Each of these analyses was restricted to individuals at risk for each incident target disorder.

Multinomial logistic regression analyses were also conducted in which each Wave 1 past-year psychiatric disorder served as the major exposure variable with transitions in BMI status over follow-up as the outcome, controlling for wave 1 sociodemographic characteristics and wave 1 past-year mood, anxiety, alcohol and drug use and disorders, medical conditions, and stressful life events, in addition to alcohol and drug use, anxiety, and mood comorbidity, use of alcohol or drugs, prescribed medications for the target anxiety or mood disorder, and prescribed medications for other mood and anxiety disorders during the follow-up period, as well as lifetime PDs. The categorical outcome variable, transition in BMI status, was categorized as: (1) remaining in the same BMI category from Wave 1 to Wave 2; (2) moving into a lower BMI category; and (3) moving into a higher BMI category. These analyses were also repeated, substituting a continuous BMI change variable for the categorical ones, that is, BMI at Wave 2 minus BMI at Wave 1, and conducting multivariable linear regression analyses.

Analyses were conducted on weighted data and standard errors and 95% confidence intervals were estimated using SUDAAN (64) a software package that adjusted for the design characteristics of the NESARC. All analyses excluded respondents who were pregnant at either Wave 1 or Wave 2, and those underweight at Wave 1.

Results

Table 1 shows the numbers of respondents at risk at Wave 1 for each psychiatric disorder during the follow-up and the 3-year incidence of each disorder by Wave 1 BMI status. Incidence rates mirror their prevalence rate counterparts, with substance use disorder incidence being greater among men and mood and anxiety disorders incidences being much greater among women, regardless of BMI status. Table 2 shows prediction of incident substance use, mood and anxiety disorders during the follow-up period by Wave 1 BMI status, controlling for all covariates. Among men, obesity at baseline decreased the risk of incident alcohol dependence and overweight at baseline decreased the risk of incident drug abuse over follow-up. Overweight men at baseline were at increased risk of incident alcohol abuse. Women obese at baseline were at decreased risk of incident alcohol abuse and drug dependence. In contrast, overweight or obesity at baseline increased the risk of incident MDD during the follow-up among women.

Table 3 shows sample sizes and percentages of respondents moving into each BMI category during the follow-up. Table 4 shows prediction of BMI categorical transitions over follow-

up by Wave 1 past-year DSM-IV substance use, mood and anxiety disorders, controlling for all covariates. Drug dependence at baseline decreased the risk of overweight and obesity among men, whereas specific phobia at baseline decreased the risk of overweight and obesity among women. When the continuous BMI change variables were substituted for the categorical transition variables, drug dependence at baseline predicted a decrease in BMI among men, consistent with the categorical results. However, the association between specific phobia at baseline and decreased risk of overweight and obesity among women at follow-up was not confirmed.

Discussion

The major finding of this prospective study was that overweight and obesity at baseline predicted an increased risk of incident MDD among women, after controlling for a wide array of covariates. These results are consistent with prior shorter-term prospective studies (31–33) but at variance with longer-term longitudinal studies (25–27, 30). Two psychosocial models have been posited to explain the temporal relationship from overweight and obesity to subsequent MDD. The self-appraisal perspective posits that stigma towards overweight and obese individuals (especially women) promotes low self-esteem and negative self-image leading to MDD (65). Alternatively, the fitting norms of appearance perspective argues that fitting the norm for weight is stressful among the obese because dieting is often unsuccessful, resulting in MDD. Women in Western cultures are generally under more pressure to be thin than men and experience greater body dissatisfaction; factors that may increase their vulnerability to MDD (66, 67). Other factors explaining the observed directionality of the relationship among women could also, in part, reflect gender differences in access to health care and treatment preferences (68), differential reporting of atypical features (e.g., increased appetite, weight gain) of MDD and biological factors, including genetic variation in susceptibility to both overweight and obesity and MDD(69).

Although this study's results on BMI status and MDD are not conclusive regarding mechanisms underlying the relationships, these findings do suggest a unidirectional relationship between overweight and obesity and subsequent MDD among women. However, the disparity in results between prospective studies of child and adolescent samples that found unidirectional relationships between MDD and overweight and obesity, and short-term studies of older samples where baseline obesity predicted later MDD, is intriguing in suggesting that the directionality of the relationship may vary over the life course. In many respects both overweight and obesity and psychiatric disorders are results of life-long interactions between biological and psychological risk and protective factors and long-term studies beginning in childhood are warranted.

With respect to substance use disorders, overweight men had a decreased risk of drug abuse and obese men had a decreased risk of alcohol dependence at follow-up, whereas obese women had a decreased risk of alcohol abuse and drug dependence during the follow-up. That overweight and obesity at baseline generally appear protective, decreasing the risk of later substance use disorders, has been observed in several cross-sectional studies (21, 22). These findings are consistent with research suggesting that neural circuits in the brain serving the functions of desiring, seeking, procuring, and consuming food, ethanol, and other psychoactive substances may overlap (70). Overeating may compete with substances of abuse for brain reward sites, resulting in reduced substance intake and lower probabilities of developing substance use disorders among the overweight and obese (71, 72).

In this study, drug dependence at baseline lowered the risk of overweight and obesity during follow-up among men. Drug-dependent individuals may neglect their physical health, including appropriate caloric intake, while procuring, using and recovering from the adverse

effects of substances (73). Drug dependence may disrupt eating habits, nutrient absorption and metabolism through associated physical morbidities including gastritis, pancreatitis and hepatitis (74, 75). Why this relationship was observed only among men may reflect the much greater prevalences of drug dependence among men relative to women in the general population.

