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Lifetime psychiatric comorbidity of alcohol dependence and bulimia nervosa in women

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Abstract

Previous work from our group revealed two groups of women with bulimia nervosa (BN), one with, and one without alcohol dependence (AD). The current study sought to determine whether women with lifetime BN and AD (BN+AD+) were more similar to women with BN and no AD (BN+AD−) or to women with AD and no BN (BN−AD+) in terms of lifetime psychiatric comorbidity and psychological functioning. Data on BN and AD from 407 female relatives in a family study of alcoholism were used to create three mutually exclusive groups: BN+AD+ ($n = 30$), BN+AD− ($n = 55$), and BN−AD+ ($n = 322$). Bivariate analyses revealed fewer differences between BN+AD+ and BN−AD+ women than between BN+AD+ and BN+AD− women. BN+AD+ women were more likely than BN+AD− women to have drug dependence, conduct disorder, and suicidality, and were more likely to have major depression, lower GAF scores, and to engage in unsafe sex than both BN+AD− and BN−AD+ women. After adjusting for other psychopathology and demographic variables, BN+AD+ women were more likely than BN+AD− women to have major depression, drug dependence, and tobacco dependence and more likely than BN−AD+ women to have major depression and obsessive-compulsive disorder. These results suggest that BN+AD+ women exhibit more severe psychopathology than either BN+AD− or BN−AD+ women and may represent a distinct subgroup within bulimia nervosa or alcohol dependence.

Keywords: Bulimia nervosa; Alcohol dependence; Comorbidity; COGA

1. Introduction

Previously published studies have found elevated rates of lifetime alcohol dependence (AD) in women with bulimia nervosa (BN) compared to controls in both clinical and population based samples (Garfinkel et al., 1995; Lilenfeld et al., 1998; Wade et al., 2004). The lifetime prevalence of AD in women was estimated as 8.2% using data from the National Comorbidity Study (Kessler et al., 1994); comparable rates of AD in women with BN ranged from 13.2% in the population-based National Women's Study (Dansky et al., 2000) to 47% in a clinical sample (Bulik et al., 1997). Although there appears to be a connection between these two disorders, the reasons for this association are unknown. Family studies that have examined coaggregation of alcoholism and BN in families have found no evidence for shared genetic or environmental factors in the etiology of these two disorders in female samples (Lilenfeld et al., 1997; Schuckit et al., 1996) or in a mixed gender sample (Nurnberger et al., 2004).

Women with BN and comorbid alcohol and/or other substance use disorders (SUD) have been shown to have increased prevalence of other lifetime psychiatric diagnoses, including major depression, anxiety disorders, conduct disorder, and cluster B personality disorders (Bulik et al., 1997, 2004; Lilenfeld et al., 1997; Suzuki et al., 1994). Criteria for many of these disorders (e.g., conduct disorder, cluster B personality disorders), as well as BN and SUDs, feature impulsive behaviors (American Psychiatric Association, 2000). Indeed, women with comorbid BN and alcohol use disorders (AUD) have been found to have higher scores on impulsivity measures (Bulik et al., 1997, 2004), and more impulsive behaviors (Suzuki et al., 1994) than women

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with BN and no AUD. It has thus been hypothesized that these women with BN and AUD represent an impulsive subtype of BN and that impulsivity may be a risk factor common to both BN and AUD that could account for the high rate of comorbidity between these two disorders (Fichter et al., 1994; Lilenfeld et al., 1997).

In a previously published study using data from wave I of the Collaborative Study on the Genetics of Alcoholism (COGA; Duncan et al., 2005), we found evidence for two classes of BN in a latent class analysis of lifetime comorbid diagnoses in women with BN. One class was characterized by a high prevalence of depression and low prevalence of other disorders, while the other class exhibited an equally high prevalence of depression, as well as elevated levels of alcohol dependence, marijuana dependence, cocaine dependence, and antisocial personality disorder. Members of this class were also more likely than the depression only class to have persistent suicidal ideation, to have made a suicide attempt, to have ever been a daily smoker, and to have lower Global Assessment of Functioning (GAF) scores at the time of interview. These findings support the possibility of an externalizing, impulsive subtype of BN.

The previously mentioned studies have several limitations. First, many investigators who have examined comorbidity of BN and AD have not looked at AD separately, but rather combine AD with other drug abuse and dependence (Grilo et al., 1995; Kaye et al., 1996) or alcohol abuse (Bulik et al., 1997, 2004; Suzuki et al., 1993, 1994). Although different types of substance use disorders (SUD) have been found to have shared genetic and environmental liabilities, there is also variance specific to each disorder (Bierut et al., 1998; Tsuang et al., 1998). Therefore, grouping individuals with different forms of SUDs may have obscured the true relationship between BN and AD. Second, most were conducted using clinical samples (Bulik et al., 1997; Lilenfeld et al., 1997, 1998; Suzuki et al., 1994). Because people who present for treatment tend to have more severe psychopathology (Kessler et al., 1996; Regier et al., 1990; Wu et al., 1999), results from studies using such samples may not be generalizable to the population at large. Finally, the comparison group for the majority of these studies has been restricted to women with BN and no AD or SUD. While women with BN and AD may represent a unique group, it is possible that the excess comorbidity seen in women with BN and AD is simply associated with their AD diagnosis. Additional comparisons between women with BN and AD and women with AD and no eating disorder could provide valuable insights into the etiologic relationship between BN, AD, and other psychiatric comorbidity. Furthermore, identification of women with BN and AD as a distinct subgroup with a heavy burden of psychopathology could lead to improved assessment and treatment of individuals with these disorders.

