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Antisocial Behavioral Syndromes and Body Mass Index Among Adults in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions

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Abstract

Objective—To describe associations of antisocial behavioral syndromes, including DSM-IV antisocial personality disorder (ASPD) and conduct disorder without progression to ASPD (“CD only”), and syndromal antisocial behavior in adulthood without CD before age 15 (AABS, not a codable DSM-IV disorder), with body mass index (BMI) status in the general U.S. adult population.

Methods—This report is based on the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (n=43,093, response rate=81%). Respondents were classified according to whether they met criteria for ASPD, AABS, “CD only,” or no antisocial syndrome, and on current BMI status based on self-reported height and weight. Associations of antisocial syndromes with BMI status were examined using multinomial logistic regression.

Results—Among men, antisociality was not associated with BMI. Among women, ASPD was significantly associated with overweight and extreme obesity; AABS was associated with obesity and extreme obesity; and “CD only” was significantly associated with overweight, obesity, and extreme obesity.

Conclusions—Assessment of antisocial features appears warranted in overweight, obese, and extremely obese women, and assessment of BMI status appears indicated in antisocial women. Prevention and treatment guidelines for overweight and obesity may need revision to address comorbid antisociality, and interventions targeting antisociality may need to include attention to weight concerns.

Keywords

Antisocial personality disorder; conduct disorder; body mass index; overweight; obesity

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Introduction

Antisocial personality disorder (ASPD) affects 3 to 5 percent of adults in the United States [1-3]. According to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders – Third Edition* (DSM-III) [4], the *Diagnostic and Statistical Manual of Mental Disorders – Third Edition, Revised* (DSM-III-R) [5], and the *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition* (DSM-IV) [6], the ASPD diagnosis requires both conduct disorder (CD) with onset before age 15 years, and a persistent pattern of irresponsible, impulsive, aggressive, and remorseless behaviors thereafter. ASPD is associated with substantial burden on affected individuals, their families, and the larger society, both in its own right and because of its high comorbidity with mood [2,3,7], anxiety [2,3,7,8], substance use [1-3], and other personality [9] disorders. In part because of its comorbidity with substance use and other psychiatric disorders, ASPD is also associated with increased morbidity and mortality related to injuries [10-12], sexually transmitted diseases including HIV/AIDS [13-16], and chronic diseases such as diabetes, liver disease, and arthritis [17-19].

Another potential contributor to the association between ASPD and chronic disease is the relationship of ASPD to overweight and obesity, the prevalences of which have increased markedly over the past several decades [20,21]. Among morbidly obese patients presenting to a bariatric surgery clinic to be evaluated for vertical banded gastroplasty, Black et al. [22] found an elevated prevalence of DSM-III ASPD compared with age- and sex-matched community controls. More recently, a cross-sectional study of a large, nationally representative general population sample of U.S. adults [23] found elevated odds of overweight (body mass index [BMI] of 25.0-29.9 kg/m²) and extreme obesity (BMI ≥ 40 kg/m²) among female, but not male, respondents with versus without DSM-IV ASPD. A recent longitudinal study [24] of a U.S. community sample also found antisocial traits reported either by respondents or by their mothers about them at mean age 14 to 22 years to be significantly, albeit modestly (OR=1.3), associated with obesity (BMI ≥ 30 kg/m²) at mean age 33 years among respondents without previous histories of obesity. Similarly, in a 20-year longitudinal study of a community-based Swiss cohort originally ascertained in early adulthood, antisocial traits were significantly associated with overweight (BMI > 25 kg/m²) [25].

To our knowledge, associations of fully diagnosable CD without progression to ASPD (hereinafter, “CD only”) with measures of overweight and obesity have not been studied. However, as with fully diagnosable ASPD and antisocial traits, CD symptoms rated by parents and teachers have been associated in cross-sectional studies conducted in both the U.S. and Australia with overweight and obesity among boys [26,27]. Moreover, CD symptoms assessed in a U.S. community sample at mean age 14 years predicted obesity, (≥ the 80th percentile of the BMI distribution: 25.86 kg/m² for women and 27.31 kg/m² for men), in both sexes at mean age 22 years [28]. Similarly, disruptive behavior disorders, including CD as well as attention-deficit/hyperactivity and oppositional defiant disorders, diagnosed before age 16 years predicted significantly higher BMI z-scores as assessed longitudinally in both sexes from childhood to early and middle adulthood (ages 28 to 38 years) [29].

As has been documented in both clinical [30-36] and epidemiologic [1,37-39] samples, individuals with syndromal levels of antisocial behavior in adulthood frequently do not report symptomatic behaviors sufficient to meet criteria for CD before age 15 (adult antisocial behavioral syndrome, or AABS, not a codable disorder in DSM-IV). Individuals with AABS differ little from those with fully diagnosable ASPD on antisocial symptomatology in adulthood and psychiatric comorbidity [33,34,36,38,39,42]. However, to our knowledge, associations between AABS or antisocial traits specifically with onset after age 15, and measures of overweight or obesity, have not yet been examined.

