

## Relationships Between Features Associated with Vomiting in Purging-Type Eating Disorders

Lauren Reba, BA<sup>1</sup>  
 Laura Thornton, PhD<sup>2</sup>  
 Federica Tozzi, MD<sup>1</sup>  
 Kelly L. Klump, PhD<sup>3</sup>  
 Harry Brandt, MD<sup>4</sup>  
 Steve Crawford, MD<sup>4</sup>  
 Scott Crow, MD<sup>5</sup>  
 Manfred M. Fichter, MD<sup>6</sup>  
 Katherine A. Halmi, MD<sup>7</sup>  
 Craig Johnson, PhD<sup>8</sup>  
 Allan S. Kaplan, MD<sup>9</sup>  
 Pamela Keel, PhD<sup>10</sup>  
 Maria LaVia, MD<sup>3</sup>  
 James Mitchell, MD<sup>11</sup>  
 Michael Strober, PhD<sup>12</sup>  
 D. Blake Woodside, MD<sup>9</sup>  
 Alessandro Rotondo, MD<sup>13</sup>  
 Wade H. Berrettini, MD<sup>14</sup>  
 Walter H. Kaye, MD<sup>2</sup>  
 Cynthia M. Bulik, PhD<sup>1\*</sup>

### ABSTRACT

**Objective:** Vomiting is a pernicious symptom of eating disorders. We explored the relation between the symptom of vomiting and features of eating disorder course and severity, personality traits, and Axis I and II comorbidity in individuals with purging-type eating disorders.

**Method:** The sample included participants from the multisite, international Price Foundation Genetic Studies, who had an eating disorder diagnosis (anorexia nervosa, bulimia nervosa, or eating disorder not otherwise specified) and had data available for the frequency of purging behaviors ( $n = 1,048$ ). Axis I disorders, personality disorders, trait anxiety, perfectionism, and temperament and character dimensions were included as possible correlates.

**Results:** The presence of vomiting was associated with less regular laxative use,

lower self-directedness, organization, personal standards, and higher novelty seeking.

**Conclusion:** Vomiting remains a prevalent and potentially destructive symptom of eating disorders, with significant dental and medical morbidity. Our findings suggest that certain clinical and personality variables distinguish individuals with purging-type eating disorders who vomit from those who do not, although there were no marked differences in Axis I or II comorbidity. Specifically targeting treatment to decrease duration of exposure to this dangerous symptom continues to be an important clinical objective. © 2005 by Wiley Periodicals, Inc.

**Keywords:** vomiting; purging-type eating disorders; clinical variables; personality variables

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\*Correspondence to: Cynthia Bulik, PhD, Department of Psychiatry, University of North Carolina at Chapel Hill, 1st floor, Neurosciences Hospital, 101 Manning Drive, CB 7160, Chapel Hill, NC 27599-7160. E-mail: cbulik@med.unc.edu

<sup>1</sup> Department of Psychiatry, University of North Carolina at Chapel Hill, North Carolina

<sup>2</sup> Department of Psychiatry, University of Pittsburgh, Pittsburgh, Pennsylvania

<sup>3</sup> Department of Psychology, Michigan State University, East Lansing, Michigan

<sup>4</sup> Department of Psychiatry, University of Maryland School of Medicine, Baltimore, Maryland

<sup>5</sup> Department of Psychiatry, University of Minnesota, Minneapolis, Minnesota

<sup>6</sup> Roseneck Hospital for Behavioral Medicine, affiliated with the University of Munich (LMU), Prien, Germany

<sup>7</sup> New York Presbyterian Hospital-Westchester Division, Weill Medical College of Cornell University, White Plains, New York

<sup>8</sup> Laureate Psychiatric Clinic and Hospital, Tulsa, Oklahoma

<sup>9</sup> Department of Psychiatry, The Toronto Hospital, Toronto, Canada

<sup>10</sup> Department of Psychology, University of Iowa, Iowa City, Iowa

<sup>11</sup> Neuropsychiatric Research Institute, Fargo, North Dakota

<sup>12</sup> Neuropsychiatric Institute and Hospital, School of Medicine, University of California at Los Angeles, Los Angeles, California