The purpose of the current study was to examine differences in comorbid psychopathology, SUDs, impulsive behaviors, and psychiatric functioning between women with: (a) BN without AD, (b) BN with AD, and (c) AD with no BN, in a non-clinical sample enriched for AD. We sought to determine the degree to which any observed excess comorbidity found in women with BN and AD may be related to their AD diagnosis and to what degree women with BN and AD represent a distinct subtype.

2. Methods

2.1. COGA

Briefly, the Collaborative Study on the Genetics of Alcoholism (COGA) is a multi-center family study of alcoholism in which probands ascertained from treatment facilities at each of six centers in the United States and their family members were interviewed with the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA), a comprehensive structured psychiatric diagnostic instrument (Bucholz et al., 1994). For inclusion in COGA, probands had to satisfy lifetime criteria for both DSM-III-R alcohol dependence (AD; American Psychiatric Association, 1987) and Feighner alcoholism at the definite level (Feighner et al., 1972). A two-stage ascertainment protocol was followed. In stage 1, all first-degree relatives of the probands were sought for interview. In stage 2, families where at least two first-degree relatives of the proband met lifetime criteria for AD were selected, and additional relatives were interviewed, assessed with a neurophysiological protocol, and invited to donate a blood sample for DNA analysis. Control families were selected from a variety of sources, including drivers' license record bureaus, individuals attending medical/dental clinics, and university subjects responding to advertisements and randomly mailed questionnaires. The COGA protocol was approved by IRBs at all six COGA centers, and written informed consent was obtained from all subjects prior to administering the protocol. The follow-up assessment (SSAGA-II) was conducted 5 years after the initial wave of data collection. Many of the subjects (31%) in these analyses did not have baseline data because they had refused, were unavailable, or had not been actively recruited for the time 1 assessment. Only data from the follow-up study are analyzed here.

2.2. Study participants

The present study uses data from female relatives of alcoholic probands and from female controls who participated in the 5 year follow-up assessment of COGA. For the purposes of this study, data from female alcoholic probands were not included in order to avoid the severity and comorbidity problems associated with clinically ascertained subjects. Female alcoholic probands were approximately twice as likely to have a BN diagnosis compared to relatives and control family members (BN prevalence = 5.10% in alcoholic probands, 2.56% in proband relatives, and 2.38% in control family members). Male subjects were also excluded from the analysis because of the extremely low prevalence of BN among males in the sample—only 11 men total (.38%), including probands, met criteria for BN. For these analyses, female relatives of probands and female control family members with a lifetime diagnosis of DSM-III-R BN were divided into two groups based on whether or not they had met the diagnostic criteria for lifetime DSM-IV AD. An additional comparison group of women with a lifetime diagnosis of AD and no eating disorder diagnosis (BN or anorexia nervosa) was also drawn from the relatives of probands and controls. In order to ensure that the sample

was demographically comparable, the age range of women in the AD comparison group was restricted to that observed in the women with BN: 18–59 years.

Of the 3044 female relatives of alcoholic probands and controls aged 18–59 years, 85 (2.8%) met the criteria for lifetime DSM-III-R BN. Thirty women with BN (35.29%) also had a lifetime diagnosis of AD (BN+AD+). The remaining 55 women with BN had no AD diagnosis (BN+AD−), although 26 (47.27%) qualified for a diagnosis of DSM-IV alcohol abuse. Three hundred and twenty-two women (10.58% of 3044) had a lifetime diagnosis of AD but no BN diagnosis (BN−AD+). Women in the BN+AD+ group came from 27 case families and one control family; women in the BN+AD− group came from 38 case families and 12 control families; women in the BN−AD+ group represented 243 case families and 10 control families. Fifty-three percent ($n = 16$) of women in the BN+AD+ group had onset of first AD symptom and 40% ($n = 12$) had onset of the full AD syndrome before onset of BN. Seventeen percent ($n = 5$) and 3.3% ($n = 1$) of women in the BN+AD+ group had onset of BN in the same year as onset of first AD symptom and full syndrome AD, respectively.

2.3. Assessment

The assessment interview for the second phase of COGA, the SSAGA-II, is based on the SSAGA-I, which has been shown to be a reliable and valid interview that elicits both lifetime and current information for a comprehensive range of psychiatric disorders, including eating disorders (Bucholz et al., 1994, 1995; Hesselbrock et al., 1999). The original version of the SSAGA was primarily based on the DSM-III-R classification system, although other classification systems were covered for some diagnoses. In 1997, the SSAGA was revised to obtain DSM-IV diagnoses (American Psychiatric Association, 2000), and additional disorders were added (e.g., posttraumatic stress disorder). Reliability data for individual diagnoses of the original SSAGA, including AD, other drug dependence, and depression have indicated good to excellent reliability, with kappas exceeding .60 for most diagnoses studied (Bucholz et al., 1994; Hesselbrock et al., 1999). Unfortunately, BN was not included in the original reliability study of the SSAGA.