Because comparative data concerning associations of DSM-IV ASPD, “CD only,” and AABS with BMI have not previously been available from nationally representative epidemiologic samples, it remains unclear whether antisocial syndromes occurring at different points in the life course bear differential associations with BMI status in the general population. Regardless of whether full diagnostic criteria for any antisocial behavioral syndrome are met, onsets of antisociality early in life, particularly before age 10, are associated with more severe and persistent antisocial behavior, as well as increased risks for a wide range of adverse mental and physical health outcomes, compared to later onsets of antisocial behavior [43-45]. Similarly, onsets of overweight and obesity in childhood are associated with increased risks of persistence of obesity with its well-documented adverse physical health outcomes into adulthood [46-49]. Thus, differential associations with BMI status based on developmental phases of onset and persistence of antisociality over the life course could indicate a need to tailor prevention and treatment approaches to both antisocial syndromes and BMI status, including underweight as well as overweight, obesity, and extreme obesity.

The prevalences of antisocial behavioral syndromes show male preponderances [1,50-52]. Conversely, the prevalence of obesity ($BMI \geq 30 \text{ kg/m}^2$) and to a lesser extent extreme obesity ($BMI \geq 40 \text{ kg/m}^2$) show female preponderances among adults, whereas the prevalence of overweight but not obesity ($25.0 \text{ kg/m}^2 \leq BMI < 30 \text{ kg/m}^2$) shows a male preponderance [53,54]. The observed sex differentials in antisocial syndromes could reflect genuine male-female differences in rates of antisociality. However, the diagnostic validity of both CD and ASPD among females has been questioned. DSM criteria for these conditions rely heavily on overtly aggressive behaviors that are far more prevalent in males, while giving relatively limited attention to covert acts such as truancy, lying, and relational aggression that are asserted to be more typical manifestations of antisociality in women [55-57]. If the diagnostic criteria for CD and ASPD are biased with respect to sex, then the associations between these syndromes as they are now defined and BMI, the potential correlates or modifiers of these associations, and the implications of these associations for prevention and treatment of overweight and obesity, may also differ importantly by sex.

Accordingly, this report examines associations of antisocial syndromes with BMI status among adult respondents in Wave 1, conducted in 2001-2002, of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) [58,59]. The NESARC is the first major psychiatric epidemiology survey to employ DSM-IV criteria. With a nationally representative sample of 43,093 adult respondents, the NESARC allows precise estimates of the prevalences of antisocial syndromes, BMI status, and relevant sociodemographic and clinical correlates including, tobacco, alcohol, and drug use and associated disorders, and lifetime psychiatric comorbidity, by antisocial syndrome. In addition, the large number of respondents both with and without antisocial syndromes allows examination of whether patterns of association between antisocial syndromes and BMI status vary by sex.

Methods

Sample

The entire research protocol, including informed consent procedures, was approved by the institutional review board of the U.S. Census Bureau and the U.S. Office of Management and Budget. As described in detail elsewhere [60,61], the 2001-2002 NESARC was conducted by NIAAA and based on a representative sample of the general U.S. population. The NESARC's target population was non-institutionalized adults, 18 years and older, residing in households and group quarters. All potential respondents who consented to participate after being informed in writing about the nature of the NESARC, the statistical uses of the survey data, the voluntary nature of their participation, and the federal laws that rigorously provide for the strict confidentiality of identifiable survey information were interviewed. Face-to-face interviews

were conducted with 43,093 respondents, yielding a response rate of 81%. Blacks, Hispanics, and young adults 18 to 24 years of age were oversampled, with data adjusted for oversampling and household- and person-level nonresponse. The weighted data were then further adjusted to represent the U.S. civilian population based on the 2000 Census.

Assessments

The diagnostic interview used in the NESARC was the NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version [62]. Developed to advance measurement of substance use and mental disorders in large-scale surveys, the AUDADIS-IV is a fully structured instrument designed for experienced nonclinician interviewers.

Antisocial behavioral syndromes—An AUDADIS-IV diagnosis of ASPD required the specified numbers of DSM-IV CD symptoms with onset before, and adult antisocial behaviors since, age 15 years. Consistent with DSM-IV [6], at least 1 CD symptom before age 15 years must have caused social, academic, or occupational dysfunction. Respondents were classified as having “CD only” if they met DSM-IV criteria for CD but not ASPD. AABS was operationalized as meeting all criteria for ASPD except CD before age 15. Respondents who did not meet criteria for ASPD, AABS, or “CD only” were considered to have no antisocial syndrome.

Body mass index—Respondents were asked to self-report their height and weight. BMI status was defined according to standards developed by the National Heart, Lung and Blood Institute [63]: underweight, BMI < 18.5 kg/m²; healthy weight, 18.5-24.9 kg/m²; overweight, 25.0-29.9 kg/m²; obesity, 30.0-39.9 kg/m²; and extreme obesity, ≥ 40 kg/m². Self-reported weight is highly correlated with measured weight ($r \approx 0.86$) and largely independent of height ($r \approx -0.03$) [64]. In addition, recent evidence suggests that bias in measurement of BMI by self-report is unlikely to influence conclusions about associations in epidemiologic studies [65-68]. Further, we computed correlation coefficients by sex, 5 racial/ethnic groups, and 6 age groups, measuring the association between NESARC BMI data and comparable data derived from the combined 1999-2000 National Health and Nutrition Examination Survey [69], in which respondents were weighed and measured as part of the survey protocol. Correlations of BMI were 0.76 for healthy weight, 0.75 for overweight, 0.84 for obesity, and 0.72 for extreme obesity [23].

