Co-Occurrence of Binge Eating Disorder With Psychiatric and Medical Disorders

Kristin N. Javaras, D.Phil.; Harrison G. Pope, Jr., M.D.; Justine K. Lalonde, M.D.; Jacqueline L. Roberts, B.A.; Yael I. Nillni, B.A.; Nan M. Laird, Ph.D.; Cynthia M. Bulik, Ph.D.; Scott J. Crow, M.D.; Susan L. McElroy, M.D.; B. Timothy Walsh, M.D.; Ming T. Tsuang, M.D., Ph.D., Sc.D.; Norman R. Rosenthal, M.D.; and James I. Hudson, M.D., Sc.D.

Background: Prior studies suggest that certain psychiatric and medical disorders co-occur with binge eating disorder (BED). However, there has been no large, community-based study with diagnoses made by clinician interviewers. We used data from that type of study to assess the co-occurrence of various psychiatric and medical disorders with DSM-IV BED and with subthreshold BED.

Method: From October 2002 to July 2004, we interviewed 150 probands with BED, 150 probands without BED, and 888 of their first-degree relatives (135 of whom had BED, and 54 of whom met specific partial criteria for BED that we defined as subthreshold BED). Study participants were interviewed using the Structured Clinical Interview for DSM-IV to assess BED and other psychiatric disorders and a supplemental structured interview to assess certain medical disorders; participants also completed a self-report questionnaire, the Bad Things Scale. For each psychiatric and medical disorder, we calculated the age- and sex-adjusted co-occurrence odds ratio: the odds of having that disorder in one's lifetime among individuals with (full or subthreshold) lifetime BED compared to individuals without lifetime BED. We also used subjects' responses to the Bad Things Scale to adjust for adversity over-reporting, a type of response bias that could result in spurious findings of co-occurrence.

Results: Full BED co-occurred significantly with bipolar disorder, major depressive disorder, bulimia nervosa but not anorexia nervosa, most anxiety disorders, substance use disorders, body dysmorphic disorder, kleptomania, irritable bowel syndrome, and fibromyalgia. These results changed little after correcting for adversity over-reporting. Subthreshold BED co-occurred significantly with many, but not all, of the significantly co-occurring disorders for full BED.

Conclusion: BED and, to a lesser degree, subthreshold BED exhibit substantial lifetime co-occurrence with psychiatric and medical disorders.

(J Clin Psychiatry 2008;69:266–273)

Received March 12, 2007; accepted May 2, 2007. *From the Department of Biostatistics, Harvard School of Public Health, Boston, Mass. (Drs. Javaras and Laird); the Department of Psychiatry, Harvard Medical School, and Biological Psychiatry Laboratory, McLean Hospital, Belmont, Mass. (Drs. Javaras, Pope, Lalonde, and Hudson and Mss. Roberts and Nillni); the Departments of Psychiatry and Nutrition, University of North Carolina at Chapel Hill (Dr. Bulik); the Department of Psychiatry, University of Minnesota, Minneapolis (Dr. Crow); the Department of Psychiatry, University of Cincinnati College of Medicine, Cincinnati, Ohio (Dr. McElroy); the Department of Psychiatry, Columbia University College of Physicians and Surgeons and New York State Psychiatric Institute, New York State Psychiatric Hospital, New York (Dr. Walsh); the Institute of Behavioral Genomics, Department of Psychiatry, University of California at San Diego and The Harvard Institute of Psychiatric Epidemiology & Genetics, Boston, Mass. (Dr. Tsuang); and Ortho-McNeil Pharmaceutical, Inc., Raritan, N.J. (Dr. Rosenthal). Dr. Lalonde is now with AstraZeneca, Zug, Switzerland.*

The analysis presented here was supported by the National Institutes of Health Training Program in Psychiatric Epidemiology and Biostatistics (grant no. 5 T32 MN17119-22). The Boston family study was supported by a grant from Ortho-McNeil Pharmaceutical, Inc.

Presented in part at the 12th annual meeting of the Eating Disorders Research Society, September 1, 2006, Port Douglas, Australia.

Financial disclosure appears at the end of the article.

Corresponding author and reprints: Kristin N. Javaras, D.Phil., Waisman Center, 1500 Highland Ave., Madison, WI 53705 (e-mail: javaras@wisc.edu).

If individuals with one disorder are more likely to have a second disorder than they would be otherwise, then the second disorder is said to co-occur with the first. The extent to which various psychiatric and medical disorders co-occur with binge eating disorder (BED) is interesting from both an etiologic and clinical perspective.

Prior studies have investigated BED co-occurrence by examining how the lifetime prevalence of other disorders differs for individuals with BED or related syndromes compared to individuals without BED.[1–13] With a few exceptions,[11–13] these studies have focused on overweight or obese subjects. The following psychiatric disorders have been found to co-occur significantly with BED in these studies: all mood disorders, all anxiety disorders, bulimia nervosa, substance use disorders, and personality disorders (especially avoidant and borderline). In the studies that included medical disorders,[9,12] self-reported problems such as back, neck, and chronic muscular pain in males and insomnia in females have been found to co-occur significantly with BED.

Although prior studies have helped us begin to understand BED co-occurrence, they are limited by their sampling or assessment procedures. Each study has at least one of the following limitations: small numbers of participants, clinic rather than community or population ascertainment, absence of males, and assessment of disorders based on responses to self-report questionnaires. Further, no prior study has attempted to adjust for a type of response bias that we refer to as *adversity over-reporting* or simply *over-reporting*. Adversity over-reporting is a tendency to report having experienced more adverse events than one actually has experienced, where the adverse events are of various types including psychiatric and medical disorders. Adversity over-reporting could reflect either a conscious exaggeration of adverse events or an unconscious bias towards perceiving one's past experiences in terms of adversity, a distinction analogous to the division of social desirability, another type of response bias, into impression management and self-deceptive enhancement.[14] Regardless of whether over-reporting is conscious or not, it can lead us to overestimate the co-occurrence of other disorders with BED if individuals with BED exhibit greater over-reporting than individuals without.