With one exception, anxiety disorders did not predict later overweight or obesity and baseline overweight and obesity did not predict any anxiety disorders during follow-up, results at variance with the few cross-sectional epidemiological surveys (8, 14, 18–22) that examined anxiety disorders. Also inconsistent with prior research (19, 20, 22) was the puzzling relationship observed among women between specific phobia at baseline and decreased risk of overweight or obesity during follow-up, a result not replicated when continuous BMI change served as the outcome measure. Nonetheless, the extraordinary fear, anxiety and avoidance of phobic stimuli among individuals with specific phobia can significantly interfere with social and occupational functioning and eating habits, including undereating (34). However, the cardinal feature of excessive anxiety is common to most anxiety disorders, all of which were not shown to reduce the risk of overweight or obesity during the follow-up. Future research is warranted to determine what if any characteristics of specific phobia confer protection against subsequent overweight or obesity among women.

This study has limitations common to most large-scale surveys. First, because NESARC samples only households and group quarters and those 18 years and older, information on adolescents and the homeless was unavailable. Second, the BMI measure was self-reported. However, self-reported BMI has been shown to yield valid results in epidemiological surveys, and correlations between the NESARC and NHANES BMI data were strong.

Despite these limitations, the observed temporal relationships between overweight and obesity and MDD among women and between drug dependence and overweight and obesity among men have strong clinical and public health implications. The temporal relationship between overweight and obesity and MDD may presage increases in MDD among women, given that the epidemics of overweight and obesity are predicted to increase in the United States. Accordingly, overweight and obese women should be monitored for MDD by primary care physicians and other health professionals and targeted for weight reduction interventions to prevent incident MDD. Given the lack of effective treatments for obesity, however, more research is needed to test specific interventions targeting overweight and obesity among women, especially those with MDD. Foremost there is an urgent need to update treatment guidelines for MDD to address the management of overweight and obesity. Similarly, nutritional counseling may be warranted for men with drug dependence.

With regard to research implications, this study revealed important gender differences in the temporal relationships between overweight and obesity and specific psychiatric disorders. Identification of additional psychosocial and biological factors impacting on these relationships within a long-term longitudinal study commencing in early childhood is urgently needed.

Acknowledgments

Financial Support: The National Alcohol Epidemiologic Survey on Alcohol and Related Conditions (NESARC) is funded by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) with supplemental support from the National Institute on Drug Abuse (NIDA). This research was supported in part by the Intramural Program of the National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism. The study is also supported by NIH grants DA019606, DA020783, DA023200, 1 DA023973, MH076051 and MH082773 (Dr. Blanco), AA08159, AA018111 and AA00161 (Dr. Hasin), the American Foundation for Suicide Prevention (Dr. Blanco), and the New York State Psychiatric Institute (Drs. Blanco, Hasin).

References

1. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among adults, 1999–2000. *JAMA*. 2002; 288:1723–1727. [PubMed: 12365955]
2. Freedman DS, Khan LK, Serdula MK, Dietz WH. Trends and correlates of Class 3 obesity in the United States from 1900 through 2000. *JAMA*. 2002; 288:1758–1761. [PubMed: 12365960]
3. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999–2004. *JAMA*. 2006; 295:1549–1555. [PubMed: 16595758]
4. National Task Force on the Prevention and Treatment of Obesity. Overweight, obesity and health risk. *Arch Intern Med*. 2000; 160:898–904. [PubMed: 10761953]
5. Patterson RE, Frank LL, Kristal AR, White E. A comprehensive examination of health conditions associated with obesity in older adults. *Am J Prev Med*. 2004; 27:385–390. [PubMed: 15556738]
6. Eells LJ, Lang R, Shield JPH, Wilkinson JR, Lidstone JSM, Coulton S, et al. Obesity and disability – a short review. *Obes Rev*. 2006; 7:341–345. [PubMed: 17038128]
7. Katzmatzyk PT, Janssen J, Arden CI. Physical activity, excess adiposity, and premature mortality. *Obes Rev*. 2003; 4:257–290. [PubMed: 14649376]
8. Barry D, Pietrzak RH, Petry NM. Gender differences in associations between body mass index and DSM-IV mood and anxiety disorders: results from The National Alcohol Epidemiologic Survey on Alcohol and Related Conditions. *Ann Epidemiol*. 2008; 18:458–466.
9. Becker ES, Margraf J, Turke V, Soeder U, Neumer S. Obesity and mental illness in a representative sample of young women. *Int J Obes Relat Metab Disord*. 2001; 25 (Suppl 1):55–59.
10. Bruffaerts R, Demyttenaere K, Vilagut G, Martinez M, Bonnewyn A, DeGrafaf R, et al. The relation between body mass index, mental health, and functional disability: a European population perspective. *Can J Psychiatry*. 2008; 53:679–688. [PubMed: 18940036]
11. Carpenter KM, Hasin DS, Allison DB, Faith MS. Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study. *Am J Public Health*. 2000; 90:251–257. [PubMed: 10667187]
12. Hatch I, Ruhl VE, Klose M, Klotzsch J, Kirch W, Jacobi F. Obesity and risk for mental disorders in a representative German adult sample. *Eur J Public Health*. 2006; 17:297–305. [PubMed: 16973642]
13. Kamertz CM, Jacobi C, Yassouridis A, Arnold K, Henkel AW. Are obese adolescents and young adults at higher risk for mental disorders? a community survey. *Obes Res*. 2002; 10:1152–1160. [PubMed: 12429879]
14. Ma J, Xiao L. Obesity and depression in U.S. women: results from the 2005–2006 National Health and Nutrition Examination Survey. *Obesity*. 2009 Epub ahead of print.
15. Mather AA, Cox BJ, Enns MW, Sareen J. Associations of obesity with psychiatric disorders and suicidal behaviors in a nationally representative sample. *J Psychosom Res*. 2009; 66:277–285. [PubMed: 19302884]
16. McIntyre RS, Konarski JZ, Wilkins K, Soczynska JK, Kennedy SH. Obesity in bipolar disorder and major depressive disorder: results from a national community health survey on mental health and well being. *Can J Psychiatry*. 2006; 51:274–280. [PubMed: 16986816]
17. McLaren L, Beck CA, Patten SB, Fick GH, Adair CE. The relationship between body mass index and mental health: a population-based study of the effects of the definition of mental health. *Soc Psychiatry Psychiatr Epidemiol*. 2008; 43:63–71. [PubMed: 17960318]
18. Onyike CU, Crum RM, Lee HB, Lyketsos CG, Eaton WW. Is obesity associated with major depression? results from the Third National Health and Nutrition Examination Survey. *Am J Epidemiol*. 2003; 158:1139–1147. [PubMed: 14652298]
19. Petry NM, Barry D, Pietrzak RH, Wagner J. Overweight and obesity are associated with psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosom Med*. 2008; 70:288–297. [PubMed: 18378873]
20. Pickering RP, Grant BF, Chou SP, Compton WM. Are overweight, obesity and extreme obesity associated with psychopathology? results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry*. 2007; 68:998–1009. [PubMed: 17685734]