Drug and alcohol use disorder diagnoses—AUDADIS-IV questions operationalize DSM-IV criteria for drug-specific abuse and dependence for 10 drug classes that are aggregated in this report, as well as alcohol use disorders and nicotine dependence. Consistent with DSM-IV, lifetime AUDADIS-IV diagnoses of drug abuse required ≥ 1 of the 4 criteria for abuse either in the 12 months preceding the interview or previously. AUDADIS-IV drug dependence diagnoses required ≥ 3 of the 7 DSM-IV dependence criteria to be met for the same specific drug class during the past year or prior. For prior diagnoses of drug dependence, ≥ 3 criteria must have occurred in association with the same drug class within a 1-year period, following DSM-IV. Alcohol abuse and dependence and nicotine dependence diagnoses followed the same algorithms.

Tobacco, alcohol, and drug consumption—Because the vast majority of nicotine in the United States is consumed as cigarettes [70], tobacco use was estimated as the number of cigarettes per day during the past year for current smokers, and for ex-smokers’ most recent year of smoking. Alcohol consumption during the period of heaviest lifetime drinking was assessed as the average daily volume (ADV) of ethanol ingested during that period. For respondents who never drank more heavily than in the past year, past-year consumption measures reflected their heaviest drinking. For both the past year and the period of heaviest

drinking, respondents were asked to indicate their overall frequency of drinking, their typical and largest numbers of drinks per day, the frequency with which they drank their largest number of drinks and the frequency of drinking five or more drinks in a day, considering all beverage types together. For the past year, comparable series of questions, with the inclusion of drink size and main brand consumed, were asked for each individual beverage type (coolers, beer, wine or spirits); for period of heaviest drinking, respondents were asked an additional question on the main type of beverage they drank during that period. ADV of ethanol intake was estimated on the basis of quantity, frequency, and drink size for all beverages combined, incorporating information for atypically heavy drinking days. For individuals whose heaviest consumption was in the past year, drink size (ounces of beverage times the ethanol content by volume of the main brand consumed) was estimated as a weighted function of the drink sizes for the individual beverage types. For those whose heaviest consumption was not in the past year, the drink size for their main beverage type was used if available from past-year information; otherwise, a standard drink size was assumed. Drug use was quantified as the frequency in days per year of use of the drug respondents reported they used most frequently, during the period of heaviest lifetime consumption.

Mood and anxiety disorders—As described in detail elsewhere [71], anxiety (panic disorder with and without agoraphobia, social and specific phobias, and generalized anxiety disorder) and mood (major depressive disorder, dysthymia, bipolar I, and bipolar II) diagnoses in this report are DSM-IV primary, or independent, diagnoses. In DSM-IV (p. 192), “primary” excludes mental disorders that are substance induced or due to a general medical condition [6]. All mood and anxiety disorders met the DSM-IV criterion for clinical significance; major depressive disorder diagnoses also ruled out bereavement.

Other personality disorders—AUDADIS-IV assessments of DSM-IV personality disorders (PDs) have been presented previously [7,9,59]. In addition to ASPD, these include avoidant, dependent, obsessive-compulsive, paranoid, schizoid, and histrionic PDs. DSM-IV PD diagnoses require evaluation of long-term patterns of functioning. AUDADIS-IV PD diagnoses were made accordingly. Respondents were asked a series of 64 PD symptom questions about how they felt or acted *most* of the time, *throughout* their lives, *regardless* of the situation or whom they were with. Respondents were instructed not to include symptoms occurring only when they were depressed, manic, anxious, drinking heavily, using medicines or drugs, experiencing withdrawal symptoms, or physically ill. For each reported symptom, respondents were queried to ascertain whether they experienced distress or social or occupational dysfunction resulting from the symptom.

To receive a DSM-IV PD diagnosis, respondents needed to endorse the required number of DSM-IV symptoms for the specific PD, with ≥ 1 symptom causing distress or social or occupational impairment. Administration time was minimized by the concise explanation, repeated throughout, of the criteria common across PDs (pervasiveness, inflexibility, stability over the lifetime), and by assessing only a subset of PDs. Borderline, schizotypal, and narcissistic PDs were included in Wave 2.

General medical conditions—Respondents were asked whether a physician or other health professional told them during the past year that they had 11 general medical conditions, spanning cardiovascular (atherosclerosis, hypertension, tachycardia, myocardial infarction, angina pectoris, or other form of heart disease), hepatic (cirrhosis or other liver disease), other gastrointestinal (stomach ulcer or gastritis), and arthritic diseases.