Here, we use data from a large, community-based sample of both sexes to assess the co-occurrence of various psychiatric and medical disorders with BED. All disorders were diagnosed by psychiatrists in Structured Clinical Interview for DSM-IV (SCID)–based interviews. We also examine how the co-occurrence results for BED change when we use responses to the Bad Things Scale to adjust for greater adversity over-reporting among individuals with BED. Finally, we assess the co-occurrence of the other medical and psychiatric disorders with subthreshold BED.

METHOD

We used data from a case-control family study of BED that we conducted in the Boston area from October 2002 to July 2004.[15] We used radio and print advertising to recruit probands who were overweight or obese. We selected 150 "case" probands who met all the DSM-IV criteria[16] for current or past BED within their lifetime and 150 "control" probands reporting no lifetime history of BED or other DSM-IV eating disorder. The control probands were frequency matched in age and sex to the case probands. We then contacted all available first-degree relatives and included them in the study if they consented to be interviewed. Both probands and relatives gave informed consent to participate. The McLean Hospital institutional review board approved the family study.

Psychiatrists administered the SCID[17] and a questionnaire about certain medical disorders in SCID format[18] (used as described in Hudson et al.[19]) to all participants. Individuals who reported eating binges but did not reach full criteria for lifetime BED were diagnosed with subthreshold BED if the eating binges were accompanied by any 1 of the following 3 sets of criteria: (1) eating binges meeting DSM-IV criterion A (definition of an episode of binge eating) that average ≥ 1 day a month for ≥ 6 months, but average < 2 days a week; (2) all BED criteria except for criterion B (associated features); or (3) eating binges that average ≥ 2 days a week for ≥ 6 months, but did not fully meet criterion A for amount of food consumed or loss of control, but in which the amount of food was at least *somewhat* large, and there was at least *some* loss of control over eating.

In addition, we asked study participants to complete the Bad Things Scale,[20] which asks the respondent whether he or she has experienced various adverse events "never," "rarely," "often," or "very often." (The respondent can also choose a "no response" category.) The questionnaire asks about 22 kinds of adverse events that include being sexually or physically abused by family members or nonfamily members, being stopped and questioned by police or other law enforcement persons for no good reason, being misdiagnosed by physicians, and being the victim of cruel and demeaning jokes. Although it can be debated whether adverse events are a cause or a result of psychopathology, almost all research suggests that individuals with more psychopathology tend to experience more adverse events of other types, too. Thus, in general, endorsing more of the events queried in the Bad Things Scale cannot and should not be taken as an indication of adversity over-reporting. However, as we discuss below, a few of the adverse events queried in the Bad Things Scale would not be expected to occur more frequently for those with mental illness and, further, would not be expected to occur frequently for anyone. Thus, individuals who report having experienced these particular events often or very often may tend to over-report adversity, including the psychiatric and medical disorders assessed here.

Our analyses included the 300 probands and only those 888 relatives who were personally interviewed. Table 1 presents summaries of age, sex, and body mass index (BMI) for the 1188 individuals included in our analyses. Note that 285 (150 probands and 135 relatives) met the DSM-IV criteria for lifetime (current or past) full BED, 54 (all of whom were relatives) met our criteria for lifetime subthreshold BED, and 849 (150 probands and 699 relatives) did not meet the criteria for BED or subthreshold BED.

We performed 2 sets of analyses for each of the other psychiatric and medical disorders. The first examined the co-occurrence of the other disorder with BED, first without adjustment for over-reporting (set 1a) and then with adjustment for over-reporting (set 1b). The second examined the co-occurrence of the other disorder with subthreshold BED (set 2).

Table 1. Demographic Information for Probands (N = 300) and Relatives (N = 888) by Binge Eating Disorder (BED) Status[a]

	Interviewed Participants					
	With No BED		With Subthreshold BED		With Full BED	
Characteristic	Probands	Interviewed Relatives	Probands[b]	Interviewed Relatives	Probands	Interviewed Relatives
Number, N	150	699	NA	54	150	135
Age, y[c]						
Mean	50.2	47.5	NA	46.2	49.5	43.0
SD	12.6	18.0	NA	16.2	12.8	14.3
Range	21–75	18–91	NA	21–83	18–75	18–77
Sex, %[c]						
Female	75.3	63.7	NA	81.5	76.0	74.8
Male	24.7	36.3	NA	18.5	24.0	25.2
BMI, kg/m^2						
Mean	33.3	27.7	NA	30.7	35.8	33.4
SD	5.2	5.9	NA	7.2	6.7	8.6
Range	25.7–49.0	17.3–59.6	NA	16.0–48.8	25.0–63.0	19.2–59.6

[a]Statistics in Table 1 do not incorporate sampling weights.
[b]Probands were required to have either full BED or no BED.
[c]Case and control probands were frequency matched by sex and age.
Abbreviations: BMI = body mass index, NA = not applicable.