2.3.1. Eating disorders. The eating disorders diagnostic section of the SSAGA-II is based on the DSM-III-R classification system. Questions were based on those in the eating disorder section of the Diagnostic Interview Schedule, version 4 (Robins et al., 1999). In order to qualify for a diagnosis of BN, an individual must: engage in binge eating episodes two or more times a week for atleast 3 months, feel a lack of control over eating behavior during these binges, regularly engage in inappropriate compensatory behaviors in order to prevent weight gain (e.g., self-induced vomiting, use of laxatives or diuretics, strict dieting, fasting or vigorous exercise), and report persistent overconcern with body shape and weight.

2.3.2. Psychiatric comorbidity. Lifetime diagnoses of DSM-IV alcohol dependence (AD), cocaine, marijuana, opioid, stimulant, and sedative abuse and dependence, nicotine dependence, conduct disorder, major depression, dysthymia, obsessive-compulsive disorder (OCD), social phobia, agoraphobia, posttraumatic stress disorder (PTSD), and panic disorder were used in these analyses. A distinctive feature of the SSAGA is the ability to identify symptoms that are caused by substance use (or withdrawal), physical illness, or other factors. Only subjects who experienced symptoms that were independent of these factors were coded positive for affective and anxiety diagnoses in the present report.

2.3.3. Drinking and eating disorder symptomatology, psychological functioning, suicidality, sexual, and impulsive behaviors. In addition to comorbid psychiatric disorders, several variables from the SSAGA-II addressing psychological functioning, eating disorder symptoms, alcohol symptomatology, and drinking milestones were utilized. Included in these analyses was the Global Assessment of Functioning (GAF) score, which was assigned by the interviewer at the time of assessment (American Psychiatric Association, 2000). The GAF score ranges from 0 to 100 and indicates the subject's current overall level of psychosocial functioning. Height and current and maximum weight were used to compute body mass index (BMI). Women who were pregnant at time of interview ($n = 16$) were excluded from current BMI calculations. Age of BN onset and recency, method of compensatory behavior (purging versus non-purging) and eating disorder treatment seeking were elicited as part of the SSAGA-II eating disorders section. Onset ages of regular drinking, first intoxication, first alcohol dependence symptom, and first alcohol dependence syndrome, along with maximum number of drinks in a 24 h period and number of lifetime alcohol dependence symptoms were assessed in the SSAGA-II alcohol use disorders section.

Number of sexual partners, age at first sexual intercourse, and impulsive behavior variables (stealing/shoplifting three or more times, quitting a job without having another lined up or dropping out of an academic program three or more times, having sex without a condom despite the belief that a disease could be spread by you or your partner that way, and taking chances when someone might get physically hurt) were assessed in the SSAGA-II antisocial personality disorder section. Impulsive behaviors were not coded positive if they only occurred under the influence of drugs or alcohol. Indicators of suicidality, including suicidal ideation, suicidal ideation for 7+ days, having a suicide plan, making a suicide attempt, and self-mutilation, were taken from the suicidal behavior section of the SSAGA-II, and were collected regardless of whether they occurred in the context of a depressive episode.

2.4. Data analysis

Comparisons were made between groups of women with BN and AD (BN+AD+), BN and no AD (BN+AD−), and AD and no BN (BN−AD+) using Fisher's exact test (categorical variables) and the Kruskal–Wallace test (non-categorical variables) using SAS, version 8 (Cary, NC). Exact and nonparametric statistical tests were used because the assumptions

for χ^2 and ANOVA were not met for many of the variables used in comparisons. When omnibus tests were statistically significant ($p < .05$), post hoc tests were performed in order to ascertain which of the three groups differed significantly. To determine whether the significant bivariate relationships between the BN/AD groups and individual comorbid psychiatric disorders were confounded by relationships among the other psychiatric disorders, a multinomial logistic regression was performed with the three-level BN/AD variable (BN+AD+, BN+AD−, BN−AD+) as the dependent variable, using the BN+AD+ group as the referent. The comorbid substance use and psychiatric disorders and demographic variables for which significant bivariate relationships were found were included as independent variables. Because data from members of the same families may not be independent, error terms for the multinomial regression were adjusted for clustering using Huber-White robust standard errors in Stata, version 8 (College Station, TX).

3. Results

3.1. Characteristics of the sample

The demographics of the sample are displayed in Table 1. There were no significant differences between groups for ethnicity, marital status, employment status, income ≤$ 40,000, or age. Women in the BN+AD− group were more likely to come from control families than women in either the BN+AD+ or BN−AD+ groups (21.82% versus 3.33% and 4.04%, respectively, $p < .001$). Women in the BN+AD− group were significantly more likely to have education beyond high school than those in the BN−AD+ group (67.27% versus 41.61%, $p < .001$).

3.2. Substance use and other psychiatric disorders

Table 2 shows lifetime prevalence rates of drug abuse and dependence. There were no significant differences between the BN+AD+ and BN−AD+ groups for any illicit drug abuse or dependence, although the prevalence of the SUD diagnoses was higher for the BN+AD+ group in nearly every instance. Among those qualifying for either abuse or dependence of any drug, a very high proportion of the BN+AD+ group had the more severe dependence diagnosis (85%), much higher than the proportion in the BN+AD− group (69%) and even higher than that in the BN−AD+ group (79%). Women in the BN+AD− group were significantly less likely to have marijuana dependence ($p = .004$), cocaine dependence ($p < .001$), opioid dependence ($p = .041$), tobacco dependence ($p = .006$), and any illicit drug dependence ($p < .001$) than women in either the BN+AD+ or BN−AD+ groups.