Physical health-related disability and impairment—Past-month physical health-related disability and impairment were assessed using the Physical Component Summary Scale

(PCS) of the SF-12, version 2 (SF-12v2), a reliable and valid measure of health-related quality of life, disability, and impairment used in general population surveys [72].

Reliability and validity of AUDADIS-IV diagnoses and tobacco, alcohol, and drug consumption measures—As reported in detail elsewhere [71], reliability and validity were good to excellent for all substance use disorders [1,60,73-80], and fair to good for mood, anxiety, and personality disorders, including ASPD [1,7,9,59-61,71,73,74,81,82]. Measures of tobacco, alcohol, and drug use utilized in this study also displayed good to excellent reliability [60,75-77,83,84].

Statistical Analyses

The analysis sample for the present report excludes women pregnant at their NESARC interviews (n=453) and respondents with missing BMI data (n=1,423), leaving a total sample size of 41,217. BMI status and categorical covariates were compared by antisocial syndrome using standard contingency table approaches [85]. Where appropriate, continuous covariates were compared by antisocial syndrome, and assessed for sex by antisocial syndrome interactions, using normal theory analyses of variance. Continuous covariates with highly skewed distributions that could not be rendered approximately normal with transformations were converted into categorical variables based on their observed distributions. Categories were defined based on cutpoints chosen to balance variability with adequate subgroup sizes to permit meaningful analyses.

Multinomial logistic regression was used to examine associations of antisocial syndromes with BMI status, adjusted for the potentially confounding effects of age, sex, race/ethnicity, marital status, education, past-year income, region, urbanicity, number of past-year medical conditions, PCS score, comorbid Axis I and II psychiatric diagnoses, and tobacco, alcohol, and drug consumption [86]. The referent category of antisocial syndrome was the group with no antisocial syndrome in either childhood or adulthood and the referent group for BMI status consisted of respondents with healthy weight. β coefficients from the logistic models were exponentiated to yield odds ratios (ORs), and 95% confidence intervals (CIs) were estimated. It is important to note that the ORs reported herein for ASPD differ from those reported by Pickering et al. [23] because the latter examined BMI status in respondents with versus without ASPD, whereas the current analyses compare BMI status in groups defined by ASPD, AABS, and “CD only,” with BMI status among respondents with no antisocial syndrome. The interaction of sex by antisocial syndrome was tested with an α to stay of 0.05. All analyses were conducted using SUDAAN [87], a software program that uses Taylor series linearization to make adjustments for the NESARC’s complex sampling design.

Results

The overall prevalence \pm standard error of ASPD among respondents with BMI data who were not pregnant at interview was 3.7% \pm 0.15, 5.6% \pm 0.26 among men and 1.9% \pm 0.12 among women. AABS occurred in 12.6% \pm 0.38 of the sample, 16.8% \pm 0.53 among men and 8.6% \pm 0.32 among women; “CD only,” in 1.1% \pm 0.07 in the total sample, 1.5% \pm 0.13 among men and 0.7% \pm 0.06 among women. As shown in Table 1, the highest rates of all antisocial behavioral syndromes were generally found among obese and extremely obese respondents. Conversely, as shown in Table 2, the highest rates of extreme obesity were found in the total sample, and among female respondents, with ASPD and “CD only.” Among male respondents, the highest rates of extreme obesity were observed in the group with ASPD. The lowest rates of obesity were found among respondents with no antisocial behavioral syndrome; this was also the case for extreme obesity, except that men with “CD only” demonstrated the same prevalence as men with no antisocial syndrome.

Sociodemographic characteristics of the total NESARC sample by antisocial syndrome are described in detail elsewhere [1] and did not change when we excluded pregnant women and respondents with missing BMI data. Statistically significant associations were observed between antisocial syndromes and all examined sociodemographic characteristics. In brief, respondents with ASPD were most likely and those with no antisocial syndrome least likely to be male, in the 3 youngest age groups (18-29, 30-44, and 45-64 years), of Native American race/ethnicity, with a high school education or less, with past-year income less than \$35,000. Conversely, respondents with no antisocial syndrome were most likely to be female, 65 years or older, most likely to be married or cohabiting, or widowed, separated, or divorced, most likely to live in the Northeast or South, and least likely to have been employed in the past year. Respondents with “CD only” were least likely to be of non-Hispanic White but most likely to be of Hispanic race/ethnicity, reported the highest past-year personal income and were most likely to live in the Midwest and in urban areas.

Because a statistically significant ($p < 0.05$) sex by antisocial syndrome interaction was observed, all associations of antisocial syndromes with BMI status are described separately for men and women. As shown in Table 3, antisocial syndrome was not associated with BMI status for men, except for a modest inverse relationship in the unadjusted analysis (OR=0.7, 95% CI=0.59-0.84) between ASPD and overweight, and a modest positive relationship in the unadjusted analysis (OR=1.3, 95% CI 1.10-1.45) between AABS and obesity. The only significant ($p < 0.05$) pairwise differences between ORs, demonstrated by nonoverlapping 95% CIs, were observed in the unadjusted analysis, for ASPD with overweight versus AABS with overweight, and for AABS with overweight versus AABS with obesity.