<sup>13</sup> Department of Psychiatry, Neurobiology, Biotechnologies, University of Pisa, Pisa, Italy

<sup>14</sup> Department of Psychiatry, University of Pennsylvania, School of Medicine, Philadelphia, Pennsylvania

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### Introduction

In community samples of women with eating disorders (ED), vomiting appears to be the most frequently used purging behavior (American Psychiatric Association, 1994). The prevalence of vomiting in clinical samples of individuals with anorexia nervosa (AN) has been estimated to be 31%–39% (Ben-Tovim, Subbiah, Scheutz, & Morton, 1989; Garner, Garner, & Rosen, 1993). In clinical samples of individuals with bulimia nervosa (BN), vomiting has been reported to be present in more than 90% of the cases (Ben-Tovim et al., 1989). Despite the prevalence of vomiting, and its consequent medical and dental morbidity (Mitchell, Specker, & De Zwaan, 1991), few studies have addressed factors that are associated with the presence of this pernicious symptom in individuals who purge.

Russell's initial description of BN defined a cycle of binge eating and vomiting. However, the definition of the syndrome gradually expanded to include other forms of purging behaviors (e.g., laxatives and diuretics), as well as nonpurging compensatory behaviors (e.g., excessive exercise and fasting). This progression was associated with a trend for studies to combine the various forms of

compensatory behaviors into a single category of purging rather than looking at the different types of behaviors separately. Ultimately, all purging behaviors may serve a similar function. However, the specific action of each behavior differs substantially. For example, the active process and immediacy of vomiting differ markedly from the more delayed effects of laxative use on the body. Different personality or psychological features could render one method more attractive to particular individuals.

The inclusion of multiple forms of purging in most studies makes it difficult to determine the features associated with any single method. In clinical samples, frequency of vomiting has been associated with the rate of relapse in individuals with BN (Olmsted, Kaplan, & Rockert, 1994). Few studies have explored the features associated with the presence of the symptom of vomiting in a large sample of individuals with AN, BN, and related ED diagnoses.

Self-induced vomiting is also an intriguing variable from a genetic perspective. It has been shown to be reliably measured (Sullivan, Bulik, & Kendler, 1998), heritable (Sullivan et al., 1998), and has proven to be a valuable covariate in linkage studies of BN (Bulik et al., 2003).

In a large well-characterized sample of individuals with purging types of eating disorders, we sought to examine the relation between the specific symptom of vomiting and (a) features of eating disorder course and severity, (b) personality traits, and (c) Axis I and Axis II comorbidity. The aims of these analyses were to isolate the symptoms of self-induced vomiting from other forms of compensatory behaviors to enhance our understanding of factors independently associated with self-induced vomiting as a purging method.

## Method

### *Participants*

Participants were recruited from two multisite international Price Foundation Genetic Studies of Eating Disorders: One focusing on families with BN ("BN Affected Relative Pair Study"; Kaye et al., 2004) and another focusing on individuals with AN and their parents ("AN Trios"). These studies were designed to identify susceptibility loci involved in the risk for ED. Informed consent was obtained from all study participants, and all sites received approval from their local institutional review board. Brief descriptions of each study are provided in

the current study. Full details on the BN study are available elsewhere (Kaye et al., 2004).

**BN Affected Relative Pair Study.** Probands and male and female biologic relatives affected with AN, BN, or eating disorder not otherwise specified (EDNOS) were recruited from 10 sites in North America and Europe including Pittsburgh (W.H.K), New York (K.A.H.), Los Angeles (M.S.), Toronto (A.S.K., D.B.W.), Munich (M.M.F.), Philadelphia (W.H.B.), Pisa (A.R.), Fargo (J.M.), Minneapolis (Scott C.), and Boston (P.K.). Probands were required to meet the modified criteria of a lifetime diagnosis of BN, purging type (PBN), as defined in the 4th ed. of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association [APA], 1994). Purging must have included regular vomiting, with other means of purging also allowed, and bingeing and vomiting must have occurred at least twice a week for a duration of at least 6 months (for the complete list of inclusion and exclusion criteria see Kaye et al., 2004).