Table 3 displays the prevalence of lifetime non-substance related psychiatric diagnoses. BN+AD+ women had a significantly higher mean number of additional psychiatric disorders (agoraphobia, OCD, panic disorder, PTSD, social phobia, major depressive episode, dysthymia, or conduct disorder) than either the BN+AD− or BN−AD+ groups (1.47 versus .71 and .72, respectively, $p < .001$). There were no significant differences in prevalence rates for agoraphobia, panic disorder, PTSD, social phobia, or dysthymia. Women in the BN+AD+ group were significantly more likely to have OCD than those in the BN−AD+ group ($p < .005$) and significantly more likely to have had a major depressive episode than women in both the BN+AD− and BN−AD+ groups ($p < .001$). The prevalence of childhood conduct disorder in the BN+AD− group was significantly lower than that in either the BN+AD+ or BN−AD+ groups, which were not different from each other ($p = .007$).

Table 1
Demographic information for women with bulimia nervosa and alcohol dependence (BN+AD+; $n = 30$), bulimia nervosa and no alcohol dependence (BN+AD−; $n = 55$), and alcohol dependence and no bulimia nervosa (BN−AD+; $n = 322$) participating in the Collaborative Study on the Genetics of Alcoholism

	BN+AD+ % (*n*)	BN+AD− % (*n*)	BN−AD+ % (*n*)	*p*-Value
Control family member	3.33 (1) a	21.82 (12) aB	4.04 (13) B	<.001
Race				
Caucasian	86.67 (26)	83.64 (46)	75.16 (242)	
African American	6.67 (2)	10.91 (6)	15.22 (49)	.549
Other	6.67 (2)	5.45 (3)	9.63 (31)	
Marital status				
Never married	33.33 (10)	34.55 (19)	28.88 (93)	
Currently married	30.00 (9)	34.55 (19)	39.75 (128)	.763
Formerly married	36.67 (11)	30.91 (17)	31.37 (101)	
Education beyond high school	63.33 (19)	67.27 (37) A	41.61 (134) A	<.001
Employment status				
Unemployed	30.00 (9)	21.82 (12)	32.92 (106)	
Part-time	13.33 (4)	23.64 (13)	15.22 (49)	.380
Full-time	56.67 (17)	54.55 (30)	51.86 (167)	
Household income < $ 40,000/year	73.33 (22)	58.18 (32)	63.52 (202)[a]	.381
Mean age (S.D.)	37.57 (9.09)	34.49 (10.83)	36.84 (9.35)	.222

Values with the same letter differ significantly from one another (capital letter: $p \leq .01$; lower case letter: $p \leq .05$).
[a] Out of 318 women.

Table 2
Comorbid substance use disorders in women with bulimia nervosa and alcohol dependence (BN+AD+; $n = 30$), bulimia nervosa and no alcohol dependence (BN+AD−; $n = 55$), and alcohol dependence and no bulimia nervosa (BN−AD+; $n = 322$) participating in the Collaborative Study on the Genetics of Alcoholism

Lifetime diagnosis	BN+AD+ % (*n*)	BN+AD− % (*n*)	BN−AD+ % (*n*)	*p*-Value
Marijuana				
Abuse	13.33 (4)	10.91 (6)	13.04 (42)	.925
Dependence	33.33 (10) A	9.09 (5) AB	28.26 (91) B	.004
Either	46.67 (14) A	20.00 (11) AB	41.30 (133) B	.005
Cocaine				
Abuse	3.33 (1)	.00 (0)	6.21 (20)	.157
Dependence	33.33 (10) A	5.45 (3) AB	24.06 (77) B[a]	<.001
Either	36.67 (11) A	5.45 (3) AB	30.31 (97) B[a]	<.001
Opioids				
Abuse	3.33 (1)	.00 (0)	1.86 (6)	.443
Dependence	10.00 (3) a	.00 (0) ab	7.17 (23) b[b]	.041
Either	13.33 (4) A	.00 (0) AB	9.03 (29) B	.014
Stimulants				
Abuse	10.00 (3)	.00 (0)	5.92 (19)[b]	.060
Dependence	16.67 (5)	7.27 (4)	9.94 (32)	.342
Either	26.67 (8) a	7.27 (4) a	15.89 (51)[b]	.048
Sedatives				
Abuse	3.33 (1)	1.82 (1)	4.04 (13)	.886
Dependence	6.67 (2)	1.82 (1)	5.92 (19)[b]	.511
Either	10.00 (3)	3.64 (2)	9.94 (32)[b]	.359
Any illicit drug				
Abuse	26.67 (8)	10.91 (6)	23.60 (76)	.076
Dependence	56.67 (17) A	16.36 (9) AB	44.69 (143) B[a]	<.001
Either	66.67 (20) A	23.64 (13) AB	56.25 (180) B[a]	<.001
Mean no. illicit substance diagnoses (S.D.)	1.33 (1.24) A	.36 (.73) AB	1.06 (1.21) B	<.001
Tobacco dependence	70.00 (21) A	38.89 (21) AB	60.19 (192) B[c]	.006

Values with the same letter differ significantly from one another (capital letter: $p \leq .01$; lower case letter: $p \leq .05$).
[a] Out of 320 women.
[b] Out of 321 women.
[c] Out of 319 women.