Among women, antisocial syndrome was not associated with underweight. Significant associations of ASPD with overweight and extreme obesity, AABS with obesity and extreme obesity, and “CD only” with overweight, obesity, and extreme obesity, were observed. The only significant pairwise differences between ORs were observed in the unadjusted analysis for ASPD versus AABS with overweight, ASPD with obesity versus ASPD with extreme obesity, and AABS with obesity versus AABS with extreme obesity; and in the adjusted analysis for AABS with obesity versus “CD only” with extreme obesity. Nevertheless, in both unadjusted and adjusted analyses, the strongest relationships were observed between ASPD and extreme obesity, and between “CD only” and extreme obesity. As shown in the second panel of Table 3, adjustment for sociodemographic and clinical covariates did not materially alter either the patterns or the magnitudes of the observed associations except between ASPD and extreme obesity.

Discussion

Consistent with findings from previous epidemiologic [24,25] and clinical [22] studies, we found significant associations of antisociality with current overweight, obesity, and extreme obesity in a large, nationally representative sample. In the adjusted analysis, these associations were observed only in women, and largely independent of a wide range of potentially confounding sociodemographic, clinical, and substance use characteristics. While we identified no significant pairwise differences between adjusted ORs for antisocial syndromes within BMI categories, the ORs were 1.5 to 2 times as large in the 2 groups of women characterized by histories of CD as among the women with AABS.

The numerically stronger associations with elevated BMI in the 2 groups of women characterized by CD than among women with AABS are at variance with findings of more similarities than differences between individuals with ASPD and those with AABS in adult antisocial symptomatology and psychiatric comorbidity [1,33,34,36,38,39,42]. These findings suggest that, while antisociality over the life course may appropriately be characterized within

one or more continuous models of externalizing psychopathology [88-90], the optimal configurations of those models with respect to their ordering by severity of the antisocial behavioral syndromes along the continua might vary with the outcomes under study, or by sex of affected individuals. For example, in contrast to the findings we observed among women regarding associations of ASPD and “CD only” with the most severe excesses of weight, ASPD and AABS are associated with more severe clinical presentations of substance use disorders among adults of both sexes than “CD only” [1,40,41].

The present findings replicate, among women but not men, previous results from longitudinal studies [24,29] of associations of antisocial behavior problems in childhood or adolescence with overweight and obesity in adulthood. They also complement the evidence from longitudinal studies that suggests influences of psychosocial factors, including antisociality, on the development of overweight and obesity during critical periods of childhood and adolescence [24,28,29]. To our knowledge, however, except for the findings concerning ASPD reported by Pickering et al. [23] that were also based on the NESARC data, the specificity to women of the associations we observed of antisociality, particularly ASPD and “CD only,” with excess body mass among adults have not previously been reported.

While the longitudinal studies cited previously [24,28,29] indicated prediction of excess weight by antisociality, heterogeneity in these associations cannot be ruled out. Therefore, it is possible that either excess weight or its consequences, including weight-related teasing or bullying, might predict or contribute to CD or ASPD behaviors, particularly among a subset of women. In the U.S. and among other western cultures, social norms and pressures toward thinness are directed disproportionately toward women [91]. School-aged and adolescent girls who were overweight or obese more often reported weight-related teasing by family members, or by both peers and family members [92], and more often reported being victims of bullying [93], than boys in similar BMI categories. However, weight-related teasing was associated with low body satisfaction, low self-esteem, depressive symptomatology, and suicidality, to largely similar degrees, among adolescents of both sexes [92]. Physically or emotionally traumatized individuals might adopt antisocial behaviors as a means of seeking safety [94]. Nevertheless, to our knowledge, the contribution of weight-related teasing or bullying to the prediction or causation of CD or ASPD behaviors has not been investigated in overweight or obese individuals of either sex.

Previous work has identified greater burdens among antisocial women than among antisocial men of psychiatric morbidity, socioeconomic disadvantage, and life stress, especially childhood maltreatment [95-97]. Associations of similar individual-level adversity factors, including mood and anxiety disorders and suicidal ideation [23,98], socioeconomic disadvantage [23,54,99] and childhood abuse [100,101], with overweight and obesity in women have also been reported. In the NESARC, antisocial women were heavily overrepresented among the most socioeconomically disadvantaged subgroups and met criteria for mood, anxiety, and, to a lesser extent, additional personality disorders strikingly more often than their male counterparts (data available upon request). While we controlled for these variables in our adjusted analysis, the possibility that residual confounding, either by these factors or by other unmeasured characteristics, could explain some portion of the observed sex differentials in associations between antisociality and BMI status cannot be excluded. In addition, the life-course trajectory of socioeconomic position, which may be particularly adverse among antisocial women, appears to be a key predictor of adult BMI status [102-104], and may not be fully accounted for by control for past-year personal income, even in combination with lifetime educational attainment. However, we did not collect data on life-course trajectory of respondents' socioeconomic position, and our assessment of adverse childhood events and lifetime trauma history took place in Wave 2.