Affected relatives were biologically related to the proband (e.g., siblings, half siblings, cousins), were 13–65 years of age, and had lifetime ED diagnoses of DSM-IV BN, PBN or nonpurging type, modified DSM-IV AN (i.e., criterion D not required), or EDNOS (subthreshold AN, subthreshold BN, binge eating disorder [BED], or purging disorder). See Kaye et al. (2004) for more details.

**AN Trios Study.** Male and female probands affected with restrictor or purging-type AN (PAN) were recruited from nine sites in North America and Europe including Pittsburgh (W.H.K), New York (K.A.H.), Los Angeles (M.S.), Toronto (A.S.K., D.B.W.), Munich (M.M.F.), Pisa (A.R.), Fargo (J.M.), Baltimore (H.B., Steve C.), and Tulsa (C.J.). Probands were required to meet the following criteria: (a) modified DSM-IV (APA, 1994) lifetime diagnosis of AN, with or without amenorrhea; (b) low weight that is/was less than the 5th percentile of body mass index (BMI) for age and gender on (Hebebrand, Himmelman, Hesecker, Schafer, & Remschmidt, 1996) the chart of a National Health and Nutrition Examination Survey epidemiologic sample; (c) onset before the age of 25 years; (d) weight that is/was controlled through restricting and/or purging, which includes vomiting, use of laxatives, diuretics, enemas, suppositories, or Ipecac; (e) age between 13 years and 65 years; (f) Caucasian (one grandparent from another racial group is acceptable); (g) no lifetime history of binge eating; and (h) study diagnostic criteria were met for at least 3 years before study entry. This last inclusion criterion ensured that AN individuals were unlikely to develop binge eating in the future, as research has shown that most binge eating develops within the first 3 years of illness in AN (Bulik, Sullivan, Fear, & Pickering, 1997; Eckert, Halmi, Marchi, Grove, & Crosby, 1995; Eddy et al., 2002; Strober, Freeman, & Morrell, 1997; Tozzi, Thornton, Klump, et al., 2005). Potential

participants were excluded if they reported a maximum BMI since puberty  $>27 \text{ kg/m}^2$  for females and  $>27.8 \text{ kg/m}^2$  for males. This exclusion of individuals who were overweight or obese was based on the initial inclusion criteria for the genetic studies which were designed to increase sample homogeneity.

The total number of female participants from these studies that were available for the current analyses was 1471 individuals with AN, BN, or EDNOS. Individuals were excluded from the analyses if they did not have a valid response for the Structured Inventory of Anorexia Nervosa and Bulimic Syndromes (SIAB) item regarding vomiting behavior ( $n = 1$ ). Our resultant sample only included those individuals with purging-type ED. Individuals with a diagnosis of AN restricting subtype, nonpurging BN, and EDNOS-1 (subthreshold AN) were excluded because, by definition, they engaged in no purging behaviors ( $n = 422$ ). Had we included individuals in whom, by definition, vomiting was absent, this would have led to autocorrelations in the data when using ED subtype as a covariate and subsequent model failure. Thus, our design excluded individuals who, by definition, did not engage in vomiting behavior (AN, nonpurging BN, or EDNOS-1). This resulted in the following sample: individuals with PAN ( $n = 222$ ), individuals with binge-purge AN ( $n = 141$ ), individuals with a history of both AN and BN (ANBN;  $n = 373$ ), individuals with BN with no history of AN (BN;  $n = 258$ ), and individuals with purging forms of EDNOS ( $n = 54$ ). The final sample size was 1,048.

### Assessments

**Demographic and Clinical Variables.** Data relative to current age, age at onset, and current, minimum, and maximum BMI were included in the analyses.