3.3. Drinking and eating disorder milestones, suicidality, sexual behavior, impulsivity, and psychological functioning

Results from group comparisons for drinking and eating disorder variables are displayed in Table 4. The BN+ groups did not differ significantly from each other with regard to current or maximum BMI, ever having received treatment for an eating disorder, purging-type BN, current BN, or mean age of binging onset. Women with BN−AD+ had a significantly lower average maximum BMI than women with BN+AD+ or BN+AD− (29.25 versus 34.35 and 31.82; $p < .002$). In terms of drinking variables, there were no significant differences between

Table 3
Comorbid psychiatric disorders in women with bulimia nervosa and alcohol dependence (BN+AD+; $n = 30$), bulimia nervosa and no alcohol dependence (BN+AD−; $n = 55$), and alcohol dependence and no bulimia nervosa (BN−AD+; $n = 322$) participating in the Collaborative Study on the Genetics of Alcoholism

Lifetime diagnosis	BN+AD+ % (*n*/*N*)	BN+AD− % (*n*/*N*)	BN−AD+ % (*n*/*N*)	*p*-Value
Anxiety disorder				
Agoraphobia	10.34 (3/29)	7.27 (4/55)	6.21 (20/322)	.521
Obsessive compulsive disorder	10.71(3/28) A	3.64 (2/55)	.95 (3/316) A	.005
Panic disorder	3.33 (1/30)	5.45 (3/55)	2.49 (8/321)	.273
Posttraumatic stress disorder	20.69 (6/29)	16.36 (9/55)	12.70 (40/315)	.373
Social phobia	10.34 (3/29)	5.45 (3/55)	6.01 (19/316)	.584
Any	34.48 (10/29)	30.19 (16/53)	20.06 (63/314)	.066
Major depressive episode	73.33 (22/30) AB	32.73 (18/55) B	27.41 (88/321) A	<.001
Dysthymia	3.33 (1/30)	1.82 (1/55)	1.56 (5/321)	.577
Childhood conduct disorder	26.67 (8/30) A	5.45 (3/55) AB	21.18 (68/321) B	.007
Mean no. of additional disorders (S.D.)	1.47 (1.07) AB	.71 (.79) A	.72 (.86) B	<.001

Values with the same letter differ significantly from one another (capital letter: $p \leq .01$).

Table 4
Eating disorder, and alcohol variables in women with bulimia nervosa and alcohol dependence (BN+AD+; $n = 30$), bulimia nervosa and no alcohol dependence (BN+AD−; $n = 55$), and alcohol dependence and no bulimia nervosa (BN−AD+; $n = 322$) participating in the Collaborative Study on the Genetics of Alcoholism

	BN+AD+ % (*n*)	BN+AD− % (*n*)	BN−AD+ % (*n*)	*p*-Value
Ever treated for ED	30.00 (9)	32.73 (18)	–	1.000
Purging-type BN	66.67 (20)	70.90 (39)	–	.806
Current BN	30.00 (9)	25.45 (14)	–	.799
Mean age onset of binging (S.D.)	21.47 (8.16)	18.21 (4.80)	–	.133
Mean current BMI (S.D.)	29.15 (7.88)	27.90 (7.73)	26.94 (6.59)	.370
Mean maximum BMI (S.D.)	34.35 (9.63) A	31.82 (8.68) b	29.25 (7.83) Ab	.002
Mean age onset regular drinking (S.D.)	17.70 (4.14)	17.93 (3.34)	18.00 (4.93)	.769
Mean age onset first intoxication (S.D.)	15.93 (5.11)	16.65 (2.96)	16.34 (4.29)	.209
First intoxication < age 15	43.33 (13)	29.41 (15)	33.02 (106)[a]	.410
Mean maximum drinks in 24 h (S.D.)	21.73 (16.38) A	11.57 (8.37) AB	21.79 (14.00) B	<.001
Mean number of AD symptoms (S.D.)	5.00 (1.53) A	.95 (1.13) AB	4.67 (1.45) B	<.001
Mean age onset first AD symptom (S.D.)	17.90 (5.26) A	20.21 (4.55) Ab	19.26 (5.73) b	.031
Mean age onset AD[b] (S.D.)	23.37 (7.58)	–	25.05 (7.70)	.152
Current AD	23.33 (7)	–	31.99 (103)	.412
Ever treated for alcoholism	53.33 (16) A	5.45 (3) AB	48.14 (155) B	<.001

Values with the same letter differ significantly from one another (capital letter: $p \leq .01$; lower case letter: $p \leq .05$).
[a] Out of 321 women.
[b] Full DSM-IV alcohol dependence syndrome.

the BN+AD+ and BN−AD+ groups, although in almost every instance the BN+AD+ group was numerically more deviant. BN+AD− women did not differ significantly from either of the AD groups with regard to mean age onset of regular drinking or first intoxication, or percent with onset of first intoxication before age 15, but they had a significantly lower mean maximum number of drinks in a 24 h period, lower mean number of AD symptoms, higher mean age of first AD symptom, and lower percentage ever in treatment for alcoholism than the BN+AD+ or BN−AD+ groups ($p < .001$).