In all analyses, we tested the hypothesis that (full or subthreshold) BED co-occurs with each of the other psychiatric and medical disorders by calculating the co-occurrence odds ratio for the other disorder with (full or subthreshold) BED. The co-occurrence odds ratio is the odds of an individual with (full or subthreshold) BED having the other disorder in his or her lifetime versus the odds of an individual without BED having the other disorder in his or her lifetime. The co-occurrence odds ratio was calculated from a logistic regression model with lifetime diagnoses of the other disorder as the outcome and lifetime diagnoses of (full or subthreshold) BED as the explanatory variable. We included indicators for age category (18–29 years, 30–39 years, 40–49 years, 50–59 years, and 60+ years) and sex in the logistic regression model in order to adjust for age and sex. In some of the analyses, we also included indicators for BMI categories defined by the quintiles of the BMI values observed in our sample (16.0–24.3, 24.3–27.8, 27.8–30.8, 30.8–35.6, and 35.6–63.0).

To adjust the full BED analyses for adversity over-reporting (set 1b), we used responses to the Bad Things Scale. More specifically, we used responses to 2 questions—"I have been sold defective products" and "I have been overbilled by stores, utility companies, or other organizations"—because we reasoned that these experiences were least likely to be associated with psychopathology (compared to, say, sexual abuse) and, further, do not occur frequently. Thus, any participant who reported that he or she had experienced either of these events frequently or very frequently was categorized as exhibiting adversity over-reporting ("Over-reporting" group). The remaining subjects belonged to the "No Over-reporting" group. We then calculated an adversity over-reporting adjusted co-occurrence odds ratio by including an indicator for over-reporting group as a covariate in the logistic regression model. In addition, we calculated separate co-occurrence odds ratios for the Over-reporting group and No Over-reporting group to see whether they differed.

We repeated analyses 1a, 1b, and 2 using data from 3 groups, whenever possible: the probands only (set 1a), the relatives only (sets 1a and 2), and both the probands and relatives combined (sets 1a, 1b, and 2). When using relatives only or relatives and probands combined, we used generalized estimating equations[21] with an independence working covariance matrix to fit the logistic regression model because these analyses involved multiple participants from each family. When using probands and relatives combined, we included an indicator for proband versus relative in the logistic regression model since the lifetime prevalence of other disorders differed for the 2 types of subjects.

To correct for the effects of over-sampling probands with BED and relatives of probands with BED (compared to their representation in the population), we weighted the data proportionally to the inverse probability of their selection. We did so in all analyses. For probands, the probability of selection depended on whether they had BED. For relatives, the probability of selection depended on how many family members with and without BED they had. Calculation of the selection probabilities required knowing the lifetime prevalence of BED for different age and sex groups in the overweight/obese segment of the greater Boston area population from which our sample was drawn. To calculate these prevalences, we used a method developed for estimating prevalence from relatives of case and control probands.[22] The validity of this method requires assumptions that families are singly ascertained, that proband selection is independent of relative characteristics, and that family size is not associated with the proportion of

Table 2. Number and Percent of Participants With Other Disorders, by Relative Type and BED Status[a]

	Subjects With Other Disorder/Disease, N (%)							
	Probands Only[b]		Relatives Only			Probands and Relatives		
Other Disorder	No BED (N = 150)	Full BED (N = 150)	No BED (N = 699)	Sub-BED (N = 54)	Full BED (N = 135)	No BED (N = 849)	Sub-BED (N = 54)	Full BED (N = 285)
Mood								
Bipolar disorder	2 (1.3)	14 (9.3)	20 (2.9)	3 (5.6)	17 (12.6)	22 (2.6)	3 (5.6)	31 (10.9)
Major depressive disorder	24 (16.0)	60 (40.0)	147 (21.0)	25 (46.3)	70 (51.9)	171 (20.1)	25 (46.3)	130 (45.6)
Dysthymic disorder	3 (2.0)	10 (6.7)	18 (2.6)	3 (5.6)	5 (3.7)	21 (2.5)	3 (5.6)	15 (5.3)
Anxiety								
Generalized anxiety disorder	2 (1.3)	12 (8.0)	34 (4.9)	7 (13.0)	23 (17.0)	36 (4.2)	7 (13.0)	35 (12.3)
Obsessive-compulsive disorder	2 (1.3)	13 (8.7)	12 (1.7)	1 (1.9)	9 (6.7)	14 (1.6)	1 (1.9)	22 (7.7)
Panic disorder	6 (4.0)	16 (10.7)	30 (4.3)	6 (11.1)	17 (12.6)	36 (4.2)	6 (11.1)	33 (11.6)
Posttraumatic stress disorder	7 (4.7)	22 (14.7)	28 (4.0)	3 (5.6)	20 (14.8)	35 (4.1)	3 (5.6)	42 (14.7)
Social phobia	0 (0)	8 (5.3)	43 (6.2)	12 (22.2)	31 (23.0)	43 (5.1)	12 (22.2)	39 (13.7)
Specific phobia	6 (4.0)	20 (13.3)	85 (12.2)	15 (27.8)	38 (28.1)	91 (10.7)	15 (27.8)	58 (20.4)
Agoraphobia without panic disorder	0 (0)	4 (2.7)	6 (0.9)	0 (0)	4 (3.0)	6 (0.7)	0 (0)	8 (2.8)
Eating								
Anorexia nervosa	NA[c]	NA[c]	20 (2.9)	2 (3.7)	7 (5.2)	NA[c]	NA[c]	NA[c]
Bulimia nervosa	NA[c]	NA[c]	11 (1.6)	1 (1.9)	7 (5.2)	NA[c]	NA[c]	NA[c]
Substance use								
Alcohol abuse/dependence	25 (16.7)	31 (20.7)	124 (17.7)	11 (20.4)	41 (30.4)	149 (17.6)	11 (20.4)	72 (25.3)
Drug abuse/dependence	20 (13.3)	41 (27.3)	79 (11.3)	12 (22.2)	32 (23.7)	99 (11.7)	12 (22.2)	73 (25.6)
Somatoform								
Somatization disorder	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Body dysmorphic disorder	1 (0.7)	9 (6.0)	3 (0.4)	0 (0)	3 (2.2)	4 (0.5)	0 (0)	12 (4.2)
Psychotic								
Schizophrenia	0 (0)	0 (0)	2 (0.3)	0 (0)	0 (0)	2 (0.2)	0 (0)	0 (0)
Schizoaffective disorder	2 (1.3)	0 (0)	2 (0.3)	0 (0)	0 (0)	4 (0.5)	0 (0)	0 (0)
Other psychiatric								
Kleptomania	3 (2.0)	8 (5.3)	3 (0.4)	0 (0)	8 (5.9)	6 (0.7)	0 (0)	16 (5.6)
Tourette's disorder	1 (0.7)	0 (0)	3 (0.4)	0 (0)	0 (0)	4 (0.5)	0 (0)	0 (0)
Medical								
Irritable bowel syndrome	11 (7.3)	29 (19.3)	59 (8.4)	10 (18.5)	29 (21.5)	70 (8.2)	10 (18.5)	58 (20.4)
Fibromyalgia	5 (3.3)	11 (7.3)	9 (1.3)	3 (5.6)	14 (10.4)	14 (1.6)	3 (5.6)	25 (8.8)
Chronic fatigue syndrome	2 (1.3)	5 (3.3)	3 (0.4)	0 (0)	3 (2.2)	5 (0.6)	0 (0)	8 (2.8)
Migraine	12 (8.0)	14 (9.3)	65 (9.3)	7 (13.0)	12 (8.9)	77 (9.1)	7 (13.0)	26 (9.1)