**ED Diagnoses and Vomiting Behavior.** Lifetime histories of ED and the presence or absence of ED behaviors (e.g., dieting, bingeing, purging) in probands and affected relatives were assessed with the SIAB (Fichter, Herpertz, Quadflieg, & Herpertz-Dahlmann, 1998) and with an expanded version of Module H of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1997). The training procedures for the SIAB and SCID have been described in detail elsewhere (Kaye et al., 2004).

Participants were divided into two groups based on their response to the SIAB question: "Have you induced vomiting in order to avoid weight gain, or in order to feel relieved?" Those who endorsed never (including those who tried but were unsuccessful, or those who experimented with vomiting but did not continue) were considered as not engaging in vomiting. All others were considered as engaging in vomiting.

**Personality Traits.** Temperament and character dimensions were measured with the Temperament and Char-

acter Inventory (TCI; Cloninger, Svrakic, & Przybeck, 1993). Perfectionism was assessed with the Frost Multi-dimensional Perfectionism Scale (MPS; Frost, Marten, Lahart, & Rosenblate, 1990), whereas trait levels of anxiety were assessed with the State-Trait Anxiety Inventory (STAI Form Y-1; Spielberger, Gorsuch, & Luchene, 1970).

**Axis I and II Psychiatric Disorders.** Axis I disorders were assessed with the SCID (First, Spitzer, et al., 1997). Personality disorders were assessed with the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1997).

### Statistical Analyses

Standardized scores on MPS scales, TCI measures, STAI trait anxiety, Yale-Brown-Cornell Eating Disorders Scale (YBS-EDS), Yale-Brown Obsessive-Compulsive Scale (YBOCS), BMI measures, age at interview, age of onset of ED, and duration of ED were included in a logistic regression with vomiting status as the outcome variable with corrections for nonindependence using generalized estimating equations (GEE; Diggle, Liang, & Zeger, 1994; Liang & Zeger, 1986; Zeger, Liang, & Albert, 1988). GEE is a statistical approach based on regression techniques that is used to investigate clustered data. In the current study, biologically related family members comprised each cluster in the GEE analyses. However, because the current study included family members of varying relatedness (i.e., first, second, and third-degree relatives as well as unrelated controls), the GEE analyses were conducted in two steps. First, models were fit to the data via the GEE method for probands and their siblings only using the exchangeable working correlation matrix to obtain an estimate of the familial correlation among these first-degree relatives. Second, models were refit to the entire dataset of relatives using familial correlations estimated from the probands and siblings as the user-defined working correlation matrix. The model parameters and statistics from these models were then used as the final solution. This approach to the analyses can be considered conservative, as the proband/sibling correlations are likely overestimates of the expected correlations among clusters of unrelated individuals and second and third-degree relatives. Such overestimation is likely to result in fewer, rather than more, significant findings.

All statistical analyses were conducted using the GENMOD procedure of SAS version 8.1 (SAS, Inc., 1999). Potential covariates (age at interview, gender, and eating disorder type) were excluded from the model for various reasons: (a) Age at interview was found not to be significantly associated with vomiting behavior; (b) all participants included in the analyses were female; and (c) only 9 participants with a diagnoses of BN were in the non-vomiting group, prohibiting model convergence when

ED type was included. We focus our discussions on the variables with effect sizes  $>.20$  (Cohen's *D*).

This research was reviewed and approved by an institutional review board.

## Results

### Prevalence of Vomiting across ED Subgroups

Table 1 presents the percentage of individuals who endorsed regular vomiting by ED diagnosis. Statistical differences were not explored because the majority of the PBN and ANBN participants were probands, who were required to have a history of at least 6 months of regular vomiting, biasing the frequencies observed.

