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Prevalence and Correlates of DSM-5–Defined Eating Disorders in a Nationally Representative Sample of U.S. Adults

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ABSTRACT

BACKGROUND: Few population-based data on the prevalence of eating disorders exist, and such data are especially needed because of changes to diagnoses in the DSM-5. This study aimed to provide lifetime and 12-month prevalence estimates of DSM-5–defined anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED) from the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions.

METHODS: A national sample of 36,306 U.S. adults completed structured diagnostic interviews (Alcohol Use Disorder and Associated Disabilities Interview Schedule-5).

RESULTS: Prevalence estimates of lifetime AN, BN, and BED were 0.80% (SE 0.07%), 0.28% (SE 0.03%), and 0.85% (SE 0.05%), respectively. Twelve-month estimates for AN, BN, and BED were 0.05% (SE 0.02%), 0.14% (SE 0.02%), and 0.44% (SE 0.04%). The odds of lifetime and 12-month diagnoses of all three eating disorders were significantly greater for women than for men after adjusting for age, race and/or ethnicity, education, and income. Adjusted odds ratios (AORs) of lifetime AN diagnosis were significantly lower for non-Hispanic black and Hispanic respondents than for white respondents. AORs of lifetime and 12-month BN diagnoses did not differ significantly by race and/or ethnicity. The AOR of lifetime, but not 12-month, BED diagnosis was significantly lower for non-Hispanic black respondents relative to that of non-Hispanic white respondents; AORs of BED for Hispanic and non-Hispanic white respondents did not differ significantly. AN, BN, and BED were characterized by significant differences in age of onset, persistence and duration of episodes, and rates of current obesity and psychosocial impairment.

CONCLUSIONS: These findings for DSM-5–defined eating disorders, based on the largest national sample of U.S. adults studied to date, indicate some important similarities to and differences from earlier, smaller nationally representative studies.

Keywords: Anorexia nervosa, Binge-eating disorder, Bulimia nervosa, Impairment, Obesity, Prevalence

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Few nationally representative population-based data on the prevalence of eating disorders (EDs) exist (1). In the United States, the National Institutes of Mental Health Collaborative Psychiatric Epidemiological Studies (2) comprised three nationally representative samples of adults assessed with diagnostic interviews: the National Comorbidity Survey–Replication [NCS-R (3)], the National Survey of American Life (4), and the National Latino and Asian American Study (5). NCS-R used structured lay-administered diagnostic interviews (Composite International Diagnostic Interview) to generate DSM-IV–based psychiatric diagnoses, including anorexia nervosa (AN), bulimia nervosa (BN), and binge-eating disorder (BED), which was not listed as a formal diagnosis but was included as a provisional diagnosis category and criteria set. Hudson *et al.* (6) analyzed data from a subset of 2980 respondents (randomly selected from the larger NCS-R pool of 5692) and reported lifetime prevalence estimates for AN, BN, and BED as 0.6%, 1.0%, and 2.8%, respectively (0.9%, 1.5%, and 3.5% among women and 0.3%, 0.5%, and 2.0% among men, respectively). Marques *et al.* (7) compared ED prevalence rates across ethnic/racial groups by pooling National Institutes of Mental Health Collaborative Psychiatric Epidemiological Studies data, including NCS-R (6) data aggregated with data from 3750 African American respondents from the National Survey of American Life and 2554 Latino respondents and 2095 Asian American respondents from the National Latino and Asian American Study. Similar prevalence estimates for AN and BED across ethnic and/or racial groups but higher estimates for BN among Latino and African American respondents than white respondents were reported (7).

Data from large-scale nationally representative samples assessed with diagnostic interviews are required to update

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prevalence estimates of EDs in the United States. Expert reviews of worldwide ED epidemiology have emphasized the need for larger, rigorous studies to produce a better understanding of the prevalence and distribution of EDs (1). This is especially needed because of recent changes in diagnoses and criteria of EDs that were published in the DSM-5 (8) and that could impact prevalence estimates. In the DSM-5, AN diagnosis no longer requires amenorrhea and now defines "low weight" as less than minimally normal and/or less than minimally expected. The BN diagnosis now has a frequency requirement of once weekly for binge-eating and weight-compensatory behaviors, a lower frequency than twice weekly in the DSM-IV. BED, now a formal diagnosis, is also defined with a lower frequency requirement of once-weekly binge eating for 3 months, to parallel the BN diagnosis.

Research on the impact of changes between the DSM-IV and the DSM-5 on prevalence of EDs has been limited. One study from Switzerland, which used diagnostic interviews to assess a nationally representative sample of 10,038 residents, examined differences between the DSM-IV and DSM-5 entries for AN (9). A Swedish Twin Study reanalyzed data from diagnostic interviews with 13,295 female twins to estimate the impact of reduced frequency and/or duration criteria for binge eating on estimates for BN and BED (10). One United States–based Internet-survey study of 22,397 respondents used self-reports to estimate the prevalence of BED based on DSM-IV and DSM-5 definitions (11). These studies suggested that DSM-5–based criteria yielded higher estimates for AN (9), BN (10), and BED (11). However, no previous study has estimated the prevalence of DSM-5–defined EDs using diagnostic interviews with a large-scale nationally representative U.S. sample.

This study aimed to provide lifetime and 12-month prevalence estimates of DSM-5–defined AN, BN, and BED in a nationally representative sample of U.S. adults using data from the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC-III). NESARC-III, which included 36,309 respondents assessed with lay-administered diagnostic interviews, is by far the largest nationally representative sample of U.S. adults to allow for estimating prevalence of AN, BN, and BED following the DSM-5 criteria (8).