[a]Statistics in Table 2 do not incorporate sampling weights.
[b]Probands were required to have either full BED or no BED.
[c]Probands were required to not have a lifetime diagnosis of anorexia or bulimia nervosa and thus could not be used to calculate ORs for eating disorders.
Abbreviations: BED = binge eating disorder, NA = not applicable, sub-BED = subthreshold BED.

family members with BED. Note that standard errors for the co-occurrence odds ratios do not reflect the uncertainty stemming from the estimation of the inverse probability weights.

We did not correct the results of our analyses for multiple comparisons due to the difficulty of determining an appropriate and not-overly-conservative correction for correlated outcomes. Therefore, the reader should bear in mind when viewing the results that some findings, especially those of marginal significance ($.01 < p < .05$), may represent type I error. All analyses were performed using Stata 9.0 software (StataCorp, College Station, Tex.).

RESULTS

Binge eating disorder and, to a lesser extent, subthreshold BED, co-occurred significantly with a wide range of other disorders (Tables 2 and 3). Note that the co-occurrence odds ratios are generally higher for probands than for relatives, but not significantly so (results not reported). For both probands and relatives combined, BED displayed significant comorbidity with major depressive disorder, bipolar disorder, most anxiety disorders (except agoraphobia without panic), bulimia nervosa (but not anorexia nervosa), substance use disorders, body dysmorphic disorder, and kleptomania. In addition, BED exhibited significant comorbidity with fibromyalgia and irritable bowel syndrome. Adjusting for BMI had little effect on the co-occurrence odds ratios (Table 3).

The over-reporting–adjusted analyses included 1171 of the 1188 total subjects (17 individuals could not be assigned to over-reporting groups because they were missing responses for the Bad Things Scale). Of the remaining 1171, 119 (10.2%) belonged to the Over-reporting group, and 1052 (89.8%) belonged to the No Over-reporting group. Approximately 17.4% of participants with BED belonged to the Over-reporting group, compared to 7.9% of those without BED ($p < .001$, by Fisher exact test, 2-tailed). Figure 1 presents the number of co-occurring psychiatric and medical disorders for individuals with and

without BED, separately for the 2 over-reporting groups. Note that subjects in the Over-reporting group reported more co-occurring disorders than the corresponding subjects in the No Over-reporting group. However, within each over-reporting group, those with BED still had more co-occurring disorders than those without BED.

The co-occurrence odds ratios for some disorders were smaller after correction for adversity over-reporting (Table 3), but all of the disorders listed above as co-occurring significantly with BED retained their significance. When we calculated separate co-occurrence odds ratios for each over-reporting group (not reported), we found that the odds ratios were higher, but not significantly so, in the Over-reporting group than in the No Over-reporting group for all disorders except substance use disorders. For both alcohol abuse/dependence and drug abuse/dependence, the co-occurrence odds ratios for BED were significantly smaller in the Over-reporting group.

Table 3. Co-occurrence Odds Ratios[a] for Other Disorders[b]