### Logistic Regression Analyses

Of all the demographic and course of illness variables (Tables 2–4), the significant differences were found for maximum BMI ( $\chi^2 = 11.56, p = .00007$ ), odds ratio [OR] = 1.40 (95% confidence intervals [CIs] = 1.13–1.73); minimum BMI ( $\chi^2 = 16.35, p = .0001$ ), OR = 1.45 (95% CI = 1.21–1.74); and age at menarche ( $\chi^2 = 4.19, p = .04$ ), OR = 0.83 (95% CI = 0.72–0.96). Individuals in the vomiting group reported higher BMI values and younger age at menarche. We then trichotomized laxative and diuretic use into never, occasionally (less than daily), and regularly (daily or more). Individuals who did not vomit were significantly more likely to use laxatives ( $\chi^2 = 6.02, df = 2, p < .05$ ) and less likely to use diuretics regularly ( $\chi^2 = 7.96, df = 2, p < .02$ ) than those who did vomit. Significant differences in personality variables with effect sizes  $>2.0$  emerged for the MPS Personal Standards (PS) subscale ( $\chi^2 = 9.04, p = .003$ ), OR = 0.76 (95% CI = 0.62–0.92), Cohen's *D* = .26; MPS Organization (O) subscale ( $\chi^2 = 27.59, p = 0.0001$ ), OR = 0.61 (95% CI = 0.49–0.75), Cohen's *D* = .47; TCI Novelty Seeking ( $\chi^2 = 6.33, p = .01$ ), OR = 1.25 (95% CI = 1.05–1.48), Cohen's *D* = .23; and TCI self-directedness ( $\chi^2 =$

**TABLE 1. Frequency of regular self-induced vomiting across ED subgroups**

| ED Diagnosis   | Regular Vomiting (n) |
|----------------|----------------------|
| PAN            | 73% (162)            |
| BAN            | 66% (93)             |
| PBN            | 97% (249)            |
| ANBN           | 94% (349)            |
| NOS-2 or NOS-3 | 56% (30)             |

Note: ED = eating disorders; PAN = purging anorexia nervosa; BAN = bingeing anorexia nervosa; PBN = purging bulimia nervosa; ANBN = anorexia nervosa and bulimia nervosa; NOS = not otherwise specified.

**TABLE 2. Results from logistic regression analysis (using GEE) predicting vomiting from BMI measures, duration of illness, age, and age of onset**

| Variable                 | <i>M (SD)</i>                      |                                   | Variable                                |                          |
|--------------------------|------------------------------------|-----------------------------------|---|--------------------------|
|                          | Vomit Present<br>( <i>n</i> = 883) | Vomit Absent<br>( <i>n</i> = 165) | $\chi^2$ ( <i>p</i> Value) <sup>a</sup> | OR (95% CI) <sup>b</sup> |
| Age                      | 27.8 (8.5)                         | 28.4 (9.1)                        | 0.63 (.43)                              |                          |
| Current BMI              | 20.2 (3.3)                         | 19.8 (3.1)                        | 0.26 (.61)                              |                          |
| Maximum BMI              | 23.3 (3.2)                         | 22.5 (3.1)                        | 11.56 (.0007)                           | 1.40 (1.13–1.73)         |
| Minimum BMI              | 16.1 (2.9)                         | 15.2 (2.8)                        | 16.35 (.0001)                           | 1.45 (1.21–1.74)         |
| Age of first ED symptoms | 15.4 (3.5)                         | 15.4 (3.5)                        | 0.05 (.82)                              |                          |
| Age of onset             | 17.0 (3.5)                         | 17.0 (3.6)                        | 0.02 (.90)                              |                          |
| ED duration              | 9.6 (7.7)                          | 9.4 (8.4)                         | 0.22 (.64)                              |                          |
| Menarche                 | 13.0 (1.7)                         | 13.4 (2.2)                        | 4.19 (.04)                              | 0.83 (0.72–0.96)         |

Note: GEE = generalized estimating equations; BMI = body mass index; ED = eating disorder; OR = odds ratio; 95% CI = 95% confidence interval.

<sup>a</sup>Continuous variables were standardized before fitting the model.

<sup>b</sup>ORs are indicated if significant.