METHODS AND MATERIALS

Sample

NESARC-III included 36,309 noninstitutionalized U.S. civilians 18 years of age and older (12,13). Respondents completed computer-assisted face-to-face personal interviews between April 2012 and June 2013. NESARC-III employed multistage probabilistic sampling with counties or groups of contiguous counties as primary sampling units, groups of U.S. Census–defined blocks as secondary sampling units, and households within secondary sampling units as tertiary sampling units. Within each household, eligible adults were randomly selected, but Hispanic, black, and Asian household members were oversampled (i.e., two respondents from households with more than four eligible minority members) relative to white household members. Household response rate was 72% and person-level response rate was 84%, yielding an overall response rate of 60.1% (13). Data were adjusted for nonresponse and weighted to represent the U.S. population based on the 2012 American Community Survey from the Bureau of the Census. NESARC-III was approved by the National Institutes of Health Institutional Review Board, and respondents provided informed oral consent that was electronically recorded (13). The authors obtained exempt approval from the University at Albany Institutional Review Board to perform analyses.

Measurement

Sociodemographic Characteristics. Respondents provided sociodemographic information including age, sex, race and/or ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic Asian/Pacific Islander, non-Hispanic American-Indian/Alaska Native, or Hispanic [any race]), education (categorized as less than high school, high school and/or general equivalency diploma, at least some college), and annual income (categorized as $<$\$25,000, \$25,000–\$39,999, \$40,000–\$69,999, $\geq$\$70,000).

Body Mass Index. Self-reported height and weight were used to calculate body mass index (BMI).

Diagnostic Assessment. NESARC-III used the National Institute on Alcohol Abuse and Alcoholism Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5) (14) to assess DSM-5–defined psychiatric disorders and their criteria, including AN, BN, and BED. The AUDADIS-5 assessed age at onset and age for most recent episode to calculate 12-month and lifetime prevalence estimates and assessed for impairment in social function due to EDs, including 1) interference with normal daily activities, 2) serious problems getting along with others, and 3) serious problems fulfilling responsibilities.

AUDADIS-5 was administered by 970 trained lay assessors who had an average of five years of experience with health-related surveys (13). Good test–retest reliability and fair-to-moderate concordance levels for the AUDADIS-5 with a semi-structured diagnostic interview administered by independent and/or blinded research clinicians have been reported for substance use and psychiatric disorders (15,16). Reliability for NESARC-III ED diagnoses has not been reported.

Creation of ED Diagnoses[1]

We created specific ED diagnostic groups (AN, BN, BED) based on DSM-5 criteria using NESARC-III respondents' responses to relevant AUDADIS-5 items.[2] We did not utilize NESARC-III–generated ED diagnosis variables because

[1] The NESARC-III was the first wave of this nationally representative survey study that included EDs. To our knowledge, the reliability and validity of the AUDADIS-5 for specific EDs have not been reported.

[2] Supplemental Table S1 lists DSM-5 criteria for AN, BN, and BED alongside the exact AUDADIS-5 items in the NESARC-III dataset used to create each specific ED criterion, including how each item was scored. The Supplemental Table S1 footnotes describe the clinical and/or empirical rationale for scoring decisions.

inspection of the dataset revealed various errors.[3] Thus, it seemed clearly indicated to rescore NESARC-III variable data to create DSM-5–based ED categories for our analysis.[4,5]

For AN diagnosis, respondents were required to meet the following criteria: 1) had a self-reported lowest BMI <18.5; 2) tried not to gain weight or restricted food intake despite low weight; 3) were afraid of gaining weight or "getting fat" despite low weight; and 4) reported at least one of the following while their BMI was lowest: 1) thought they "looked fat"; 2) thought their weight or shape was one of the most important things about them; 3) did not think they might have been unhealthy; 4) did not believe others who thought their weight was unhealthy; or 5) were constantly weighing themselves or measuring body parts.

For BN and BED diagnoses, respondents were required to report recurrent binge eating, which was defined by three criteria: 1) had ever eaten an unusually large amount of food within 2-hour period, not including during the holidays; 2) had ever eaten unusually large amounts of food on average at least once weekly for at least 3 months; and 3) while eating an unusually large amount of food, had felt unable to stop eating or control how much and/or what they were eating.

For BN diagnosis, in addition to meeting criteria for recurrent binge eating, respondents were required to report whether during any of those times that they were binge eating they 1) tried to keep from gaining weight by vomiting; using enemas, laxatives, diuretics, and/or other medicines; fasting; or exercising excessively; 2) engaged in the weight-compensatory behaviors at least once weekly for at least 3 months; or 3) thought their weight and/or shape was one of the most important things about them.

For BED diagnosis, in addition to meeting criteria for recurrent binge eating, respondents were required to report 1) eating an unusually large amount of food that made them very upset, and 2) at least three of the following five features during the times they ate unusually large amounts of food: 1) eating much more quickly than usual; 2) eating until uncomfortably full; 3) eating despite not being hungry; 4) eating alone because they were embarrassed by how much they were eating; or 5) feeling disgusted, depressed, or very guilty about the overeating.

Statistical Analysis

Analyses were performed using Statistical Analysis System (SAS release 9.4, 2002–2012) and accounted for NESARC-III survey design by using Proc Survey procedures with the Taylor series-variance-estimation method. Weighted means, frequencies, and cross-tabulations were computed for 12-month and lifetime DSM-5–based diagnosis for the three specific EDs overall (total sample) and separately for specific sociodemographic groups (sex, race and/or ethnicity, age, education, income).