	Subthreshold BED vs No BED[c]					
	Relatives Only			Probands and Relatives		
	Adjusted for Age and Sex			Adjusted for Age, Sex, and Type		
Other Disorder	OR	CI	p	OR	CI	p
Mood						
Bipolar disorder	0.80	0.18 to 3.6	.77	0.87	0.19 to 3.9	.85
Major depressive disorder	4.8	2.0 to 12	.001	4.7	1.9 to 11	.001
Dysthymic disorder	2.4	0.52 to 11	.27	2.0	0.43 to 9.5	.38
Anxiety						
Generalized anxiety disorder	4.2	1.2 to 15	.027	4.4	1.2 to 16	.022
Obsessive-compulsive disorder	0.52	0.055 to 4.8	.56	0.59	0.07 to 5.1	.63
Panic disorder	1.4	0.39 to 4.8	.62	1.3	0.39 to 4.6	.65
Posttraumatic stress disorder	0.51	0.12 to 2.2	.37	0.49	0.12 to 2.0	.33
Social phobia	5.7	2.0 to 16	.001	6.0	2.1 to 17	.001
Specific phobia	2.4	0.97 to 6.2	.059	2.5	0.96 to 6.3	.060
Agoraphobia without panic disorder	0	UD	UD	0	UD	UD
Eating						
Anorexia nervosa	3.0	0.50 to 19	.25	3.0[e]	0.50 to 19	.25
Bulimia nervosa	0.3	0.032 to 2.8	.29	0.3[e]	0.032 to 2.8	.29
Substance use						
Alcohol abuse/dependence	3.0	1.0 to 9.1	.050	2.8	0.99 to 8.1	.052
Drug abuse/dependence	2.7	0.90 to 7.8	.076	2.5	0.97 to 7.1	.088
Somatoform						
Somatization disorder	UD	UD	UD	UD	UD	UD
Body dysmorphic disorder	0	UD	UD	0	UD	UD
Psychotic						
Schizophrenia	0	UD	UD	0	UD	UD
Schizoaffective disorder	0	UD	UD	0	UD	UD
Other psychiatric						
Kleptomania	0	UD	UD	0	UD	UD
Tourette's disorder	0	UD	UD	0	UD	UD
Medical						
Irritable bowel syndrome	4.4	1.6 to 12	.004	4.0	1.5 to 11	.006
Fibromyalgia	4.9	0.95 to 29	.076	2.9	0.57 to 15	.20
Chronic fatigue syndrome	0	UD	UD	0	UD	UD
Migraine	1.4	0.45 to 4.3	.58	1.4	0.44 to 4.2	.60

[a]Co-occurrence odds ratio is the odds of having the other disorder for individuals with BED compared to individuals without BED, adjusted for age and sex and, in analyses that include both probands and relatives, also for type (proband vs. relative).
[b]Statistics incorporate sampling weights.
[c]There are no "probands only" columns for subthreshold BED because probands were required to have either full BED or no BED.

DISCUSSION

We found that BED co-occurred significantly with a broad range of psychiatric disorders, including mood disorders, anxiety disorders, bulimia nervosa, and substance use disorders. This finding is generally consistent with previous studies using smaller samples, which have demonstrated a numerically, but not always statistically significant, elevated prevalence of these disorders in individuals with BED.[1,2,4–6,8–11,13] We also found that BED co-occurred significantly with body dysmorphic disorder and kleptomania, 2 disorders not assessed in previous studies.

In addition to psychiatric disorders, we found high levels of co-occurrence of BED with the medical conditions fibromyalgia and irritable bowel syndrome—disorders that have not previously been assessed in studies of BED but which have been reported to co-occur frequently with mood and anxiety disorders.[23,24]

Subthreshold BED also co-occurred with certain mood and anxiety disorders, though to a lesser extent than full BED. This observation suggests that subthreshold BED has important similarities with full BED, as opposed to being simply a nonspecific pattern of disturbed eating, a finding also suggested by other studies examining clinical characteristics of BED.[25,26] Notably, the National Comorbidity Survey Replication[11] found little evidence that subthreshold BED co-occurs with other disorders, but this apparent inconsistency is likely attributable to a different definition of subthreshold BED.

Because of concerns that individuals with BED might be more likely to over-report adversity, we used responses to the Bad Things Scale to create a binary indicator variable assessing the tendency to over-report adverse events. While individuals with BED may be more likely than those without to experience most adverse events, we assumed that this was not likely to be so for 2 items: having been sold defective products and having been overbilled. If an individual responded with "often" or "very often" to either of these 2 items, we took it as an indication that the individual was prone to over-reporting. Ac-