11.25,  $p = .0008$ ), OR = 0.74 (95% CI = 0.63–0.89), Cohen's *D* = .29. Individuals who endorsed vomiting scored lower on the self-directedness, PS, and O subscales. Finally, the prevalence of all Axis I and II disorders did not differ significantly between the individuals who did and did not vomit.

## Conclusion

Vomiting is a pernicious ED symptom that leads to both physical and psychological ill effects. Given that self-induced vomiting is such an extreme behavior and a behavior that is actively eschewed by healthy individuals, it is intriguing to ask what characteristics of an individual would render them likely to engage in this particular form of purging. We found no notable differences in the presence of comorbid Axis I or Axis II disorders between those who did or did not engage in self-induced vomiting. The only differences that did emerge were in the domains of weight, alternative purging methods, and personality.

In a sample of women with purging-type ED, we found the presence of the symptom of vomiting to be associated with higher lifetime maximum and lifetime minimum BMI, earlier menarche, lower rates of laxative use, lower self-directedness, personal standards, organization, and higher novelty seeking.

Although there were no differences in current BMI between those who did and did not vomit, the presence of both higher lifetime maximum and higher lifetime minimum BMI among those who self-induced vomiting suggests that either individuals who are more prone to be overweight

**TABLE 3. Logistic regression analyses (using GEE) predicting vomiting from psychological and personality features**

| Instrumental Scale                     | <i>M (SD) and Significance</i>        |                                      |                            | OR (95% CI) <sup>a</sup><br>OR and Effect Sizes |
|--|---------------------------------------|--------------------------------------|----------------------------|---|
|  | Vomiting Present<br>( <i>n</i> = 883) | Vomiting Absent<br>( <i>n</i> = 165) | $\chi^2$ ( <i>p</i> Value) |   |
| State-Trait Anxiety Inventory – Form Y |                                       |                                      |                            |   |
| Trait anxiety                          | 51.2 (14.0)                           | 49.4 (12.1)                          | 2.66 (.10)                 |   |
| Temperament and Character Inventory    |                                       |                                      |                            |   |
| Harm Avoidance                         | 20.3 (7.9)                            | 20.5 (7.3)                           | 0.09 (.77)                 |   |
| Novelty Seeking                        | 20.0 (6.9)                            | 18.4 (7.1)                           | 6.33 (.01)                 | 1.25 (1.05–1.48) Effect size = .23              |
| Reward Dependence                      | 16.7 (3.9)                            | 16.6 (4.1)                           | 0.12 (.73)                 |   |
| Persistence                            | 5.5 (2.0)                             | 5.8 (2.0)                            | 4.05 (.04)                 | 0.84 (0.70–1.00) Effect size = .15              |
| Cooperativeness                        | 34.0 (6.0)                            | 34.1 (6.0)                           | .02 (.89)                  |   |
| Self-Directedness                      | 25.3 (9.4)                            | 28.0 (8.9)                           | 11.25 (.0008)              | 0.74 (0.63–0.89) Effect size = .29              |
| Self-Transcendence                     | 14.9 (6.6)                            | 15.6 (6.7)                           | 1.55 (.21)                 |   |
| Multidimensional Perfectionism Scale   |                                       |                                      |                            |   |
| Concern over Mistakes                  | 32.0 (9.6)                            | 32.4 (9.3)                           | 0.28 (.60)                 |   |
| Doubts about Actions                   | 12.8 (4.1)                            | 13.2 (4.0)                           | 1.24 (.27)                 |   |
| Personal Standards                     | 26.4 (6.2)                            | 28.0 (6.1)                           | 9.04 (.0026)               | 0.76 (0.62–0.92) Effect size = .26              |
| Organization                           | 23.8 (5.8)                            | 25.8 (4.9)                           | 27.59 (.0001)              | 0.61 (0.49–0.75) Effect size = .47              |
| Parental Criticism                     | 11.6 (4.9)                            | 10.7 (4.7)                           | 4.82 (.03)                 | 1.20 (1.02–1.42)                                |
| Parental Expectations                  | 15.1 (5.9)                            | 14.4 (6.0)                           | 2.02 (.15)                 |   |
| YBC-EDS                                |                                       |                                      |                            |   |
| Ritual <sup>b</sup>                    | 12.0 (3.4)                            | 11.9 (3.5)                           | 0.08 (.77)                 |   |
| Preoccupation <sup>b</sup>             | 12.5 (2.8)                            | 12.4 (2.9)                           | 0.03 (.86)                 |   |
| Motivation to Change <sup>b</sup>      | 17.4 (5.7)                            | 18.4 (5.5)                           | 4.54 (.03)                 | 0.82 (0.69–0.99) Effect size = .18              |
| YBOCS                                  |                                       |                                      |                            |   |
| Obsessions                             | 6.1 (6.2)                             | 7.4 (6.6)                            | 5.58 (.02)                 | 0.82 (0.69–0.96) Effect size = .20              |
| Compulsions                            | 6.9 (6.6)                             | 7.3 (6.9)                            | 0.38 (.54)                 |   |