For each ED, weighted means, medians, and frequencies were computed for age, BMI, age of onset, years with episode, persistence of ED, and ED-related impairment; analysis of covariance was used to examine whether current age, current BMI, age of onset, and years with episodes differed between AN, BN, and BED after adjusting for sociodemographic variables. The Rao-Scott χ^2 test was used to compare the proportion of respondents reporting persistence of ED and ED-related impairment across ED groups. Significant omnibus χ^2 tests were probed by comparing cells to identify significant differences between ED groups (17,18). For these inferential statistics comparing lifetime ED groups, we followed a well-established diagnostic "hierarchy" of AN > BN > BED (i.e., the lifetime BN group excluded those with lifetime AN, the lifetime BED group excluded those with lifetime AN and/or BN). Multiple logistic regression was used to calculate adjusted odds ratios (AORs) comparing risk of lifetime and 12-month diagnoses of EDs by sociodemographic variables, adjusting for the other sociodemographic variables not being tested. Cox proportional hazards models were used to test for differences in age-cohort effects on ED, adjusting for sociodemographic variables. Multiple logistic regression was used to examine whether the likelihoods of having BMI <18.5 (underweight), 18.5 ≤ BMI < 25 (normal weight), 25 ≤ BMI < 30 (overweight), 30 ≤ BMI < 40 (obese), or BMI ≥40 (extremely obese) differed significantly between ED diagnoses (12-month and lifetime) relative to those of respondents without lifetime history of any ED. These analyses were adjusted for sociodemographic variables (except for 12-month AN diagnosis, which required BMI <18.5).

RESULTS

Prevalence Estimates of EDs: Lifetime and 12-Month Rates, Overall and by Sociodemographic Characteristics

Prevalence estimates of lifetime AN, BN, and BED diagnoses were 0.80% (SE 0.07%), 0.28% (SE 0.03%), and 0.85%

[3] During our preliminary analyses, we found errors in how the NESARC-III co-shows every "marked distress" regarding binge eating, which is required for the BED diagnosis, and categorized many respondents with 12-month AN diagnosis despite them having current BMI in the obese range, among other errors. Thus, for this study, we re-created lifetime and 12-month diagnosis variables for AN, BN, and BED based on the criteria described in the Methods and Materials section (and elaborated further in Supplemental Table S1).

[4] Supplemental Table S2 shows every coding discrepancy between the ED diagnosis variables in our study and the NESARC-III dataset.

[5] It is possible that the finding of 12-month persistence could be influenced by age of onset. For example, for two individuals with the same length (or total years) of an ED episode, one individual having an earlier onset of that ED would have different persistence than that of a second individual having a later onset. Thus, it might be possible for increased "persistence" to reflect not only the ED persisting longer but also to be partly confounded by later onset. Thus, we performed multiple logistic regression analyses to compare the risk for reporting 12-month diagnosis among those with lifetime diagnosis by age of onset, with current age, sex, education, race, and income as covariates. For AN, because of the small number of positive cases, the model was not valid. For both BN and BED, however, later age of onset was associated with significantly greater likelihoods of meeting 12-month diagnosis criteria (for BN: adjusted odds ratio = 1.12, 95% confidence interval = 1.03–1.21, $p < .05$; for BED: adjusted odds ratio = 1.03, 95% confidence interval = 1.01–1.06, $p < .05$).

Table 1. Lifetime Prevalence of DSM-5–Defined AN, BN, and BED by Sociodemographic Characteristics

	AN		BN		BED	
	n	% (SE)	*n*	% (SE)	*n*	% (SE)
Total	276	0.80 (0.07)	92	0.28 (0.03)	318	0.85 (0.05)
Sex						
Male	23	0.12 (0.04)	12	0.08 (0.03)	68	0.42 (0.06)
Female	253	1.42 (0.12)	80	0.46 (0.06)	250	1.25 (0.10)
Race and/or Ethnicity						
Non-Hispanic white	206	0.96 (0.08)	54	0.31 (0.05)	206	0.94 (0.08)
Non-Hispanic black	17	0.19 (0.05)	14	0.20 (0.07)	41	0.62 (0.14)
Hispanic	36	0.46 (0.08)	19	0.24 (0.07)	56	0.75 (0.13)
Other[a]	17	1.05 (0.32)	5	0.17 (0.08)	15	0.59 (0.16)
Age, Years						
18–29	66	0.86 (0.13)	26	0.40 (0.10)	75	0.89 (0.12)
30–44	89	1.02 (0.14)	43	0.42 (0.07)	97	0.96 (0.12)
45–59	89	0.96 (0.12)	17	0.21 (0.07)	97	1.00 (0.13)
≥60	32	0.34 (0.07)	6	0.10 (0.05)	49	0.54 (0.10)
Educational Level						
Less than high school	22	0.47 (0.09)	14	0.22 (0.07)	43	0.79 (0.12)
High school or GED	48	0.48 (0.09)	18	0.20 (0.07)	67	0.72 (0.11)
Some college or higher	206	1.00 (0.09)	60	0.32 (0.05)	208	0.92 (0.08)
Annual Income Level						
<$25,000	62	0.58 (0.09)	28	0.34 (0.90)	100	0.98 (0.05)
$25,000–$39,999	47	0.55 (0.10)	21	0.21 (0.05)	62	0.78 (0.11)
$40,000–$69,999	74	0.88 (0.13)	23	0.30 (0.07)	86	0.80 (0.10)
≥$70,000	93	1.04 (0.13)	20	0.25 (0.06)	70	0.85 (0.12)

Calculations of prevalence and standard error were adjusted for survey weights.
AN, anorexia nervosa; BED, binge-eating disorder; BN, bulimia nervosa; GED, general equivalency diploma.
[a]"Other" included Asian, Native Hawaiian or other Pacific Islander, and Native American individuals.