Full BED vs No BED														
Probands Only			Relatives Only			Probands and Relatives								
Adjusted for Age and Sex			Adjusted for Age and Sex			Adjusted for Age, Sex, and Type			Also Adjusted for BMI			Also Adjusted for Over-Reporting[d]		
OR	CI	p	OR	CI	p	OR	CI	p	OR	CI	p	OR	CI	p
8.2	1.9 to 36	.006	3.3	1.2 to 9.4	.022	4.5	2.0 to 10	< .001	3.8	1.5 to 9.2	.004	4.2	1.9 to 9.3	.001
4.1	2.3 to 7.6	< .001	4.9	2.7 to 9.1	< .001	4.5	2.9 to 7.0	< .001	4.7	3.0 to 7.3	< .001	4.3	2.7 to 6.8	< .001
3.0	0.77 to 12	.11	1.2	0.33 to 4.2	.80	1.6	0.65 to 3.8	.31	2.2	0.92 to 5.1	.075	1.3	0.54 to 3.3	.54
7.2	1.4 to 38	.019	2.7	1.1 to 6.5	.023	3.4	1.6 to 6.9	.001	3.5	1.6 to 7.8	.002	3.3	1.6 to 6.7	.001
5.8	1.4 to 25	.018	3.5	0.94 to 13	.061	4.1	1.6 to 10	.003	4.3	1.5 to 12	.006	4.2	1.7 to 11	.002
3.1	1.1 to 8.7	.033	2.9	1.2 to 6.9	.014	3.0	1.5 to 6.1	.003	2.9	1.4 to 5.8	.003	3.2	1.5 to 6.6	.002
3.7	1.5 to 9.3	.006	3.8	1.3 to 11	.018	3.5	1.5 to 8.1	.003	3.4	1.4 to 8.1	.007	3.1	1.2 to 7.8	.017
∞	UD	UD	3.8	1.9 to 7.6	< .001	4.4	2.3 to 8.4	< .001	5.2	2.6 to 10	< .001	4.1	2.1 to 8.2	< .001
4.4	1.5 to 12	.006	3.1	1.7 to 5.6	< .001	3.4	2.1 to 5.7	< .001	3.6	2.1 to 6.2	< .001	3.4	2.0 to 5.6	< .001
∞	UD	UD	2.2	0.36 to 14	.39	3.4	0.74 to 16	.12	4.2	1.0 to 17	.044	2.7	0.62 to 11	.19
NA[f]	NA	NA	1.3	0.37 to 4.4	.71	1.3[e]	0.37 to 4.4	.71	2.9[e]	0.74 to 11	.13	1.3[e]	0.37 to 4.4	.70
NA[f]	NA	NA	4.6	1.3 to 16	.018	4.6[e]	1.3 to 16	.018	7.9[e]	1.9 to 33	.004	4.8[e]	1.4 to 17	.015
1.3	0.72 to 2.4	.38	2.0	1.0 to 3.8	.049	1.7	1.0 to 2.9	.037	1.8	1.1 to 3.0	.03	1.5	0.85 to 2.6	.16
2.4	1.3 to 4.4	.007	2.6	1.2 to 5.9	.020	2.4	1.3 to 4.4	.004	2.8	1.6 to 5.0	< .001	2.2	1.2 to 4.2	.015
UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD	UD
20	1.6 to 250	.021	7.6	1.2 to 47	.029	15	2.8 to 81	.001	22	4.0 to 119	< .001	14	2.7 to 73	.002
UD	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD
0	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD
2.5	0.62 to 10.2	.20	22	4.8 to 105	< .001	5.3	1.6 to 18	.007	6.8	1.8 to 25	.004	4.6	1.4 to 15	.010
0	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD	0	UD	UD
2.9	1.3 to 6.2	.006	4.7	2.2 to 10	< .001	3.7	2.1 to 6.8	< .001	3.8	2.0 to 7.1	< .001	3.7	2.0 to 6.9	< .001
2.4	0.78 to 7.1	.13	16	5.7 to 47	< .001	7.7	3.4 to 18	< .001	8.1	4.1 to 16	< .001	6.6	3.0 to 14	< .001
2.5	0.46 to 13	.29	3.4	0.46 to 25	.23	2.8	0.79 to 9.9	.11	4.3	1.4 to 13	.013	2.2	0.69 to 7.1	.18
1.3	0.57 to 3.0	.53	0.37	0.16 to 0.85	.020	0.56	0.31 to 1.0	.057	0.49	0.24 to 0.99	.047	0.58	0.32 to 1.1	.072

[d]Over-reporting–adjusted BED ORs were not calculated using "probands only" or "relatives only" due to small numbers of subjects in the over-reporting group.
[e]Analysis included "relatives only" since probands were not permitted to have either anorexia nervosa or bulimia nervosa.
[f]Analysis could not be performed for "probands only" since probands were not permitted to have either anorexia nervosa or bulimia nervosa.
Abbreviations: BED = binge eating disorder, BMI = body mass index, NA = not applicable, UD = undefined (i.e., 0/0 or ∞/∞).

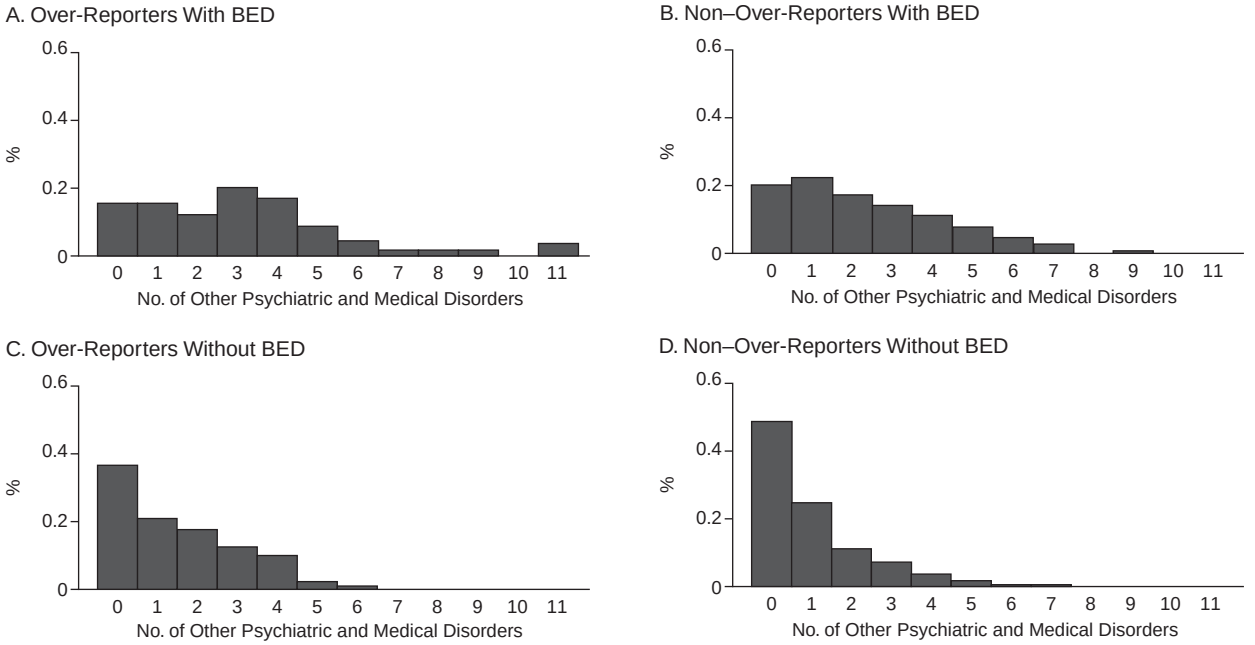
cording to this variable, individuals with BED were more likely to over-report adversity and over-reporters were more likely to endorse co-occurring disorders. However, statistical adjustment for this variable only slightly attenuated the co-occurrence odds ratios, suggesting that our results cannot be explained simply by adversity over-reporting. Furthermore, the same co-occurrence odds ratios were significant when the analyses were limited to only those individuals in the No Over-reporting group (results not reported). To our knowledge, this is the first time that the issue of adversity over-reporting has been formally addressed in a study of co-occurrence with a psychiatric disorder. However, in informal unpublished analyses, Kessler and colleagues found that estimates of comorbidity in the National Comorbidity Survey family of surveys did not change when adjusted for responses to scales measuring various types of response bias (R. C. Kessler, Ph.D., personal communication, July 2006).