21. Scott KM, Bruffaerts R, Simon GE, Alonso J, Angermeyer M, de Girolamo G, et al. Obesity and mental disorders in the general population: results from the world mental health surveys. *Int J Obes*. 2008; 32:192–200.
22. Scott KM, McGee MA, Wells E, Oakley Browne MA. Obesity and mental disorders in the adult general population. *J Psychosom Res*. 2008; 64:97–105. [PubMed: 18158005]
23. Simon GE, Von Korff M, Saunders K, Miglioretti DL, Crane PK, van Belle G, et al. Associations between obesity and psychiatric disorders in the US adult population. *Arch Gen Psychiatry*. 2006; 63:824–830. [PubMed: 16818872]
24. Ulrich J, Meyer C, Rumpf HJ, Hapke V. Relationships of psychiatric disorders with overweight and obesity in an adult general population. *Obes Res*. 2005; 13:101–109. [PubMed: 15761168]
25. Hasler G, Lissek S, Ajdacic V, Milos G, Gamma A, Eich D, et al. Major depression predicts an increase in long-term body weight variability in young adults. *Obes Res*. 2005; 13:1991–1998. [PubMed: 16339131]
26. Hasler G, Pine DS, Kleinbaum DG, Gamma A, Luckenbaugh D, Ajdacic V, et al. Depressive symptoms during childhood and adult obesity: the Zurich Cohort Study. *Mol Psychiatry*. 2005; 10:842–850. [PubMed: 15838533]
27. Hasler G, Pine DS, Gamma A, Milos G, Ajdacic V, Eich D, et al. The associations between psychopathology and being overweight: a 20-year prospective study. *Psychol Med*. 2004; 34:1047–1057. [PubMed: 15554575]
28. Kasen S, Cohen P, Chen H, Must A. Obesity and psychopathology in women: a three decade prospective study. *Int J Obes*. 2008; 32:558–566.
29. Pine DS, Cohen P, Brook J, Coplan JD. Psychiatric symptoms in adolescence as predictors of obesity in early adulthood: a longitudinal study. *Am J Public Health*. 1997; 87:1303–1310. [PubMed: 9279265]
30. Richardson LP, Davis R, Poulton R, McCauley E, Moffitt TE, Caspi A, et al. A longitudinal evaluation of adolescent depression and adult obesity. *Arch Pediatr Adolesc Med*. 2003; 157:739–745. [PubMed: 12912778]
31. Roberts RE, Deleger S, Strawbridge WJ, Kaplan GA. Prospective association between obesity and depression: evidence from the Alameda County Study. *Int J Obes Relat Metab Disord*. 2003; 27:514–521. [PubMed: 12664085]
32. Roberts RE, Strawbridge WJ, Deleger S, Kaplan GA. Art the fat more jolly? *Ann Behav Med*. 2002; 24:169–180. [PubMed: 12173674]
33. Roberts RE, Kaplan GA, Shema SJ, Strawbridge WJ. Are the obese at greater risk for depression? *Am J Epidemiol*. 2000; 152:163–170. [PubMed: 10909953]
34. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4. American Psychiatric Association; Washington, DC: 1994.
35. Grant, BF.; Kaplan, KK.; Stinson, FS. Source and Accuracy Statement: The Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions. National Institute on Alcohol Abuse and Alcoholism; Rockville, MD: 2004.
36. Grant, BF.; Moore, TC.; Shepard, J.; Kaplan, K. Source and Accuracy Statement: Wave 1 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). National Institute on Alcohol Abuse and Alcoholism; Rockville, MD: 2001.
37. Grant BF, Stinson FS, Hasin DS, Dawson DA, Chou SP, Dufour MC, et al. Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Arch Gen Psychiatry*. 2004; 61:807–816. [PubMed: 15289279]
38. Spenser EA, Appleby PN, Davey GK, Key TJ. Validity of self-reported height and weight in 48008 EPIC-Oxford participants. *Public Health Nutr*. 2002; 5:561–565. [PubMed: 12186665]
39. Jeffrey RW. Bias in reported body weight as a function of education, occupation, health and weight concern. *Addict Behav*. 1996; 21:217–222. [PubMed: 8730524]
40. Schutz Y, Woringer V. Obesity in Switzerland: a critical assessment of prevalence in children and adults. *Int J Obes Relat Metab Disord*. 2002; 26 (Supple 2):S3–S11. [PubMed: 12174323]
41. Stewart AL. The reliability and validity of self-reported weight and height. *J Chronic Dis*. 1982; 35:295–300. [PubMed: 7061685]