(SE 0.05%), respectively (Table 1). Prevalence estimates of 12-month AN, BN, and BED diagnoses were 0.05% (SE 0.02%), 0.14% (SE 0.02%), and 0.44% (SE 0.04%), respectively (Table 2). Supplemental Table S3 summarizes sensitivity analyses showing the impact of discrepancies between our coding and that of the NESARC-III (listed in Supplemental Table S2) as well as exploring the impacts of "broadening" various specific criteria on the prevalence estimates for EDs.

The lifetime prevalence estimate for comorbid EDs (i.e., having lifetime diagnoses of two or more specific EDs) was 0.22% (SE 0.03%). Of those, 0.01% (SE 0.01%) reported lifetime "comorbidity" between AN and BN, 0.02% (SE 0.01%) between AN and BED, 0.13% (SE 0.02%) between BN and BED, and 0.05% (SE 0.02%) among all three EDs. Tables 1 and 2 also show unadjusted prevalence estimates of lifetime and 12-month diagnoses, respectively, of AN, BN, and BED by sex, race and/or ethnicity, age, education, and income categories.

Adjusted Prevalence Estimate of EDs by Sex, Race and/or Ethnicity, Education, and Income

Table 3 shows AORs and 95% confidence intervals by sex, race and/or ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic respondents), education, and income groups. AORs of lifetime and 12-month diagnoses of all three EDs were significantly greater for women than for men (Tables 1 and 2 show unadjusted estimates). AORs of lifetime AN diagnosis were significantly lower for non-Hispanic black and Hispanic respondents than for non-Hispanic white respondents. AORs of 12-month AN diagnosis were significantly lower for Hispanic than non-Hispanic white respondents. There was no case of 12-month AN diagnosis among non-Hispanic black respondents; thus, it was not possible to generate valid estimates of AORs for non-Hispanic black versus non-Hispanic white groups. AORs of lifetime and 12-month BN diagnosis did not differ significantly by race and/or ethnicity. AOR of lifetime BED diagnosis was significantly lower for non-Hispanic black respondents than for non-Hispanic white respondents; AORs of BED diagnosis for Hispanic respondents and non-Hispanic white respondents did not differ significantly. There were no racial differences in AORs of 12-month BED diagnosis. Educational level was not significantly associated with any ED prevalence. Higher income categories were associated with significantly increased odds of lifetime AN diagnosis.

Age of Onset, Duration, and Persistence of EDs

Table 4 summarizes mean and median age of onset across the EDs (current age at interview is shown to provide context). Compared with lifetime AN or BN, those with lifetime BED had later age of onset of ED and longer duration of ED episodes. Twelve-month persistence, defined as the proportion of those with 12-month diagnosis among those with the lifetime

Table 2. Twelve-Month Prevalence of DSM-5–Defined AN, BN, and BED by Sociodemographic Characteristics

	AN		BN		BED	
	n	% (SE)	*n*	% (SE)	*n*	% (SE)
Total	13	0.05 (0.02)	44	0.14 (0.02)	166	0.44 (0.04)
Sex						
Male	2	0.01 (0.01)	6	0.05 (0.02)	41	0.26 (0.05)
Female	11	0.08 (0.03)	38	0.22 (0.05)	125	0.60 (0.07)
Race and/or Ethnicity						
Non-Hispanic white	11	0.07 (0.02)	24	0.15 (0.04)	107	0.48 (0.06)
Non-Hispanic black	0	0.00 (0.00)	7	0.09 (0.04)	20	0.28 (0.09)
Hispanic	1	0.01 (0.01)	10	0.14 (0.05)	31	0.40 (0.09)
Other[a]	1	0.03 (0.03)	3	0.11 (0.06)	8	0.39 (0.16)
Age, Years						
18–29	4	0.08 (0.05)	13	0.23 (0.08)	43	0.46 (0.08)
30–44	3	0.04 (0.03)	23	0.23 (0.06)	46	0.46 (0.09)
45–59	5	0.06 (0.03)	4	0.03 (0.02)	48	0.50 (0.09)
≥60	1	0.01 (0.01)	4	0.08 (0.05)	29	0.33 (0.07)
Educational Level						
Less than high school	0	0.00 (0.00)	10	0.17 (0.07)	25	0.51 (0.12)
High school or GED	3	0.05 (0.04)	11	0.15 (0.06)	36	0.38 (0.07)
Some college or higher	10	0.06 (0.02)	23	0.13 (0.03)	105	0.45 (0.05)
Annual Income Level						
<$25,000	4	0.08 (0.05)	14	0.19 (0.07)	51	0.48 (0.09)
$25,000–$39,999	1	0.01 (0.01)	10	0.10 (0.03)	34	0.42 (0.10)
$40,000–$69,999	3	0.02 (0.02)	12	0.12 (0.04)	46	0.38 (0.06)
≥$70,000	5	0.07 (0.03)	8	0.14 (0.05)	35	0.47 (0.09)

Calculations of prevalence and standard error were adjusted for survey weights.
AN, anorexia nervosa; BED, binge-eating disorder; BN, bulimia nervosa; GED, general equivalency diploma.
[a]"Other" included Asian, Native Hawaiian or other Pacific Islander, and Native American individuals.

diagnosis, was 63.5% for BED and 54.7% for BN, significantly higher than that for AN (9.4%).[5]

Cohort Effects

Cox proportional hazard models revealed an inverse association between age cohort (age at interview) and lifetime risk for EDs (Table 5). Adjusting for age, sex, race and/or ethnicity, and educational level, hazard ratios of AN and BED in younger age groups (18–29 years of age, 30–44 years of age, 45–59 years of age) were significantly higher relative to those of the oldest group (≥60 years of age); adjusted hazard ratios (AHRs) increased as age decreased. AHRs of BN were significantly higher in the groups of respondents who were 18 to 20 years of age and 30 to 44 years of age relative to that of the ≥60 years of age group but not that of the 45- to 59-years-of-age group.