Our findings have both practical and theoretical implications. On a practical level, these findings suggest that clinicians should be alert for various co-occurring disorders frequently seen in patients with BED. The overall outcome of treatment in such patients will be determined not only by the improvement of BED itself, but also by the response of associated conditions.

On a theoretical level, our findings suggest that BED may share common etiologic features with other conditions. However, the nature of these potential common factors is not clear. They may represent, for example, factors contributing to specific clusters of disorders, such as "affective spectrum disorder"[19,27]; factors linked to underlying endophenotypes, such as impulsivity[28]; or simply nonspecific genetic or environmental risk factors for general psychopathology.

Several limitations of this study should be considered. First, the requirement that the probands be overweight

Figure 1. Number of Co-Occurring Psychiatric and Medical Disorders for Subjects[a]



[a]Statistics in Figure 1 do incorporate sampling weights.
Abbreviation: BED = binge eating disorder.

resulted in a sample where all probands and almost all relatives were overweight, which potentially limits the generalizability of our findings. Second, the interviewers were not blinded to the diagnosis of BED in the participants. Thus, there is the possibility of observer bias if investigators were more likely or less likely to make diagnoses in individuals with BED than in individuals without BED. Third, although large relative to other samples, our sample was underpowered for some of the analyses. Lack of power may have been a particular problem for detecting other disorders that co-occur only moderately with BED, especially if they are uncommon. An example would be anorexia nervosa, the full form of which was found in only 27 individuals in the entire sample, leading to a very wide confidence interval for the co-occurrence odds ratios. Lack of statistical power may also have limited our ability to detect differences between the Over-reporting and No Over-reporting groups in the co-occurrence of other disorders with BED. In addition, a larger sample would have been needed to look at sex differences in the co-occurrence of BED with other disorders. Fourth, the constructs *somewhat* large amounts of food and *some* loss of control, used in one of our definitions of subthreshold BED, were not operationalized; indeed, the original constructs of *large* and *loss of control* are themselves not operationalized in DSM-IV. We did not obtain any continuous data on these variables, and it may be useful to develop continuous measures to assess these constructs in future research.

Finally, although we did attempt to address whether the findings of co-occurrence stemmed from greater adversity over-reporting among individuals with BED, our measure of over-reporting was not perfect. For one, our measure is binary and is therefore only a summary of the tendency to over-report, which most likely falls along a continuum. In addition, our measure, which is based on over-reporting of negative experiences with utility and other companies, may not fully capture the tendency to over-report psychiatric and medical disorders if adversity over-reporting has both general and specific features. Next, our measure may have tapped other psychopathological features, such as paranoid traits, in addition to adversity over-reporting. If so, the expected effect would likely be to bias estimates of the co-occurrence odds ratios downward, thus making these estimates more conservative. Further, our measure was not designed to capture the tendency to under-report psychiatric and medical disorders, another type of response bias that could affect co-occurrence findings if it occurs more frequently in individuals without BED than in individuals with BED. In general, it is not possible to fully assess the impact of over-reporting (or under-reporting) on co-occurrence findings without an objective measure of psychiatric diagnosis that does not rely on self-report, such as a biomarker.

In summary, we found that BED co-occurred significantly with a broad range of psychiatric disorders and also with certain medical conditions. These findings are

of both clinical and theoretical importance and support the possibility that BED may share etiologic factors with these other disorders.

Financial disclosure: **Dr. Pope** has been a consultant for Ortho-McNeil and has received grant/research support from Eli Lilly and Solvay. **Dr. Lalonde** is an employee of AstraZeneca, but this employment only began after the completion of this study. **Dr. Crow** has been a consultant for Eli Lilly and has received grant/research support from Eli Lilly, Pfizer, and Bristol-Myers Squibb. **Dr. McElroy** is a consultant to or member of the scientific advisory boards of Abbott, Eli Lilly, GlaxoSmithKline, Janssen, Novartis, Ortho-McNeil, and Wyeth; is a principal or co-investigator on research studies sponsored by Abbott, American Diabetes Association, AstraZeneca, Bristol-Myers Squibb, Esai, Eli Lilly, Forest, GlaxoSmithKline, Janssen, National Institute of Mental Health, Ortho-McNeil, Pfizer, Sanofi-Synthelabo, Somaxon, and Stanley Medical Research Institute; and is also inventor on U.S. Patent No. 6,323,236B2, Use of Sulfamate Derivatives for Treating Impulse Control Disorders, and, along with the patent's assignee, University of Cincinnati, Cincinnati, Ohio, receives payments from Johnson & Johnson Pharmaceutical Research and Development, L.L.C., which has exclusive rights under the patent. **Dr. Walsh** has received grant/research support from Eli Lilly. **Dr. Rosenthal** is an employee of Ortho-McNeil. **Dr. Hudson** is a consultant for Eli Lilly and Ortho-McNeil, and furthermore has received grants/research support from Eli Lilly, Ortho-McNeil, and Forest. **Drs. Javaras**, **Laird**, **Bulik**, and **Tsuang** and **Mss. Roberts** and **Nillni** report no additional financial or other relationships relevant to the subject of this article.