42. Stunkard AJ, Albaum JM. The accuracy of self-reported weights. *Am J Clin Nutr.* 1981; 34:1593–1599. [PubMed: 7270483]
43. National Center for Health Statistics. Health, United States. National Center for Health Statistics; Hyattsville, MD: 2004.
44. Grant, BF.; Dawson, DA.; Hasin, DS. The Alcohol Use Disorder and Associated Disabilities Interview Schedule—DSM-IV Version. National Institute on Alcohol Abuse and Alcoholism; Rockville, MD: 2001.
45. Grant, BF.; Dawson, DA.; Hasin, DS. The Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions Alcohol Used Disorder and Associated Disabilities Interview Schedule—DSM-IV Version. National Institute on Alcohol Abuse and Alcoholism; Rockville, MD: 2003.
46. Hasin DS, Goodwin RD, Stinson FS, Grant BF. Prevalence, correlates and comorbidity of DSM-IV major depressive disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry.* 2005; 62:1097–1106. [PubMed: 16203955]
47. Grant BF, Hasin DS, Blanco C, Stinson FS, Chou SP, Goldstein RB, et al. The epidemiology of social anxiety disorder in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry.* 2005; 66:1351–1361. [PubMed: 16420070]
48. Grant BF, Hasin DS, Stinson FS, Dawson DA, Goldstein RB, Smith SM, et al. The epidemiology of DSM-IV panic disorder and agoraphobia in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry.* 2006; 67:363–374. [PubMed: 16649821]
49. Grant BF, Hasin DS, Stinson FS, Dawson DA, Ruan WJ, Goldstein RB, et al. Prevalence, correlates, comorbidity and comparative disability of DSM-IV generalized anxiety disorder in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychol Med.* 2005; 35:1747–1759. [PubMed: 16202187]
50. Grant BF, Stinson FS, Hasin DS, Dawson DA, Ruan WJ, Huang B. Prevalence, correlates and comorbidity of DSM-IV bipolar I disorder and Axis I and II disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry.* 2005; 66:1205–1215. [PubMed: 16259532]
51. Stinson FS, Dawson DA, Chou SP, Smith SM, Goldstein RB, Ruan WJ, et al. The epidemiology of DSM-IV specific phobia in the USA: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychol Med.* 2007; 37:1047–1059. [PubMed: 17335637]
52. Compton W, Conway KP, Stinson FS, Colliver JD, Grant BF. Prevalence, correlates, and comorbidity of DSM-IV antisocial personality syndromes and alcohol and specific drug use disorders in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry.* 2005; 66:677–685. [PubMed: 15960559]
53. Canino GJ, Bravo M, Ramirez R, Febo V, Fernandez R, Hasin DS. The Spanish Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): reliability and concordance with clinical diagnoses in a Hispanic population. *J Stud Alcohol.* 1999; 60:790–799. [PubMed: 10606491]
54. Chatterji S, Saunders JB, Vraiti R, Grant BF, Hasin DS, Mager D. The reliability of the Alcohol Use Disorders and Associated Disabilities Interview Schedule-Alcohol/Drug-Revised (AUDADIS-ADR) in India, Romania and Australia. *Drug Alcohol Depend.* 1997; 47:171–185. [PubMed: 9306043]
55. Grant BF, Dawson DA, Stinson FS, Chou PS, Kay W, Pickering R. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug Alcohol Depend.* 2003; 71:7–16. [PubMed: 12821201]
56. Grant BF, Harford TC, Dawson DA, Chou SP, Pickering RP. The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): reliability of alcohol and drug modules in a general population sample. *Drug Alcohol Depend.* 1995; 39:37–44. [PubMed: 7587973]
57. Hasin DS, Carpenter KM, McCloud S, Smith M, Grant BF. The Alcohol Use Disorders and Associated Disabilities Interview Schedule: reliability of alcohol and drug modules in a clinical sample. *Drug Alcohol Depend.* 1997; 44:133–141. [PubMed: 9088785]