Note: GEE = generalized estimating equations; OR = odds ratio; 95% CI = 95% confidence interval; YBC-EDS = Yale-Brown-Cornell Eating Disorders Scale; YBOCS = Yale-Brown Obsessive Compulsive Scale.

<sup>a</sup>Odds ratios are indicated if significant.

<sup>b</sup>Assessed at worst point of illness.

**TABLE 4. Results from logistic regression analyses (using GEE) predicting vomiting from Axis I and Axis II disorders (DSM-IV)**

|                               | Vomit Present<br>( <i>n</i> = 883) | Vomit Absent<br>( <i>n</i> = 165) | $\chi^2$<br>( <i>p</i> Value) <sup>a</sup> |
|-------------------------------|------------------------------------|-----------------------------------|--|
| Axis I Disorders              |                                    |                                   |  |
| Depression                    | 74% (623)                          | 69% (110)                         | 1.21 (.27)                                 |
| Agoraphobia                   | 3% (22)                            | 2% (3)                            | NA   |
| Generalized anxiety disorder  | 11% (94)                           | 8% (13)                           | 2.09 (.15)                                 |
| Obsessive-compulsive disorder | 45% (392)                          | 50% (81)                          | 1.72 (.19)                                 |
| Panic disorder                | 12% (107)                          | 12% (20)                          | 0.02 (.88)                                 |
| PTSD                          | 18% (150)                          | 16% (24)                          | 0.18 (.67)                                 |
| Social phobia                 | 21% (179)                          | 17% (27)                          | 1.71 (.19)                                 |
| Specific phobia               | 11% (95)                           | 14% (22)                          | 0.27 (.60)                                 |
| Any anxiety disorder          | 65% (566)                          | 63% (103)                         | 0.15 (.70)                                 |
| Bipolar I disorder            | 2% (14)                            | 2% (3)                            | NA   |
| Bipolar II disorder           | 3% (22)                            | 1% (1)                            | NA   |
| Axis II disorders             |                                    |                                   |  |
| Any Cluster B                 | 16% (129)                          | 13% (19)                          | 0.93 (.34)                                 |
| Borderline                    | 14% (115)                          | 10% (15)                          | 2.12 (.15)                                 |
| Antisocial                    | 1% (9)                             | 1% (1)                            | NA   |
| Histrionic                    | 1% (11)                            | 1% (1)                            | NA   |
| Narcissistic                  | 1% (12)                            | 4% (6)                            | NA   |
| Any Cluster C                 | 34% (283)                          | 32% (48)                          | 0.19 (.59)                                 |
| Avoidant                      | 21% (178)                          | 17% (26)                          | 1.50 (.22)                                 |
| Dependent                     | 5% (40)                            | 1% (1)                            | NA   |
| Obsessive-compulsive          | 20% (168)                          | 22% (33)                          | 0.21 (.64)                                 |

Note: DSM-IV = 4th edition of the Diagnostic and Statistical Manual of Mental Disorders; PTSD = posttraumatic stress disorder; GEE = generalized estimating equation; NA = not available small cell size.