Table 5 displays suicidality, sexuality, and impulsive behavior variables. Half of the women in the BN+AD+ group had made a plan to commit suicide, significantly more than their BN+AD− and BN−AD+ counterparts (51.72% versus 21.82% and 28.80%, respectively, $p = .020$) Women in the BN+AD+ did not differ significantly from those in the BN−AD+ group on any other suicidality variables; however, they were significantly more likely to have attempted suicide and to have engaged in self-mutilation compared to the BN+AD− group ($p = .020$, $p = .040$, respectively). Although neither of the omnibus tests for suicidal ideation and persistent suicidal ideation were significant, both showed a trend toward significance ($p = .110$ and $p = .099$, respectively), and the prevalence rates in the BN+AD+ group were considerably higher than those in the BN+AD− and BN−AD+ groups. There was no significant difference between groups for mean age at first sexual intercourse. Women in the BN+AD+ had a higher mean number of sexual partners at the trend level ($p = .097$), and women in the BN+AD+ group were significantly more likely than those in the BN+AD− and BN−AD+ groups to have had unsafe sex more than once

Table 5
Suicidal, sexual, and impulsive behaviors in women with bulimia nervosa and alcohol dependence (BN+AD+; $n = 30$), bulimia nervosa and no alcohol dependence (BN+AD−; $n = 55$), and alcohol dependence and no bulimia nervosa (BN−AD+; $n = 322$) participating in the Collaborative Study on the Genetics of Alcoholism

	BN+AD+ % (*n*/*N*)	BN+AD− % (*n*/*N*)	BN−AD+ % (*n*/*N*)	*p*-Value
Suicidal ideation	79.31 (23/29)	58.18 (32)	60.13 (190/316)	.110
Persistent suicidal ideation	41.38 (12/29)	21.82 (12/55)	23.10 (73)	.099
Suicide plan	51.72 (15/29) aB	21.82 (12/55) B	28.80 (91/316) a	.017
Suicide attempt	44.83(13/29) A	16.36 (9) A	27.53 (87/316)	.020
Self-mutilation	24.14 (7/29) a	5.45 (3) a	10.76 (34/316)	.040
Mean age at first sexual intercourse (S.D.)	16.70 (2.63)	16.91 (2.53)	16.38 (2.41)	.249
Mean number of sexual partners (S.D.)	23.97 (40.30)	13.49 (21.98)	14.96 (21.43)	.097
Unsafe sex[a]	43.33 (13/30) AB	12.73 (7/55) B	16.35 (52/318) A	.002
Shoplifting three or more times	23.33 (7/30)	20.00 (11/55)	19.75 (63/319)	.850
Quit job or dropped out of school three or more times	40.00 (12/30)	16.36 (9/55)	25.40 (81/311)	.061
Take chances when someone could get hurt	10.00 (3/30)	1.82 (1/55)	6.92 (22/318)	.422
Mean GAF score (S.D.)	64.23 (12.71) aB	71.49 (10.76) B	69.28 (12.77) a	.035

Values with the same letter differ significantly from one another (capital letter: $p \leq .01$; lower case letter: $p \leq .05$).
[a] "Have you more than once had unprotected sex (without a condom) with someone you believed could give you a disease, or when you had a disease that could be spread that way?"

Table 6
Multinomial logistic regression predicting bulimia nervosa with alcohol dependence (BN+AD+; $n = 28$) compared to alcohol dependence without bulimia (BN−AD+; $n = 54$) and bulimia nervosa without alcohol dependence (BN+AD+; $n = 309$)

	BN+AD+ vs. BN+AD−			BN+AD+ vs. BN−AD+		
	RRR	Robust SE	95% CI	RRR	Robust SE	95% CI
Major depression	4.17	2.16	1.52, 11.49	5.54	2.79	2.29, 13.35
Obsessive-compulsive disorder	1.67	1.82	.20, 14.04	8.03	8.17	1.09, 58.99
Conduct disorder*	3.48	2.65	.78, 15.49	.99	.50	.87, 2.66
Ilicit drug dependence**	3.93	2.36	1.21, 12.72	1.28	.57	.53, 3.05
Tobacco dependence	3.13	1.77	1.03, 9.50	1.84	.93	.68, 4.96
Education beyond high school***	1.25	.70	.41, 3.76	2.86	1.38	1.11, 7.34

All variables were included in the model simultaneously.
* RRRs differ significantly, $\chi^2(1) = 3.85$, $p = .05$.
** RRRs differ significantly, $\chi^2(1) = 7.36$, $p = .01$.
*** RRRs differ significantly, $\chi^2(1) = 6.55$, $p = .01$.

($p = .002$). There were no significant differences between groups for shoplifting or dropping out of school or repeatedly quitting a job without having another lined up. Finally, women with BN+AD+ had significantly lower GAF scores than those in the BN+AD− and BN−AD+ groups ($p < .035$).

3.4. Multivariate analyses

A multinomial logistic regression was performed with the three level BN/AD variable (BN+AD+, BN+AD−, BN−AD+) as the dependent variable, and comorbid substance use and psychiatric disorders and demographic variables for which significant bivariate relationships were found as independent variables. In order to reduce the number of variables in the model as well as to overcome the problem of small cell sizes, one variable reflecting any illicit drug dependence was used rather than separate variables for dependence on specific drugs. Although a significant difference between groups was observed for control family member status, this variable could not be included in the model because of many sparsely populated and unpopulated cells when the variable was cross tabulated with the outcome as well as other variables in the model. The final model included major depression, obsessive-compulsive disorder, conduct disorder, drug dependence, tobacco dependence, and education beyond high school. Seventeen women (2 BN+AD+, 1 BN+AD−, and 14 BN−AD+) were excluded from the multinomial logistic regression due to missing values on one or more of these variables. The reference group was comprised of the BN+AD+ women. Results are shown in Table 6.