58. Ruan WJ, Goldstein RB, Chou SP, Smith SM, Saha TD, Pickering RP, et al. The Alcohol Use Disorder and Associated Disabilities Interview Schedule – IV (AUDADIS-IV): reliability of new psychiatric diagnostic modules and risk factors in a general population sample. *Drug Alcohol Depend.* 2008; 92:27–36. [PubMed: 17706375]
59. Hasin DS, Schuckit MA, Martin CS, Grant BF, Bucholz KK, Helzer JE. The validity of DSM-IV alcohol dependence: what do we know and what do we need to know? *Alcohol Clin Exp Res.* 2003; 27:244–252. [PubMed: 12605073]
60. Cottler LB, Grant BF, Blaine J, Mavreas V, Pull C, Hasin DS, et al. Concordance of DSM-IV alcohol and drug use disorder criteria and diagnoses as measured by AUDADIS-ADR, CIDI and SCAN. *Drug Alcohol Depend.* 1997; 47:195–205. [PubMed: 9306045]
61. Nelson CB, Rehm J, Ustun B, Grant BF, Chatterji S. Factor structure for DSM-IV substance disorder criteria endorsed by alcohol, cannabis, cocaine and opiate users: results from the World Health Organization Reliability and Validity Study. *Addiction.* 1999; 94:843–855. [PubMed: 10665074]
62. Pull C, Saunders JB, Mavreas V, Cottler LB, Grant BF, Hasin DS, et al. Concordance between ICD-10 alcohol and drug use disorder criteria and diagnoses as measured by the AUDADIS-ADR, CIDI and SCAN: results of a cross-national study. *Drug Alcohol Depend.* 1997; 47:207–216. [PubMed: 9306046]
63. Vradi R, Grant BF, Chatterji S, Ustun BT, Mager D, Olteanu I, et al. The reliability of the Romanian version of the alcohol module of the WHO Alcohol Use Disorder and Associated Disabilities Interview Schedule-Alcohol/Drug-Revised (AUDADIS-ADR). *Eur Addict Res.* 1998; 4:144–149. [PubMed: 9852366]
64. Research Triangle Institute. Software for Survey Data Analysis (SUDAAN) Version 10. Research triangle Institute; Research Triangle Park, NC: 2008.
65. Puhl RM, Brownell KD. Psychosocial origins of obesity stigma: toward changing a powerful and pervasive bias. *Obes Res.* 2003; 4:213–227.
66. Paeratakul S, White M, Williamson D, Ryan D, Bray G. Sex, race/ethnicity, socioeconomic status, and BMI in relation to self-perception of overweight. *Obes Res.* 2002; 10:345–350. [PubMed: 12006633]
67. Smolak, L.; Striegel Moore, RH. Gender and eating problems. In: Striegel-Moore, RH.; Smolak, L., editors. *Eating Disorders: Innovative Directions in Research and Practice.* American Psychological Association; Washington, DC: 2002.
68. McElroy SL, Kotwal R, Malhotra S, et al. Are mood disorders and obesity related: a review for the mental health professional. *J Clin Psychiatry.* 2004; 65:634–651. [PubMed: 15163249]
69. Comings DE, Gade R, MacMurray JP, Muhleman D, Peters WR. Genetic variants of the human obesity (OB) gene: association with body mass index in young women, psychiatric symptoms, and interaction with the dopamine D2 receptor (DRD2) gene. *Mol Psychiatry.* 1996; 1:325–335. [PubMed: 9118359]
70. Volkow ND, Fowler JS, Wang G. The addicted human brain: insights from imaging studies. *J Clin Invest.* 2003; 111:1444–1451. [PubMed: 12750391]
71. Kleiner KD, Gold MS, Frost-Pineda K, et al. Body mass index and alcohol use. *J Addic Dis.* 2004; 23:105–118.
72. Warren M, Frost-Pineda K, Gold M. Body mass index and marijuana use. *J Addic Dis.* 2005; 24:95–100.
73. Tjpkema M. Alcohol and illicit drug dependence. *Health Rep.* 2004; 15(suppl 15):9–19.
74. Diehl AM. Obesity and alcoholic liver disease. *Alcohol.* 2004; 34:81–87. [PubMed: 15670669]
75. Perry RS, Gallagher J. Management of maldigestion associated with pancreatic insufficiency. *Clin Pharm.* 1985; 4:161–169. [PubMed: 3987214]

Table 1

Number of Respondents at Risk at Wave 1 and 3-Year Incidence of BMI Status During the Follow-Up Period by Sex

Disorder	Number of Respondents at Risk	Incidence During Follow-up Period		
		Healthy Weight % (SE)	Overweight % (SE)	Obese % (SE)
Men				
Substance use disorder				
Alcohol abuse	8391	8.7 (0.67)	9.0 (0.62)	3.1 (0.20)
Alcohol dependence	11853	6.1 (0.46)	3.9 (0.30)	3.7 (0.44)
Drug abuse	12275	3.5 (0.36)	1.6 (0.24)	1.8 (0.35)
Drug dependence	13777	1.8 (0.29)	0.9 (0.15)	0.8 (0.20)
Mood disorder				
Major depressive disorder	12893	3.5 (0.30)	2.7 (0.29)	3.5 (0.44)
Bipolar I	13792	2.0 (0.29)	1.7 (0.22)	1.8 (0.27)
Anxiety disorders				
Panic disorder	13760	1.4 (0.21)	1.0 (0.16)	1.4 (0.23)
Social phobia	13631	1.5 (0.22)	1.1 (0.14)	1.5 (0.22)
Specific phobia	13312	2.2 (0.29)	1.6 (0.20)	1.7 (0.24)
Generalized anxiety	13836	2.2 (0.26)	1.7 (0.18)	2.5 (0.34)
Women				
Substance use disorder				
Alcohol abuse	15020	3.9 (0.32)	2.8 (0.32)	2.0 (0.24)
Alcohol dependence	16772	2.6 (0.25)	1.6 (0.23)	1.8 (0.26)
Drug abuse	16922	1.4 (0.15)	1.2 (0.19)	1.0 (0.20)
Drug dependence	17840	0.7 (0.14)	0.6 (0.15)	0.3 (0.11)
Mood disorder				
Major depressive disorder	15028	5.8 (0.33)	7.0 (0.55)	7.5 (0.50)
Bipolar I	17535	2.0 (0.20)	1.8 (0.23)	2.8 (0.29)
Anxiety disorders				
Panic disorder	16991	2.6 (0.26)	2.1 (0.26)	3.0 (0.31)
Social phobia	17166	1.9 (0.18)	1.6 (0.22)	2.2 (0.28)
Specific phobia	15951	3.1 (0.30)	3.0 (0.31)	3.1 (0.37)
Generalized anxiety	17181	4.3 (0.31)	4.1 (0.37)	5.6 (0.48)
Total				
Substance use disorder				
Alcohol abuse	23411	5.6 (0.33)	6.0 (0.37)	3.9 (0.31)
Alcohol dependence	28625	4.0 (0.24)	3.0 (0.20)	2.7 (0.25)
Drug abuse	29197	2.2 (0.18)	1.4 (0.16)	1.4 (0.20)
Drug dependence	31617	1.1 (0.14)	0.8 (0.11)	0.6 (0.11)
Mood disorder				
Major depressive disorder	27921	4.8 (0.23)	4.3 (0.27)	5.4 (0.33)
Bipolar I	31327	2.0 (0.17)	1.7 (0.15)	2.3 (0.20)