Impairment in Psychosocial Functioning Associated With Disordered Eating

Table 6 summarizes rates of impairment in psychosocial functioning in three domains and overall ("any form of impairment") associated with disordered eating reported by respondents categorized with the EDs; rate are shown separately for lifetime and 12-month diagnoses. For lifetime diagnoses, rates of any impairment in social function were significantly greater for BN (61.4%) and BED (53.7%) than AN (30.7%). Rates of reporting interference with normal daily activities were significantly greater for BED (52.5%) and BN (49.5%) than AN (23.5%). For 12-month diagnoses, the three EDs differed little; the only significant difference observed was respondents with BN reporting a greater rate of difficulties in getting along with others than those with BED.

Associations With Current BMI

Table 7 shows current mean (standard error) and median (interquartile range) BMI and current BMI categories (prevalence rates and AORs with 95% confidence intervals) across the ED groups for both lifetime and 12-month diagnoses. For both lifetime and 12-month diagnoses, the respondents with AN had significantly lower current BMI than those in the BN and BED groups (for 12-month diagnosis, this was as expected given the required criterion of BMI <18.5 for AN). For both lifetime and 12-month diagnoses, respondents with BN had significantly lower current BMI than those with BED.

Relative to no history of ED, respondents with lifetime AN had significantly greater odds of being categorized currently as underweight or normal weight and significantly reduced odds of currently having overweight, obesity, or extreme obesity; AORs reduced as BMI increased. Relative to no history of ED, lifetime BED was associated with significantly reduced odds of being categorized as currently having normal weight or

Table 3. Adjusted Odds Ratios and 95% Confidence Intervals of DSM-5–Defined AN, BN, and BED by Sex, by Race and/or Ethnicity, and by Educational Level

	AN	BN	BED
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Lifetime Diagnosis			
Women vs. men	12.00 (6.45–22.34)[a]	5.80 (2.82–11.92)[a]	3.01 (2.17–4.16)[a]
Race and/or ethnicity			
Hispanic vs. Non-Hispanic white	0.48 (0.33–0.72)[a]	0.65 (0.33–1.29)	0.75 (0.38–0.92)
Non-Hispanic black vs. Non-Hispanic white	0.19 (0.11–0.33)[a]	0.54 (0.25–1.19)	0.60 (0.38–0.92)[b]
Educational level			
High school and/or GED vs. less than high school	0.82 (0.50–1.36)	0.83 (0.34–2.12)	0.87 (0.59–1.29)
Some college or higher vs. less than high school	1.31 (0.87–1.97)	1. 25 (0.64–2.44)	1.05 (0.72–1.53)
Annual income level			
$25,000–$39,999 vs. <$25,000	0.97 (0.60–1.57)	0.68 (0.34–1.34)	0.82 (0.56–1.20)
$40,000–$69,999 vs. <$25,000	1.47 (1.01–2.15)[b]	0.94 (0.49–1.84)	0.83 (0.58–1.21)
≥$70,000 vs. <$25,000	1.60 (1.07–2.38)[b]	0.76 (0.39–1.48)	0.87 (0.59–1.25)
12-Month Diagnosis			
Women vs. men	6.48 (1.72–24.45)[b]	5.16 (1.83–14.56)[a]	2.37 (1.57–3.59)[a]
Race and/or ethnicity			
Hispanic vs. Non-Hispanic white	0.11 (0.01–1.00)[b]	0.64 (0.27–1.56)	0.76 (0.45–1.27)
Non-Hispanic black vs. Non-Hispanic white[c]	–	0.47 (0.16–1.41)	0.55 (0.28–1.06)
Educational level			
High school or GED vs. less than high school[c]	–	0.77 (0.24–2.46)	0.70 (0.39–1.28)
Some college or higher vs. less than high school[c]	–	0.57 (0.26–1.27)	0.76 (0.44–1.31)
Annual income level			
$25,000–$39,999 vs. <$25,000	0.06 (0.01–0.56)[b]	0.63 (0.23–1.72)	0.92 (0.51–1.65)
$40,000–$69,999 vs. <$25,000	0.26 (0.06–1.23)	0.83 (0.29–2.37)	0.84 (0.52–1.35)
≥$70,000 vs. <$25,000	0.67 (0.21–2.15)	1.05 (0.40–2.57)	1.04 (0.58–1.89)

Calculations of odds ratios and 95% confidence intervals were adjusted for survey weights.

AN, anorexia nervosa; AOR, adjusted odds ratio, adjusted for age and other sociodemographic variables; BED, binge-eating disorder; BN, bulimia nervosa; CI, confidence interval; GED, general equivalency diploma.

[a]Significant at $p < .01$.

[b]Significant at $p < .05$.

[c]Estimate was invalid because of no case in non-Hispanic black and high school and/or GED.

overweight but significantly increased odds of currently having obesity or extreme obesity. Similarly, 12-month BED was associated with significantly reduced odds of being categorized as currently having normal weight or overweight but significantly increased odds of currently having obesity or extreme obesity. For both lifetime and 12-month BED, AORs increased as BMI increased. Relative to respondents with no lifetime history of ED, those with BN (lifetime and 12-month

Table 4. Age of Onset, Duration, and Persistence of DSM-5–Defined Eating Disorders

	AN	BN	BED
Current Age, Years			
Mean (SE)	41.8 (0.96)	39.1 (2.45)	45.2 (1.21)[a]
Median (IQR)	42.2 (29.5–51.7)	38.3 (27.3–46.8)	46.0 (31.8–56.8)
Age of Onset of ED, Years			
Mean (SE)	19.3 (0.06)	20.0 (0.55)	24.5 (0.31)[a,b]
Median (IQR)	17.4 (15.2–20.5)	16.0 (13.9–21.5)	21.1 (14.6–30.4)
Years With Episode, Years			
Mean (SE)	11.4 (0.40)	12.2 (0.67)	15.9 (0.36)[a,b]
Median (IQR)	4.9 (1.6–16.3)	8.0 (3.6–18.3)	10.6 (3.5–24.4)
12-Month Persistence, % (SE)	9.4 (2.41)	54.7 (6.79)[a]	63.5 (3.87)[a]

The analysis included those with lifetime diagnosis of AN, BN without lifetime AN, or BED without lifetime AN or BN. Calculations of means, medians, and standard errors were adjusted for survey weights.