Increasing parity is associated with increased body mass [105-107]. Moreover, CD and conduct problems are associated with elevated risk for early childbearing [96,108], though the relationship of antisocial syndromes to total fertility in women has not been examined. We did not query respondents specifically about their total number of biological children, but did ascertain total number of children, including step, foster, and adopted children. Since total number of children is generally a reasonable proxy for parity, we used this variable to conduct sex-specific ancillary analyses in which we assessed reproductive history as a potential explanation of the associations of excess weight with ASPD and “CD only” in women. In bivariate analyses, women with ASPD and no antisocial syndrome reported similar mean numbers of children (2.1 ± 0.12 and 2.1 ± 0.02 , respectively), as did women with AABS (1.9 ± 0.05) and “CD only” (1.9 ± 0.15). Among men, those with no antisocial syndrome reported the largest (1.9 ± 0.02) mean number of children, followed by those with AABS (1.8 ± 0.04), ASPD (1.7 ± 0.08), and “CD only” (1.4 ± 0.14). As expected given the bivariate results, when number of children was added as a covariate to multivariable models run separately for men and women, it did not materially alter the patterns of associations between antisocial syndromes and BMI status.

In addition to associations at the individual level, relationships of both antisociality and BMI status to contextual factors have been identified. Low neighborhood and school socioeconomic status, and neighborhood indices of exposure to violent and property crime, have been associated with antisocial behavior in childhood and adolescence [109,110]. Similarly, neighborhood socioeconomic disadvantage is associated with characteristics related to overweight and obesity, including limited availability of supermarkets and grocery stores that sell nutritious foods such as fruits and vegetables, lack of safe environments in which to engage in physical activity, and high density of fast-food restaurants [111-116]. Evidence concerning associations of neighborhood-level adversities with antisocial behavior or obesity specifically among girls and women is limited. However, because individual- and family-level disadvantage is substantially correlated, and may be interactive, with community-level disadvantage [109-114,116], antisocial women, particularly those with onsets of antisociality in childhood or adolescence, may have especially high exposure to these contextual adversities both currently and over their lifespans. These cumulative, multilevel exposures could in part explain the associations we observed with BMI status. Nevertheless, we advance these potential interpretations of our findings with due recognition that they are speculative. Because the NESARC did not collect neighborhood- or community-level data, we are unable to examine associations of contextual disadvantage with antisociality or BMI status, or their interactions with individual-level variables of interest.

Limitations

Our findings and their possible interpretations should be viewed in light of the study’s limitations. In addition to the specific concerns raised previously, our data are cross-sectional, whereas longitudinal data are needed to characterize the temporality of associations between onsets and remissions of antisocial syndromes and BMI status over the life course, and to identify underlying mechanisms. Wave 2 of the NESARC, which was recently completed, will yield data bearing importantly on these questions in adults.

Some caution is also warranted in interpreting associations of lifetime psychopathology, including antisociality, with current BMI status [23]. In an attempt to address this concern, we refit the logistic model, replacing covariates denoting lifetime psychiatric comorbidity and substance consumption with their past-year counterparts; both patterns and magnitudes of the associations with antisociality remained unchanged.

Relatedly, we did not ask respondents whether they ceased their antisocial behaviors, but only if the behaviors occurred since age 15. Some antisocial individuals may have desisted long before they were interviewed, whereas others may have remained symptomatic. To our knowledge, whether “remitted” and “active” antisociality bear differential associations with BMI status has not been investigated. However, to the extent that the antisocial groups likely contained both remitted and nonremitted cases, and if remission status confers differential associations between antisociality and adverse BMI status, this might make both our estimates of associations between antisociality and BMI, and our comparisons of associations across antisocial syndromes, conservative.

Implications

Combined with previous findings [22-29] of relationships between antisocial behavior problems and excessive weight, our findings indicate the need to assess antisociality in overweight and obese patients, particularly women, to assess BMI status in patients with clinically significant antisocial features, and to direct interventions toward both conditions. Our findings also identify the need to improve the availability of developmentally and culturally appropriate prevention and treatment approaches that effectively address antisocial syndromes and adverse BMI status, and their co-occurrences, across the life course, particularly among women.

Several prevention curricula have demonstrated effectiveness against CD in children and adolescents [117-122]. However, evidence for the effectiveness of interventions to prevent and treat obesity has been more modest [123-125]. Because children’s and, to a lesser extent, adolescents’, patterns of food consumption are dependent on family context, effective approaches to obesity prevention may pose particular challenges for families of children and adolescents with CD, which are disproportionately of low socioeconomic status, headed by single parents, and characterized by inconsistent and coercive parent-offspring dynamics [126].

Many treatments for CD have demonstrated limited effectiveness and even iatrogenic effects [127]. Others, particularly those that address multiple facets of targeted children’s lives, have yielded more encouraging results [120]. Likewise, ASPD has responded poorly to treatment [128]. Its core features, including impulsivity and disregard for externally imposed norms and rules, may make self-management programs for food consumption and physical activity particularly challenging for both patients and their clinicians [129]. Future intervention research should focus on the identification of both individual and contextual characteristics that may improve or hinder antisocial patients’ responses to weight-management techniques, and ways to minimize the latter while harnessing the former in clinical practice. Further, while AABS is more prevalent than ASPD and “CD only” among adults in the general U.S. population [1], prevention and treatment approaches targeting AABS have not been described, perhaps because AABS is not currently a diagnosable DSM disorder. Future investigations should examine the extent to which patients with ASPD versus AABS respond similarly or differently to weight management protocols.