Disorder	Number of Respondents at Risk	Incidence During Follow-up Period		
		Healthy Weight % (SE)	Overweight % (SE)	Obese % (SE)
Anxiety disorders				
Panic disorder	30751	2.1 (0.19)	1.4 (0.14)	2.2 (0.19)
Social phobia	30797	1.7 (0.12)	1.3 (0.13)	1.8 (0.19)
Specific phobia	29263	2.7 (0.19)	2.2 (0.18)	2.4 (0.21)
Generalized anxiety	31017	3.4 (0.22)	2.6 (0.19)	4.0 (0.29)

Table 2

Adjusted Odds Ratios (AORs)* of BMI Status at Wave 1 Predicting Incident DSM-IV Substance Use, Mood, and Anxiety Disorders During the Follow-Up Period by Sex

Disorder	Men		Women		Total
	Overweight vs. Healthy Weight AOR ^a (95% CI)	Obese vs. Healthy Weight AOR (95% CI)	Overweight vs. Healthy Weight AOR (95% CI)	Obese vs. Healthy Weight AOR (95% CI)	Overweight vs. Healthy Weight AOR (95% CI)
Substance use disorder[†]					
Alcohol abuse	1.3 (1.04–1.64)	0.9 (0.63–1.14)	0.9 (0.72–1.23)	0.6 (0.45–0.88)	1.2 (1.00–1.39)
Alcohol dependence	0.9 (0.70–1.10)	0.7 (0.52–0.97)	0.7 (0.50–1.02)	0.7 (0.49–1.06)	0.8 (0.68–1.00)
Drug abuse	0.7 (0.44–0.96)	0.7 (0.41–1.03)	1.1 (0.76–1.63)	0.8 (0.51–1.35)	0.8 (0.59–1.03)
Drug dependence	0.8 (0.48–1.20)	0.6 (0.30–1.03)	1.2 (0.64–2.07)	0.4 (0.21–0.91)	0.8 (0.58–1.22)
Mood disorder					
Major depressive disorder	0.8 (0.58–1.08)	1.0 (0.69–1.39)	1.3 (1.02–1.56)	1.2 (1.02–1.51)	1.1 (0.90–1.24)
Bipolar I	1.0 (0.66–1.68)	0.9 (0.59–1.40)	0.9 (0.63–1.25)	1.0 (0.71–1.37)	0.9 (0.73–1.23)
Anxiety disorder					
Panic disorder	0.8 (0.52–1.26)	1.0 (0.64–1.52)	0.8 (0.60–1.13)	1.0 (0.72–1.37)	0.8 (0.63–1.07)
Social phobia	0.8 (0.51–1.32)	1.0 (0.62–1.63)	0.9 (0.67–1.30)	1.0 (0.69–1.38)	0.9 (0.66–1.15)
Specific phobia	0.8 (0.55–1.25)	0.8 (0.53–1.29)	1.1 (0.84–1.42)	1.1 (0.79–1.49)	1.0 (0.79–1.17)
Generalized anxiety	0.9 (0.65–1.32)	1.9 (0.80–1.80)	0.9 (0.75–1.20)	1.1 (0.83–1.39)	0.9 (0.74–1.13)

Note: **Bolded** figures are significant.

* AOR = Odds ratios adjusted for: Wave 1 sociodemographic characteristics; other lifetime psychiatric disorders; alcohol, drug, and nicotine use and disorders; past-year, health care provider-diagnosed medical conditions; past-year stressful life events; moving or acquiring a new roommate; fired/laid off from a job; unemployed and looking for a job for more than a month; trouble with a boss/coworker; changing jobs; separated, divorced or breaking off a serious relationship; serious problems with neighbor/friend/relative; major financial crisis including bankruptcy; serious trouble with police or the law; something stolen or property intentionally damaged; death of a close friend/family member; physical attack on family member/close friend; and any family member's/close friend's serious trouble with the police or law.

[†] For substance use disorders, Wave 1 lifetime use of the specific target substance is not included as a covariate (e.g., lifetime alcohol consumption for incident alcohol abuse and dependence).

Table 3

Prevalences and Unadjusted Odds Ratios of Wave 1 Past-Year DSM-IV Substance Use, Mood, and Anxiety Disorders Predicting BMI Transition During the Follow-Up Period by Sex