AN, anorexia nervosa; BED, binge-eating disorder; BN, bulimia nervosa; ED, eating disorder; IQR, interquartile range.

[a]Significantly different from AN at $p < .05$ based on Tukey-Kramer post hoc test or comparison of cells (17).

[b]Significantly different from BN at $p < .05$ based on Tukey-Kramer post hoc test.

Table 5. Intercohort Differences in Lifetime Risk (Adjusted Hazard Ratios) of DSM-5–Defined Eating Disorders

	AN	BN	BED
Age, Years	AHR (95% CI)	AHR (95% CI)	AHR (95% CI)
18–29	3.86 (2.21–6.74)[a]	5.81 (1.83–18.42)[a]	3.86 (2.21–6.74)[a]
30–44	2.77 (1.60–4.78)[a]	5.45 (1.63–18.24)[a]	2.77 (1.61–4.78)[a]
45–59	2.52 (1.57–4.02)[a]	2.37 (0.65–11.55)	2.52 (1.63–3.32)[a]
≥60	Reference	Reference	Reference

AHR, adjusted hazard ratio, adjusting for age, sex, race and/or ethnicity, education and income; AN, anorexia nervosa; BED, binge-eating disorder; BN, bulimia nervosa; CI, confidence interval.

[a]Significant at $p < .01$.

diagnoses) did not differ significantly in odds of any weight and/or obesity categories.

DISCUSSION

This study, with a nationally representative sample of 36,309 adults in the United States who were assessed with lay-administered diagnostic interviews, provides new prevalence estimates of EDs based on DSM-5 criteria. Prevalence estimates of lifetime AN, BN, and BED were 0.80%, 0.28%, and 0.85%, respectively, and 12-month estimates were 0.05%, 0.14%, and 0.44%, respectively. These prevalence estimates are based on our recoding of NESARC-III ED data because inspection of the original NESARC-III data revealed errors; Supplemental Tables summarize coding discrepancies and sensitivity analyses exploring the impacts of discrepancies on prevalence estimates. Findings for DSM-5–defined EDs, which included several changes from the DSM-IV, are based on the largest national sample of U.S. adults studied to date and suggest some important similarities and differences to earlier, smaller nationally representative studies.

Our prevalence estimates of DSM-5–defined BN and BED are lower than those reported by Hudson *et al.* (6) from the NCS-R based on a subset of 2980 respondents for DSM-IV–defined BN and BED (1.0% and 2.8%, for lifetime and 0.3% and 1.2%, for 12-month). Our lifetime prevalence estimate of DSM-5-defined AN (0.8%) is slightly higher than that of DSM-IV–defined AN in the NCS-R [0.6%; (6)]; for respondents with 12-month AN, we observed 0.05% prevalence whereas the NCS-R (6) found no cases. Our lower prevalence estimates for BN and BED relative to those of the NCS-R (6) estimates are surprising given the changes in criteria from DSM-IV to DSM-5 that would be expected to yield higher rates, as found in a population-based Swiss sample of 10,028 adults (9). Lifetime prevalence was higher for AN than BN while the pattern was the opposite for 12-month prevalence.

Both the current and NCS-R studies used lay-administered structured interviews, albeit different ones, and used rigorous sampling methods, and thus exact reasons for the varied findings are uncertain. Much larger sampling in our study, roughly 12 times more respondents than in the NCS-R, may allow for more stable estimation. Kessler *et al.* (19), in comparing differences across DSM-IV–based studies, addressed important methodological considerations such as how even different versions of the same interview may yield differences. Moreover, different structured interviews for psychiatric disorders vary in how diagnostic criteria are asked, strictness of wording, the survey-administration order (e.g., NCS-R assesses EDs midway through, whereas NESARC-III assesses EDs at the end, which conceivably leads to lower response rates as a result of fatigue), and in how diagnostic hierarchies are applied. We explored impacts of broadening specific criteria (i.e., "marked distress" about binge eating for BED and overvaluation of shape and/or weight for BN) because of differences in the structured interviews in NCS-R and NESARC-III. Our sensitivity analyses (described in the Supplemental Tables) revealed slight increases in lifetime estimates for BED, but not BN; however, even with broadened definitions, our prevalence estimates remained lower than the NCS-R (6). Sensitivity analyses performed for the NCS-R (6) testing stricter definitions of overvaluation revealed little effect on reducing BN prevalence estimates. Thus, neither our present analyses nor those of the NCS-R (6) suggested much impact based on either overly broad or stringent measures of overvaluation on BN prevalence estimates. Our prevalence estimates are at odds with views of the DSM-5 from critics who used

Table 6. Report of Clinical Impairment in Psychosocial Functioning Associated With Disordered Eating by DSM-5–Defined Eating Disorders

	AN, % (SE)	BN, % (SE)	BED, % (SE)
Lifetime Diagnosis			
Interference with normal daily activities	23.5 (3.34)	49.5 (7.23)[a]	52.5 (3.88)[a]
Serious problems getting along with others	21.2 (3.04)	32.9 (6.57)	20.9 (3.10)
Serious problems fulfilling responsibilities	17.5 (2.81)	25.1 (4.63)	28.2 (3.55)
Any form of impairment	30.7 (3.49)	61.4 (7.54)[a]	53.7 (3.99)[a]
12-Month Diagnosis			
Interference with normal daily activities	47.1 (14.10)	46.8 (9.56)	54.7 (4.35)
Serious problems getting along with others	43.9 (14.00)	41.8 (10.50)	19.8 (3.29)
Serious problems fulfilling responsibilities	45.4 (14.39)	32.9 (7.28)	25.6 (4.01)
Any form of impairment	47.1 (14.10)	64.6 (10.12)	54.7 (4.35)

The analysis included those with lifetime diagnosis of AN, BN without lifetime AN, or BED without lifetime AN or BN.