The specificity of the observed associations to women and the fact that the strongest relationships were observed in the 2 groups characterized by CD indicate the need for future longitudinal studies of underlying causal mechanisms that include individual-level biological and psychosocial variables as well as contextual characteristics of respondents’ neighborhoods and larger communities. Identification of causal pathways in the associations of excess body mass with developmental phase of onset of antisociality, and the sex specificity of those associations, may contribute importantly to the development of new preventive and therapeutic interventions for both antisociality and obesity. In addition to rigorous evaluation of the overall

effectiveness and acceptability of new interventions for antisociality and adverse BMI status, careful assessment of variations in their outcomes over clinically relevant subgroups is needed. Beyond those defined by sociodemographic characteristics and contextual factors, subgroups of interest might involve length of persistence of adverse BMI status, medical and psychiatric comorbidity, and family histories of antisocial syndromes, weight problems, and weight-related chronic diseases. Appropriate prioritization and sequencing of interventions targeting weight problems and comorbid antisociality in subgroups of patients, among whom both sets of conditions may be long entrenched by the time they are identified, should also be investigated.

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Table 1
Antisocial Behavioral Syndromes among NESARC Respondents by BMI Status and Sex^a

	BMI Status (kg/m ²)				
	Underweight (< 18.5)	Healthy weight (18.5-24.9)	Overweight (25.0-29.9)	Obese (30.0-39.9)	Extremely obese (≥ 40.0)
Males					
ASPD	3.3% (1.50)	6.4% (0.44)	4.6% (0.34)	6.4% (0.50)	8.4% (1.95)
AABS	16.0% (4.47)	16.1% (0.69)	15.9% (0.62)	19.4% (0.94)	19.6% (2.64)
"CD Only"	1.2% (1.21)	1.3% (0.19)	1.6% (0.16)	1.8% (0.32)	1.4% (0.73)
No antisocial behavioral syndrome	79.5% (4.72)	76.2% (0.86)	77.9% (0.76)	72.5% (1.06)	70.6% (3.16)
Females					
ASPD	2.1% (0.70)	1.4% (0.15)	2.1% (0.21)	2.2% (0.25)	5.2% (1.16)
AABS	9.0% (1.56)	7.9% (0.40)	7.8% (0.44)	10.1% (0.64)	14.5% (1.45)
"CD Only"	0.6% (0.34)	0.5% (0.08)	0.8% (0.15)	0.8% (0.16)	1.8% (0.72)
No antisocial behavioral syndrome	88.3% (1.73)	90.3% (0.48)	89.2% (0.1)	86.9% (0.74)	78.5% (1.70)
Total					
ASPD	2.3% (0.64)	3.4% (0.21)	3.6% (0.22)	4.3% (0.28)	6.3% (1.02)
AABS	10.3% (1.53)	11.3% (0.43)	12.7% (0.45)	14.8% (0.62)	16.3% (1.40)
"CD Only"	0.7% (0.35)	0.8% (0.09)	1.3% (0.12)	1.3% (0.19)	1.7% (0.52)
No antisocial behavioral syndrome	86.7% (1.60)	84.5% (0.52)	82.5% (0.55)	79.5% (0.74)	75.7% (1.61)
p-values					
Antisocial syndrome					<0.0001
Sex * antisocial syndrome interaction					0.0051

^a Respondents with missing height or weight information and women pregnant at the time of their NESARC interviews were excluded.

^b ASPD: antisocial personality disorder.

^c AABS: adult antisocial behavior without conduct disorder before age 15 years.