Disorder	Percentages of Respondents With and Without Each Disorder Who:					
	Remained in Same BMI Category % (SE)	Moved into Lower BMI Category * % (SE)	Moved into Higher BMI Category † % (SE)	With Disorder	Without Disorder	Without Disorder
Men					(n=10,724)	(n=2,179)
Substance use disorder						
Alcohol abuse	76.5 (1.66)	75.8 (0.51)	7.7 (0.96)	8.6 (0.32)	15.8 (1.50)	15.6 (0.40)
Alcohol dependence	72.9 (1.78)	76.0 (0.52)	10.0 (1.26)	8.4 (0.32)	17.1 (1.51)	15.6 (0.41)
Drug abuse	72.9 (3.44)	75.9 (0.51)	10.8 (2.14)	8.4 (0.31)	16.3 (2.85)	15.6 (0.40)
Drug dependence	77.8 (4.79)	75.9 (0.49)	13.9 (4.13)	8.4 (0.30)	8.4 (3.00)	15.7 (0.39)
Mood disorder						
Major depressive disorder	74.4 (2.50)	75.9 (0.51)	7.4 (1.20)	8.5 (0.31)	18.2 (2.23)	15.6 (0.40)
Bipolar I	75.9 (3.31)	75.9 (0.50)	9.4 (2.38)	8.5 (0.31)	14.7 (2.69)	15.7 (0.39)
Anxiety disorders						
Panic disorder	70.6 (3.62)	75.9 (0.50)	8.2 (2.55)	8.5 (0.31)	21.2 (3.45)	15.6 (0.40)
Social phobia	77.8 (2.57)	75.8 (0.50)	8.4 (1.63)	8.5 (0.31)	13.8 (1.99)	15.7 (0.40)
Specific phobia	77.1 (1.95)	75.8 (0.50)	8.3 (1.35)	8.5 (0.31)	14.6 (1.53)	15.7 (0.40)
Generalized anxiety	74.8 (3.59)	75.9 (0.50)	10.7 (2.39)	8.5 (0.31)	14.5 (2.97)	15.7 (0.40)
Women					(n=1,694)	(n=3,045)
Substance use disorder						
Alcohol abuse	78.1 (2.08)	74.9 (0.43)	7.2 (1.52)	9.4 (0.28)	14.8 (1.64)	16.7 (0.40)
Alcohol dependence	73.1 (2.84)	74.0 (0.43)	9.0 (1.65)	9.4 (0.28)	17.9 (2.50)	16.6 (0.39)
Drug abuse	75.8 (5.19)	74.0 (0.42)	10.8 (4.78)	9.4 (0.27)	13.5 (3.47)	16.7 (0.39)
Drug dependence	81.5 (5.08)	74.0 (0.42)	5.2 (2.85)	9.4 (0.28)	13.4 (4.35)	16.6 (0.39)
Mood disorder						
Major depressive disorder	75.7 (1.51)	73.9 (0.45)	9.5 (0.96)	9.4 (0.30)	14.8 (1.33)	16.8 (0.41)
Bipolar I	76.4 (2.47)	73.9 (0.43)	10.2 (1.68)	9.4 (0.28)	13.5 (2.07)	16.7 (0.40)
Anxiety disorder						
Panic disorder	73.7 (2.28)	74.0 (0.43)	9.9 (1.61)	9.4 (0.28)	16.5 (1.97)	16.6 (0.40)

Disorder	Percentages of Respondents With and Without Each Disorder Who:					
	Remained in Same BMI Category % (SE)	Moved into Lower BMI Category * % (SE)	Moved into Higher BMI Category † % (SE)	With Disorder	Without Disorder	Without Disorder
Social phobia	77.0 (2.14)	73.9 (0.43)	9.6 (1.41)	13.4 (1.60)	9.4 (0.28)	16.7 (0.41)
Specific phobia	77.5 (1.16)	73.6 (0.45)	8.9 (0.85)	13.7 (0.99)	9.4 (0.29)	16.9 (0.41)
Generalized anxiety	75.1 (2.50)	74.0 (0.43)	9.5 (1.62)	15.4 (2.22)	9.4 (0.29)	16.7 (0.39)
Total		(n=23,993)	(n=2,981)			(n=5,224)
Substance use disorder						
Alcohol abuse	76.9 (1.31)	74.8 (0.37)	7.5 (0.79)	15.6 (1.17)	9.0 (0.23)	16.2 (0.29)
Alcohol dependence	73.0 (1.43)	75.0 (0.36)	9.7 (0.98)	17.3 (1.36)	8.9 (0.23)	16.1 (0.29)
Drug abuse	73.8 (2.68)	75.0 (0.36)	10.8 (1.95)	15.4 (2.21)	8.9 (0.23)	16.2 (0.28)
Drug dependence	78.8 (3.66)	74.9 (0.35)	11.3 (3.04)	9.8 (2.49)	8.9 (0.22)	16.2 (0.28)
Mood disorder						
Major depressive disorder	75.3 (1.25)	74.9 (0.38)	8.8 (0.76)	16.0 (1.13)	8.9 (0.23)	16.2 (0.29)
Bipolar I	76.2 (2.08)	74.9 (0.36)	9.8 (1.45)	14.0 (1.76)	8.9 (0.23)	16.2 (0.29)
Anxiety disorders						
Panic disorder	72.7 (1.91)	75.0 (0.36)	9.3 (1.31)	18.0 (1.72)	8.9 (0.22)	16.1 (0.29)
Social phobia	77.3 (1.59)	74.9 (0.36)	9.1 (1.07)	13.5 (1.20)	8.9 (0.22)	16.2 (0.29)
Specific phobia	77.3 (1.03)	74.8 (0.37)	8.7 (0.70)	14.0 (0.88)	9.0 (0.24)	16.3 (0.29)
Generalized anxiety	75.0 (2.02)	74.9 (0.36)	9.9 (1.26)	15.2 (1.79)	8.9 (0.23)	16.7 (0.28)

Note: **Bolded** figures are significant.

* Moving between Wave 1 and Wave 2 from healthy weight to underweight; overweight to healthy weight or underweight; or obese to overweight, healthy weight, or underweight.

† Moving between Wave 1 and Wave 2 from healthy weight to overweight or obese, or from overweight to obese.

Table 4

Adjusted Odds Ratios (AOR)^{*} of Wave 1 Past-Year DSM-IV Specific Substance Use, Mood, and Anxiety Disorders Predicting BMI Transition during the Follow-Up Period by Sex