After adjusting for other variables in the model, women in the BN+AD+ group were significantly more likely to have a history of major depression (RRR = 4.17; 95% CI: 1.52, 11.49), illicit drug dependence (RRR = 3.93; 95% CI: 1.21, 12.72), and tobacco dependence (RRR = 3.13; 95% CI: 1.03, 9.50) compared to their BN+AD− counterparts. Compared to BN−AD+, women in the BN+AD+ group were also significantly more likely to have major depression (RRR = 5.53; 95% CI: 2.29, 13.34), obsessive-compulsive disorder (RRR = 8.03; 95% CI: 1.09, 58.99), and education beyond high school (RRR = 2.96; 95% CI: 1.11, 7.34). Post hoc tests of differences between relative risks (RRR) for the BN+AD− and BN−AD+ groups revealed significant differences for conduct disorder ($\chi^2 = 3.85$, d.f. = 1, $p = .050$) illicit drug dependence ($\chi^2 = 7.36$, d.f. = 1, $p < .007$), and education beyond high school ($\chi^2 = 6.55$, d.f. = 1, $p < .011$).

4. Discussion

4.1. Main findings

Women with a lifetime history of both bulimia and alcohol dependence more closely resembled women with alcohol dependence without bulimia than they did women with bulimia without alcohol dependence on the majority of the variables used in these analyses. In bivariate analyses, alcoholic women – whether or not they had a comorbid diagnosis of bulimia nervosa – were more likely to be dependent on illicit drugs and tobacco and to have conduct disorder than women with bulimia without alcohol dependence. Thus, it appears that some of the psychopathology seen in women with comorbid bulimia nervosa and alcohol dependence is associated with the additional lifetime alcohol dependence diagnosis. However, it also appears that women with bulimia and alcohol dependence bear additional burdens of psychopathology, with evidence from our analyses indicating that they are more likely to have OCD than women with alcohol dependence without bulimia and are more likely to have major depression and had lower GAF scores than either women with bulimia without alcohol dependence or women with alcohol dependence without bulimia. More importantly, bulimic women with alcohol dependence were more likely than bulimic women without alcohol dependence and women with alcohol dependence without bulimia to have major depression, even after adjusting for other substance use and psychiatric disorders and demographic variables.

Women with bulimia and alcohol dependence were more likely than women with bulimia without alcohol dependence to have conduct disorder, be drug dependent, exhibit suicidality, and engage in unsafe sex. This supports the theory of an externalizing, impulsive bulimic subtype. However, women with

bulimia and alcohol dependence, while still exhibiting increased likelihood of having a suicide plan and engaging in unsafe sex, appeared more similar statistically to women with bulimia without alcohol dependence in terms of diagnoses and behaviors associated with impulsivity. Despite the lack of statistical significance, women with bulimia and alcohol dependence did have numerically higher prevalences of conduct disorder, drug abuse and dependence, and all suicidal and impulsive behaviors. Thus, while it is possible that the impulsivity seen in women with bulimia and alcohol dependence is related to the alcohol dependence diagnosis, it may be that women with both bulimia and alcohol dependence are indeed more impulsive than women with alcohol dependence without bulimia but there was insufficient statistical power in this study to detect these differences. Women with bulimia and alcohol dependence still appeared to have more severe psychopathology than their alcoholic counterparts without bulimia in that they were much more likely to have major depression, OCD, and lower GAF scores. The results presented here supported those of Suzuki et al. (1993), who found that women with alcohol abuse and dependence and bulimia nervosa were significantly more likely than non-bulimic women with alcohol abuse and dependence to have major depression.

There may be two possible explanations, not necessarily mutually exclusive, for these findings. It may be that women with bulimia and alcohol dependence, while quite similar to women with alcohol dependence without bulimia, represent a distinct group reflecting a particularly severe form of comorbid alcohol dependence. Alternatively, or perhaps in addition, women with bulimia and alcohol dependence could have more severe psychopathology simply because having multiple lifetime psychiatric diagnoses, as opposed to a single diagnosis, has been shown to be associated with indicators of severity and chronicity (Kessler, 1995). There is suggestive evidence for the severity hypothesis in Table 4, where, as noted above, in almost all comparisons the group of women with bulimia and alcohol dependence exhibited numerically more severe involvement with alcohol than did the group with alcohol dependence without bulimia, although these differences did not reach statistical significance.

We found more differences between bulimic women with and without alcohol dependence than have been observed in previous studies. This may perhaps be explained by sample differences, since other studies used clinical samples, which tend to have higher rates of other severe psychopathology and could make differences in additional comorbid psychopathology and psychiatric functioning more difficult to discern. Also, we looked at alcohol dependence only and not other substance dependence, while most other studies grouped alcohol abuse and/or other substance use disorders together with alcohol dependence. This also could have obscured between group differences in previous studies, since substance use disorders are not necessarily a homogeneous group in terms of associated psychiatric comorbidity and psychiatric functioning. It is notable that so many differences between our groups of women with bulimia with and without alcohol dependence were found despite the fact that over half of the group with no alcohol dependence did have a diagnosis of alcohol abuse.