^d "CD Only": conduct disorder without adult antisocial behavior

Table 2

BMI Status among NESARC Respondents by Antisocial Behavioral Syndrome and Sex^a

	Males (n=18,159)				Females (n=23,058)				Total (n=41,217)			p-values		
	ASPD ^b (n=947)	AABS ^c (n=2,908)	"CD Only" ^d (n=257)	No Antisocial Behavioral Syndrome (n=14,047)	ASPD ^b (n=445)	AABS ^c (n=1,989)	"CD Only" ^d (n=154)	No Antisocial Behavioral Syndrome (n=20,470)	ASPD ^b (n=1,392)	AABS ^c (n=4,897)	"CD Only" ^d (n=411)		No Antisocial Behavioral Syndrome (n=34,517)	Antisocial Syndrome Interaction
BMI status (kg/m ²)														
Underweight (< 18.5)	0.4% (0.20)	0.7% (0.22)	0.6% (0.61)	0.8% (0.09)	3.6% (1.17)	3.4% (0.58)	2.8% (1.61)	3.2% (0.16)	1.3% (0.34)	1.6% (0.25)	1.3% (0.66)	2.1% (0.10)	<0.0001	0.0051
Healthy weight (18.5-24.9)	37.7% (2.02)	31.9% (1.07)	28.4% (3.40)	33.3% (0.66)	33.2% (2.82)	42.2% (1.42)	31.3% (4.67)	46.5% (0.47)	36.6% (1.65)	35.5% (0.91)	29.3% (2.56)	40.5% (0.45)		
Overweight (25.0-29.9)	35.1% (1.77)	40.9% (1.11)	44.5% (3.89)	44.1% (0.51)	31.9% (2.67)	25.8% (1.31)	33.1% (4.97)	28.3% (0.37)	34.3% (1.44)	35.7% (0.87)	40.9% (2.97)	35.5% (0.32)		
Obese (30.0-39.9)	23.9% (1.74)	24.3% (1.03)	24.7% (3.75)	20.1% (0.51)	22.1% (2.41)	23.0% (1.25)	23.9% (3.95)	19.0% (0.38)	23.4% (1.41)	23.9% (0.83)	24.4% (2.88)	19.5% (0.35)		
Extremely obese (≥ 40.0)	2.8% (0.68)	2.2% (0.34)	1.8% (0.90)	1.8% (0.14)	9.3% (1.99)	5.7% (0.64)	9.0% (3.42)	3.0% (0.15)	4.5% (0.71)	3.4% (0.33)	4.1% (1.28)	2.4% (0.11)		

^a Respondents with missing height or weight information and women pregnant at the time of their NESARC interviews were excluded.^b ASPD: antisocial personality disorder.^c AABS: adult antisocial behavior without conduct disorder before age 15 years.^d "CD Only": conduct disorder without adult antisocial behavior.

Table 3
Associations of BMI Status With Antisocial Behavioral Syndrome by Sex

	Males ^a			Females ^a		
	ASPD ^b vs. No Antisocial Behavioral Syndrome	AABS ^c vs. No Antisocial Behavioral Syndrome	"CD Only" ^d vs. No Antisocial Behavioral Syndrome	ASPD ^b vs. No Antisocial Behavioral Syndrome	AABS ^c vs. No Antisocial Behavioral Syndrome	"CD Only" ^d vs. No Antisocial Behavioral Syndrome
A. Unadjusted						
BMI status (kg/m ²)						
Underweight (< 18.5)	0.5 (0.19-1.27)	1.0 (0.49-1.87)	0.9 (0.12-6.98)	1.6 (0.76-3.23)	1.2 (0.79-1.71)	1.3 (0.38-4.41)
Healthy weight (18.5-24.9)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Overweight (25.0-29.9)	0.7 (0.59-0.84)	1.0 (0.87-1.08)	1.2 (0.84-1.66)	1.6 (1.19-2.09)	1.0 (0.86-1.16)	1.7 (1.03-2.92)
Obese (30.0-39.9)	1.1 (0.82-1.34)	1.3 (1.10-1.45)	1.4 (0.93-2.23)	1.6 (1.15-2.29)	1.3 (1.14-1.55)	1.9 (1.12-3.12)
Extremely obese (≥ 40.0)	1.4 (0.83-2.45)	1.3 (0.94-1.84)	1.2 (0.39-3.55)	4.4 (2.66-7.20)	2.1 (1.65-2.70)	4.5 (1.85-11.02)
B. Adjusted^e						
BMI status (kg/m ²)						
Underweight (< 18.5)	0.5 (0.16-1.26)	1.0 (0.49-2.03)	0.9 (0.12-6.76)	1.6 (0.68-3.51)	1.2 (0.76-1.84)	1.2 (0.34-4.36)
Healthy weight (18.5-24.9)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Overweight (25.0-29.9)	0.8 (0.68-1.04)	1.0 (0.91-1.17)	1.3 (0.86-1.85)	1.7 (1.24-2.43)	1.1 (0.94-1.31)	1.9 (1.12-3.34)
Obese (30.0-39.9)	1.0 (0.76-1.26)	1.2 (0.98-1.38)	1.5 (0.95-2.50)	1.4 (0.96-2.16)	1.2 (1.03-1.49)	1.9 (1.02-3.39)
Extremely obese (≥ 40.0)	1.0 (0.51-1.84)	1.1 (0.72-1.62)	0.8 (0.17-3.36)	3.2 (1.83-5.60)	1.7 (1.28-2.17)	4.4 (1.69-11.43)

^a Respondents with missing height or weight information and women pregnant at the time of their NESARC interviews were excluded.

^b ASPD: antisocial personality disorder.

^c AABS: adult antisocial behavior without conduct disorder before age 15 years.

^d "CD Only": conduct disorder without adult antisocial behavior.

^e Controlling for age, race/ethnicity, marital status, education, past-year personal income, region and urbanicity of respondent residence, comorbid lifetime diagnoses of nicotine dependence and any mood, any anxiety, any alcohol use, any drug use, pathological gambling, and any additional personality disorders, average daily ounces of ethanol during period of heaviest lifetime drinking, frequency of use of most frequently used drug during period of heaviest lifetime use, number of cigarettes smoked per day during most recent year of smoking, number of past-year, health care provider-diagnosed medical conditions, and SF-12 Physical Component Scale score.