Disorder	Men		Women		Total
	Moved into Lower BMI Category [†] vs. Remained in Same Category AOR ^c (95% CI)	Moved into Higher Category [‡] vs. Remained in Same Category ^b AOR (95% CI)	Moved into Lower BMI Category ^a vs. Remained in Same Category ^a AOR (95% CI)	Moved into Higher Category ^b vs. Remained in Same Category ^b AOR (95% CI)	
Substance use disorder[§]					
Alcohol abuse	1.0 (0.74–1.34)	0.9 (0.75–1.20)	0.8 (0.51–1.35)	0.8 (0.59–1.03)	0.9 (0.73–1.07)
Alcohol dependence	1.4 (0.99–1.95)	1.0 (0.78–1.25)	1.1 (0.72–1.69)	1.0 (0.72–1.50)	1.0 (0.83–1.26)
Drug abuse	1.4 (0.83–2.22)	0.9 (0.57–1.46)	1.3 (0.47–3.77)	0.7 (0.38–1.25)	0.9 (0.59–1.23)
Drug dependence	1.6 (0.78–3.28)	0.4 (0.19–0.99)	0.5 (0.16–1.80)	0.8 (0.34–1.69)	0.5 (0.30–0.97)
Mood disorder					
Major depressive disorder	0.9 (0.60–1.24)	1.1 (0.81–1.57)	1.0 (0.79–1.34)	0.9 (0.68–1.09)	0.9 (0.79–1.13)
Bipolar I	1.0 (0.57–1.82)	0.9 (0.58–1.42)	1.1 (0.75–1.71)	0.8 (0.54–1.14)	0.8 (0.62–1.14)
Anxiety disorder					
Panic disorder	1.0 (0.48–2.22)	1.4 (0.88–2.12)	1.1 (0.72–1.55)	1.0 (0.77–1.41)	1.2 (0.89–1.48)
Social phobia	1.0 (0.63–1.54)	0.8 (0.56–1.16)	1.0 (0.73–1.45)	0.9 (0.64–1.20)	0.8 (0.67–1.06)
Specific phobia	1.0 (0.67–1.39)	0.9 (0.69–1.15)	0.9 (0.73–1.16)	0.8 (0.66–0.95)	0.8 (0.70–0.96)
Generalized anxiety	1.3 (0.76–2.23)	1.0 (0.57–1.60)	1.0 (0.67–1.53)	1.0 (0.70–1.47)	1.0 (0.73–1.32)

Note: Results derived from multinomial logistic regression analyses.

[†] Moving between Waves 1 and 2 from healthy weight to underweight; overweight to healthy weight or underweight; or obese to overweight, healthy weight, or underweight.

[‡] Moving between Waves 1 and 2 from healthy weight to overweight or obese, or from overweight to obese.

^{*} AOR = Odds ratios adjusted for: Wave 1 sociodemographic characteristics; other Wave 1 past-year psychiatric disorders; Wave 1 past-year alcohol, drug, and nicotine use and disorders; Wave 1 past-year, health care provider-diagnosed medical conditions and stressful life events; and any other psychiatric disorder, any alcohol use, any nicotine use, any drug use, and any prescribed medication for the target mood or anxiety disorder or other mood or anxiety disorders during the intervening period between Waves 1 and 2.

[§] For analyses of substance use disorders, Wave 2 past-year use of the substance of interest is not included as a covariate (e.g., past-year alcohol consumption for prediction of change in BMI status by past-year alcohol abuse and dependence).

Table 5

Adjusted Associations of Wave 1 Past-Year DSM-IV Specific Substance Use, Mood, and Anxiety Disorders with Change in BMI during the Follow-Up, by Sex

Disorder	Men	Women	Total
	Adjusted* Change in BMI β (95% CI)	Adjusted Change in BMI β (95% CI)	Adjusted Change in BMI β (95% CI)
Substance use disorder[†]			
Alcohol abuse	-0.03 (-0.25 – 0.18)	-0.09 (-0.41 – 0.24)	-0.07 (-0.24 – 0.11)
Alcohol dependence	-0.29 (-0.57 – 0.02)	0.31 (-0.07 – 0.70)	-0.09 (-0.31 – 0.13)
Drug abuse	-0.32 (-0.81 – 0.17)	-0.07 (-0.75 – 0.60)	-0.22 (-0.61 – 0.16)
Drug dependence	-0.62 (-1.18 – -0.06)	-0.32 (-1.45 – 0.81)	-0.50 (-1.02 – 0.01)
Mood disorder			
Major depressive disorder	0.19 (-0.09 – 0.48)	-0.10 (-0.36 – 0.17)	0.01 (-0.19 – 0.21)
Bipolar I	-0.09 (-0.52 – 0.34)	-0.21 (-0.63 – 0.21)	-0.15 (-0.47 – 0.17)
Anxiety disorder			
Panic disorder	0.34 (-0.16 – 0.84)	-0.15 (-0.53 – 0.22)	0.01 (-0.29 – 0.30)
Social phobia	-0.08 (-0.35 – 0.18)	-0.23 (-0.55 – 0.09)	-0.17 (-0.39 – 0.06)
Specific phobia	-0.10 (-0.32 – 0.13)	-0.04 (-0.22 – 0.14)	-0.06 (-0.21 – 0.08)
Generalized anxiety	-0.16 (-0.56 – 0.25)	-0.23 (-0.61 – 0.15)	-0.20 (-0.49 – 0.08)

Note: Results derived from multiple linear regression analyses.

* Mean change in BMI between Waves 1 and 2 associated with Wave 1 past-year prevalence of index disorder, adjusted for Wave 1 sociodemographic characteristics; other Wave 1 past-year psychiatric disorders; Wave 1 past-year alcohol, drug, and nicotine use and disorders; Wave 1 past-year, health care provider-diagnosed medical conditions and stressful life events; and any other psychiatric disorder, any alcohol use, any nicotine use, any drug use, and any prescribed medication for the target mood or anxiety disorder or other mood or anxiety disorders during the intervening period between Waves 1 and 2.

[†] For analyses of substance use disorders, Wave 2 past-year use of the substance of interest is not included as a covariate (e.g., past-year alcohol consumption for prediction of change in BMI status by past-year alcohol abuse and dependence). In addition, analyses of alcohol dependence are not adjusted for alcohol abuse, nor vice versa; similarly, for drug dependence and drug abuse.