AN, anorexia nervosa; BED, binge-eating disorder; BN, bulimia nervosa.

[a]Significantly different from AN at $p < .05$ based on comparison of cells (17). All analyses were adjusted for the National Epidemiologic Survey on Alcohol and Related Conditions complex survey design.

Table 7. Differences in Current BMI and BMI Categories in Lifetime and 12-Month ED Groups

	AN	BN	BED
Current BMI by Lifetime ED Diagnosis			
Mean (SE)	24.1 (0.42)	27.7 (0.75)[a]	33.9 (0.64)[a,b]
Median (IQR)	22.2 (20.0–26.7)	27.2 (22.9–30.8)	32.6 (27.3–38.4)
Current BMI Group by Lifetime ED Diagnosis, % (SE) *n*			
<18.5	3.19 (1.03) 15	0.40 (0.40) 1	0.52 (0.41) 2
18.5–24.9	1.40 (0.14) 161	0.36 (0.07) 38	0.53 (0.08) 63
25–29.9	0.42 (0.06) 55	0.23 (0.06) 22	0.55 (0.08) 74
30–39.9	0.43 (0.09) 37	0.25 (0.06) 28	1.38 (0.16) 125
≥40	0.31 (0.21) 4	0.10 (0.06) 3	2.82 (0.47) 51
Current BMI Group by Lifetime ED Diagnosis, AOR (95% CI)			
<18.5	2.71 (1.57–4.68)[c]	–[a]	0.22 (0.03–1.58)
18.5–24.9	2.29 (1.80–2.92)[c]	0.94 (0.59–1.49)	0.29 (0.20–0.41)[c]
25–29.9	0.61 (0.45–0.82)[c]	0.87 (0.52–1.46)	0.70 (0.52–0.95)[d]
30–39.9	0.49 (0.35–0.70)[c]	1.31 (0.82–2.08)	2.09 (1.61–2.70)[c]
≥ 40	0.28 (0.10–0.74)[d]	–[b]	4.61 (3.34–6.37)[c]
Current BMI by 12-Month ED Diagnosis			
Mean (SE)	17.4 (0.39)	27.1 (0.82)[a]	34.9 (0.84)[a,b]
Median (IQR)	18.0 (16.6–18.1)	26.8 (22.8–29.1)	34.3 (29.0–39.0)
Current BMI Group by 12-Month ED Diagnosis, % (SE) *n*			
<18.5	2.91 (1.02) 13	0.40 (0.40) 1	0.12 (0.12) 1
18.5–24.9	–	0.15 (0.15) 16	0.10 (0.03) 14
25–29.9	–	0.15 (0.05) 14	0.28 (0.06) 37
30–39.9	–	0.12 (0.04) 12	0.86 (0.12) 76
≥40	–	0.03 (0.03) 1	1.95 (0.43) 36
Current BMI Group by 12-Month ED Diagnosis, AOR (95% CI)			
<18.5	–[e]	–[a]	–[a]
18.5–24.9	–	0.88 (0.49–1.60)	0.15 (0.09–0.26)[c]
25–29.9	–	1.24 (0.65–2.40)	0.65 (0.45–0.95)[d]
30–39.9	–	0.99 (0.52–1.88)	2.58 (1.88–3.54)[c]
≥40	–	–[b]	5.36 (3.67–7.83)[c]

In all analyses, a reference group was individuals without lifetime history of any ED. All analyses were adjusted for the National Epidemiologic Survey on Alcohol and Related Conditions complex survey design.

AN, anorexia nervosa; AOR, adjusted odds ratio, adjusting for sociodemographic variables; BED, binge-eating disorder; BMI, body mass index; BN, bulimia nervosa; CI, confidence interval; ED, eating disorder; IQR, interquartile range.

[a]Collapsed with BMI, 18.5–24.5.

[b]Collapsed with BMI, 30–39.9.

[c]Significant at $p < .01$.

[d]Significant at $p < .05$.

[e]The model was invalid because of low positive-response frequencies.

BED as an illustration of overpathologizing. Discrepancies in prevalence estimates underscore the need for more population-based studies with large samples using diagnostic interviews.

Our findings extend knowledge regarding the distribution and sociodemographic correlates of EDs. Adjusting for age, race and/or ethnicity, education, and income categories, odds of lifetime and 12-month diagnoses of all three EDs were significantly greater for women than men, particularly for AN and BN. We also found that 1) the risk of lifetime AN diagnosis was significantly lower for Hispanic and non-Hispanic black respondents than for non-Hispanic white respondents; 2) the risks of lifetime and 12-month BN diagnoses did not differ significantly by race and/or ethnicity; 3) the risk of lifetime BED but not 12-month BED diagnosis was significantly lower for non-Hispanic black than non-Hispanic white respondents; 4) the risks of lifetime and 12-month BED diagnoses for Hispanic and non-Hispanic white respondents did not differ significantly; and 5) the risk of lifetime AN diagnosis was associated with higher income. Overall, it is important to recognize that EDs occur across all ethnic/racial groups and that the rates for some diagnoses (e.g., BN and BED to a lesser extent) are comparable across groups. However, 12-month AN diagnosis was most prevalent among non-Hispanic white respondents, women, and respondents 18 to 29 years of age. The findings are broadly consistent with previous DSM-IV–defined EDs (6,7). Kessler *et al.* (19), in their analysis of 24,124 adult respondents from the World Health Organization World Mental Health Survey, reported roughly comparable prevalence estimates for BN and BED diagnoses across 14 countries. Collectively, such findings highlight the importance of actively considering all forms of diversity across prevention and intervention clinical and/or research work, which to date appears to be at odds with our findings [e.g., Franko *et al.* (20)].