REFERENCES

1. Hudson JI, Pope HG Jr, Wurtman J, et al. Bulimia in obese individuals: relationship to normal-weight bulimia. J Nerv Ment Dis 1988;176: 144–152
2. Marcus MD, Wing RR, Ewing L, et al. Psychiatric disorders among obese binge eaters. Int J Eat Disord 1990;9:69–77
3. Spitzer RL, Yanovski S, Wadden T, et al. Binge eating disorder: its further validation in a multisite study. Int J Eat Disord 1993;13:137–153
4. Yanovski SZ, Nelson JE, Dubbert BK, et al. Association of binge eating disorder and psychiatric comorbidity in obese subjects. Am J Psychiatry 1993;150:1472–1479
5. Brody ML, Walsh BT, Devlin MJ. Binge eating disorder: reliability and validity of a new diagnostic category. J Consult Clin Psychol 1994;62: 381–386
6. Mussell MP, Mitchell JE, de Zwaan M, et al. Clinical characteristics associated with binge eating in obese females: a descriptive study. Int J Obes Relat Metab Disord 1996;20:324–331
7. Smith DE, Marcus MD, Lewis CE, et al. Prevalence of binge eating disorder, obesity, and depression in a biracial cohort of young adults. Ann Behav Med 1998;20:227–232
8. Telch CF, Stice E. Psychiatric comorbidity in women with binge eating disorder: prevalence rates from a non–treatment-seeking sample. J Consult Clin Psychol 1998;66:768–776
9. Bulik CM, Sullivan PF, Kendler KS. Medical and psychiatric morbidity in obese women with and without binge eating. Int J Eat Disord 2002;32:72–78
10. Fontenelle LF, Mendlowcz MV, Menezes GB, et al. Psychiatric comorbidity in a Brazilian sample of patients with binge eating disorder. Psychiatry Res 2003;119:189–194
11. Hudson JI, Hiripi E, Pope HG Jr, et al. The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. Biol Psychiatry 2007;61:348–358
12. Reichborn-Kjennerud T, Bulik CM, Sullivan PF, et al. Psychiatric and medical symptoms in binge eating in the absence of compensatory behaviors. Obes Res 2004;12:1445–1454
13. Grucza RA, Przybeck TR, Cloninger CR. Prevalence and correlates of binge eating disorder in a community sample. Compr Psychiatry 2007; 48:124–131
14. Paulhus DL. Measurement and control of response bias. In: Robinson JP, Shaver PR, Wrightsman LS, eds. Measures of Personality and Social Psychological Attitudes: Volume 1 in Measures of Social Psychological Attitudes Series. San Diego, Calif: Academic Press; 1991:17–60
15. Hudson JI, Lalonde JK, Berry JM, et al. Binge eating disorder as a distinct familial phenotype in obese individuals. Arch Gen Psychiatry 2006;63:313–319
16. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Washington, DC: American Psychiatric Association; 1994
17. First MB, Spitzer RL, Gibbon M, et al. Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition (Version 2.0). New York, NY: Biometrics Research, New York State Psychiatric Institute; 1995
18. Pope HG Jr, Hudson JI. A supplemental interview for forms of "affective spectrum disorder." Int J Psychiatry Med 1991;21:205–232
19. Hudson JI, Mangweth B, Pope HG Jr, et al. Family study of affective spectrum disorder. Arch Gen Psychiatry 2003;60:170–177
20. Johnson RC, Edman JL, Danko GP, et al. How often do bad things happen? reported and predicted frequencies. Eur J Psychol Assess 1994; 10:192–199
21. Liang K-Y, Zeger SL. Longitudinal data analysis using generalized linear models. Biometrika 1986;73:13–22
22. Javaras KN, Laird NM, Hudson JI, et al. Estimating the prevalence of disease using relatives of case and control probands. COBRA Preprint Series. Article 31. August 2007. Available at: http://biostats.bepress.com/cobra/ps/art31. Accessibility verified November 5, 2007
23. Whitehead WE, Palsson O, Jones KR. Systematic review of the comorbidity of irritable bowel syndrome with other disorders: what are the causes and implications? Gastroenterology 2002;122:1140–1156
24. Arnold LM, Hudson JI, Keck PE Jr, et al. Comorbidity of fibromyalgia and psychiatric disorders. J Clin Psychiatry 2006;67:1219–1225
25. Striegel-Moore RH, Dohm FA, Solomon EE, et al. Subthreshold binge eating disorder. Int J Eat Disord 2000;27:270–278
26. Crow SJ, Agras WS, Halmi K, et al. Full syndromal versus subthreshold anorexia nervosa, bulimia nervosa, and binge eating disorder: a multicenter study. Int J Eat Disord 2002;32:309–318
27. Hudson JI, Arnold LM, Keck PE Jr, et al. Family study of fibromyalgia and affective spectrum disorder. Biol Psychiatry 2004;56:884–891
28. McElroy SL, Kotwal R. Binge eating. In: Hollander E, Stein DJ, eds. Clinical Manual of Impulse Control Disorders. Washington, DC: American Psychiatric Press; 2006:115–148