4.2. Strengths and limitations

The probands, who were ascertained through treatment facilities, were not included in these analyses. Therefore, while some of the sample may have received treatment for substance use or other psychiatric disorders at some point in their lives, it is not a clinical sample and is not necessarily subject to the limitations of generalizablity associated with clinical samples. However, our sample also is not population based. The generalizability of our results may thus be limited due to the fact that the research subjects were from a high-risk family study of alcoholics, enriched with densely alcoholic pedigrees, including spouses and extended family. Relatives of alcoholics have been found to have higher rates of alcoholism, depression, and anxiety disorders (Merikangas and Angst, 1995; Preisig et al., 2001). Slightly more than half of the women in our sample with both bulimia and alcohol dependence experienced onset of first alcohol dependence symptom before onset of bulimia nervosa, which is a much greater proportion than has been observed in other studies (Bulik et al., 1997, 2004; Higuchi et al., 1993). It is possible that women with alcohol dependence in this sample have more severe alcoholism and have an earlier and more chronic course than women in other samples that do not contain as large a proportion of women who are relatives of alcoholics. While the prevalence of bulimia nervosa in this sample (2.8%) is comparable to that reported from population-based studies in the literature (Dansky et al., 2000; Kendler et al., 1991; Wade et al., 1996), rates of psychiatric comorbidity are considerably higher than those reported for population-based samples (Bulik et al., 2002; Dansky et al., 2000; Garfinkel et al., 1995) and are more similar to those observed in clinical samples (Braun et al., 1994; Brewerton et al., 1995; Godart et al., 2000). The rate of alcohol dependence in the women with bulimia in this sample (35%) is also similar to that found in clinical rather than population-based samples. However, higher prevalence enabled us to have a larger group of women with bulimia and alcohol dependence than would have been possible had the prevalence of alcohol dependence in women with bulimia been similar to that in general population samples. This gave us the power to detect differences that would have been difficult to discern with smaller group sizes.

Although the higher rate of alcohol dependence allowed for a larger sample of women with bulimia and alcoholism than could have been achieved with a general population sample of similar size, the sample size was still relatively small, especially with regard to the group of women with both bulimia nervosa and alcohol dependence. Due to this limitation, confidence intervals for the RRRs in the multinomial logistic regression tended to be wide, and some large differences in prevalence rates did not achieve statistical significance (e.g., Table 5). Nevertheless, many statistically significant differences were observed, lending support to the possibility that women with bulimia nervosa and alcohol dependence are a distinct subgroup. Due to the large number of statistical tests

performed, it is possible that some of the statistically significant associations may be spurious due to type II error (erroneously rejecting the null hypothesis). The reader may want to adopt a more stringent *p*-value when considering these results.

Because COGA was designed to study alcoholism, not eating disorders, the assessment protocol did not include all psychiatric diagnoses that have been found to be elevated in women with eating disorders, including personality disorders (Braun et al., 1994; Diaz-Marsá et al., 2000). Borderline personality disorder, in particular, has been found to be more common in women with substance use disorder and bulimia compared to women with bulimia without substance use disorder (Bulik et al., 1997; Grilo et al., 1995; Suzuki et al., 1993). Since borderline personality disorder (BPD) is associated with other forms of psychopathology (Zanarini et al., 2004; Zimmerman and Mattia, 1999), it is possible that inclusion of BPD in the multinomial logistic regression could have altered the results. Despite this omission, we were able to assess suicidality, self-mutilation, and some impulsive behaviors, which reflect some of the symptoms of BPD (American Psychiatric Association, 2000). When a variable indicating multiple impulsive behaviors was included in the multivariate model (data not shown), it did not achieve statistical significance, nor did it alter the point estimates of the other variables significantly.

The underlying philosophy guiding the construction of the SSAGA-II had ramifications for the eating disorder section. Since a goal of the SSAGA-II was to obtain psychiatric diagnoses in as efficient a manner as possible, once it became clear that an individual would not meet diagnostic criteria, no further questions about that diagnosis were presented. The effect of this general policy for diagnosing eating disorders meant that subjects who indicated that they had never binged (defined as "eating a large amount of food in a short period of time (usually less than 2 h)"), or who binged less frequently than twice a week for at least 3 months, were skipped out of the remaining bulimia section. Only one question, set at the frequency threshold, was asked, precluding use of a broader indication of frequency, such as once per week as in other published reports (Bulik et al., 1998, 2000; Walters et al., 1992). This skipout algorithm precluded our conducting an item analysis based on BN symptoms, since not all subjects were asked all questions.

Another drawback of the SSAGA-II ED section is that subjects were allowed to define the "large amount" of food eaten during a binge themselves, and it is possible that the binge eating endorsed by some of the women in this study was subjective in nature rather than the objective binge eating required by the DSM-IV. In this case a woman would not have true BN, but instead a diagnosis of Eating Disorder Not Otherwise Specified. There is, however, some debate in the literature whether or not objective and subjective binge episodes should be differentiated from one another when it comes to a diagnosis of BN (le Grange et al., 2004). Some studies have found women with strict BN (objective bingers) to be more impulsive than women who engage in subjective binges but meet the other BN criteria (Keel et al., 2001, 2005).

4.3. Conclusions and future directions

Women with lifetime histories of both bulimia nervosa and alcohol dependence appear to represent a distinct subgroup within both bulimia and alcohol dependence, with high psychiatric comorbidity of depression and suicidal and impulsive behaviors. Clinicians should be particularly sensitive to the possibility of comorbid diagnoses and self-destructive behaviors in women with lifetime histories of bulimia nervosa and/or alcohol dependence. This group of women may require more intensive or unique therapies in order to achieve and sustain recovery. Further research into the associations between depression, alcohol dependence and bulimia nervosa is warranted and may lead to valuable insights into the etiology of these disorders and to improved treatments for women with this profile of psychopathology.

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