Findings regarding the mean ages of onset for AN, BN, and BED were nearly identical to those of the NCR-S (6): ages 19.3, 20.0, and 24.5 years, respectively, versus 18.9, 19.7, and 25.4 years. The chronic nature of EDs was suggested by long illness durations and rates of 12-month persistence, which highlight the importance of early recognition and intervention. The percentage of 12-month persistence in AN was significantly lower than that in BN or BED, which is at odds with NCR-S (6) findings and reports on the course of AN (21). We found some support for the view that EDs might be increasing in incidence. We observed an inverse association between age cohort (age at interview) and lifetime risk, particularly for BN and BED, echoing earlier findings for BN (1,6,22) and BED (6). Odds of AN diagnosis showed a slight increase with cohort, adding to the mixed literature, primarily case register data. As noted by Hudson *et al.* (6), cohort effects overlap with age effects, and thus prospective studies should investigate whether the incidence of EDs is on increasing trend.

Impairment in psychosocial functioning associated with disordered eating was common. Most lifetime BN (61.4%) and BED (53.7%) groups reported "any" impairment; these rates were significantly higher than those reported by respondents with lifetime AN (30.7%). However, the rates of reporting "any" impairment were not significantly different for 12-month diagnoses (AN = 47.1%, BN = 64.6%, and BED = 54.7%). Comparison with the NCS-R (6) findings is difficult due to different measurement of impairment and because their smaller study precluded analysis of AN cases. Nonetheless, these two studies converge in suggesting that roughly half of persons with BN and BED suffer from impaired functioning associated with their disordered eating. Our findings for AN might seem surprising given the established seriousness and even life-threatening nature of this disorder. Alternatively, it is possible that the findings for AN reflect, in part, underreporting associated with the well-known minimization of severity and ego-syntonic nature of the underweight state in persons with AN.

We observed significant but varied associations between EDs and obesity. Respondents with lifetime AN had

significantly lower current BMI than those with lifetime BN or BED, and respondents with lifetime BN had significantly lower BMI than those with lifetime BED. Consistent with findings of the NCS-R (6) and clinical studies (19,21), we found that respondents with lifetime AN had significantly greater odds of currently having underweight or normal weight and lower odds of having overweight or obesity or extreme obesity, with AORs increasing with increasing BMI. Conversely, lifetime and 12-month BED diagnoses were associated with significantly reduced odds of currently being categorized as normal weight or overweight but increased odds of being currently categorized with obesity or extreme obesity. Substantially elevated odds of having current extreme obesity in those with lifetime BED diagnosis (AOR = 4.67) and 12-month BED (AOR = 5.42) echo previous NCS-R (6) and World Health Organization (19) findings and clinical reports regarding steep weight gains among persons with BED prior to seeking treatment (23). Finally, in contrast to significant, albeit opposite, associations with weight for AN versus BED, BN diagnosis (lifetime and 12-month) did not differ significantly in association with different weight and/or obesity categories.

We note strengths and limitations as context for our findings. A major strength is the large epidemiological dataset with a representative sample of U.S. adults assessed by trained interviewers using structured interviews. A relative weakness is the use of lay interviewers, rather than clinicians; standardized training and structured assessments may offset this limitation to some extent. The AUDADIS-5 has not been evaluated for reliability or validity for ED diagnoses, although it has been validated for other psychiatric conditions. We note that even different diagnostic interviews or even versions of the same interview may produce different diagnostic estimates (24). EDs are thought to be associated with shame and secrecy, and some specific types such as AN are ego-syntonic, and these factors might result in underreporting and lower estimates. Different reference time points used to define the lowest BMI across studies may also result in different prevalence estimates of AN. The use of telephone interviews might have offset this to some degree by allowing for greater honesty when reporting sensitive or embarrassing issues. The AUDADIS-5 does not assess EDs using the exact wording of the DSM-5; as we described in Methods and Materials, we rescored specific AUDADIS-5 items to map very closely to criteria and performed sensitivity analyses that revealed relatively limited impacts of loosening criteria on prevalence estimates. BMI was calculated based on self-reported height and weight, that may be biased (25).[6]

[6] When errors in self-report of weight and/or height occur, they tend to be in the direction of underreporting weight and overreporting height (25); in community-based studies, for example, this may produce on average a BMI estimate of 1.3 units lower than that based on measured values (26). Nonetheless, large-scale studies generally report high correlations between self-reported and measured height and weight (27), and studies with patients with EDs have found that errors in self-reported height and weight tend to be very slight (28,29) and that the discrepancies between self-report and measured values are not associated with ED psychopathology or psychological features (29).

Conclusions

Our findings for DSM-5–defined EDs, based on the largest national sample of U.S. adults studied to date, indicate these are prevalent disorders distributed across age groups, across both men and women, and across different ethnic and/or racial groups. Although substantial differences between EDs exist, overall, they appear to be persistent and associated with substantial rates of impairment in psychosocial functioning. EDs show differential associations with obesity, and our findings highlight substantial associations between BED and extreme obesity. Thus, our findings indicate that DSM-5–defined EDs represent an important public health problem.

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