<sup>a</sup>The percentage of individuals who vomit indicates the percentage of individuals who vomit who have the indicated disorder.

(as evidenced by higher lifetime BMI scores) are more likely to engage in vomiting behavior, or alternately, that self-induced vomiting may, perhaps, paradoxically be associated with weight gain throughout the course of illness. Given that our retrospective data did not include sufficient temporal specificity to detail the sequence of highest achieved weights and offset and onset of periods of self-induced vomiting, we were unable to determine the direction of causality inherent in this relation.

We also found that individuals who self-induce vomiting reach menarche at younger ages than individuals who use other purging methods. This finding could reflect the higher lifetime minimum and maximum BMIs of those who self-induce vomiting in this sample, as a clear inverse relation has been noted between age of menarche and BMI (Mandel, Zimlichman, Mimouni, Grotto, & Kreiss, 2004). Further, early onset of menarche is a risk factor for the development of dieting concerns and body image issues (Striegel-Moore et al., 2001).

In terms of personality features, individuals who self-induce vomiting report higher TCI Novelty Seeking scores than those who use other means of purging. Novelty seeking is a temperamental trait

hypothesized to be associated with dopaminergic function (Benjamin et al., 1996; Ebstein et al., 1996; Hansenne et al., 2002) that is characterized by excitement in response to novel stimuli, impulsivity, dramatization, and thrill seeking (Cloninger, Przybeck, Svrakic, & Wetzel, 1994). Several studies have found higher novelty seeking scores in women with BN than in women with AN (Blok, Hoek, Callewaert, & van Furth, 2004; Bulik, Sullivan, Weltzin, & Kaye, 1995; Fassino et al., 2002). These impulsive characteristics may influence an individual's choice of an immediate purging method such as vomiting, reflecting an inability to tolerate the sensations of having food in the stomach and the impulsive need to remove it immediately—rather than a slower method such as laxative or diuretic use in which such immediate effects are not experienced.

Another TCI characteristic, low self-directedness, was also associated with the presence of self-induced vomiting. Yet, this does not appear to be specific to vomiting as it has also been shown to be related to the presence of laxative use (Tozzi, Thornton, Mitchell, et al., 2005), borderline personality disorder (Bulik, Sullivan, Carter, & Joyce, 1995; Svrakic, Whitehead, Przybeck, & Cloninger, 1993), and poorer outcome in individuals with ED (Bulik, Sullivan, Carter, McIntosh, & Joyce, 1998). In contrast, higher self-directedness has been associated with more rapid response to cognitive-behavioral therapy (Bulik, Sullivan, McIntosh, Carter, & Joyce, 1999). Low self-directedness appears to be emerging as a general marker of pathology in individuals with BN rather than a specific marker of self-induced vomiting.

On the MPS, individuals who engaged in self-induced vomiting scored lower on the PS and O subscales than individuals who do not. Frost et al. (1990) define personal standards as the setting of very high standards and the excessive importance placed on these high standards for self-evaluation. Typically, in studies of ED in comparison to controls, higher scores on the subscales Doubts about Actions (DA) and Concerns over Mistakes (CM) are found in individuals with ED (Bulik et al., 2003). Given that our sample was composed entirely of individuals with ED, with extreme scores on the DA and CM subscales, there was no differentiation between these scales, which were universally endorsed as pathologic across all individuals. PS, which tends to be more normally distributed throughout the population, did differentiate.

O is a subscale of the MPS that has not figured prominently in previous studies of perfectionism in individuals with EDs. This subscale assesses an

individual's tendency to emphasize orderliness and precision in daily tasks and their tendency to be overorganized. The subscale tends not to be strongly correlated with other MPS subscales and the overall perfectionism score (Frost et al., 1990). Rather than being a marker of psychopathology, organization appears to reflect positive personal characteristics such as achievement striving and work habits (Frost et al., 1990; Purdon, Antony, & Swinson, 1999). Organization has also been positively associated with extraversion and negatively associated with neuroticism (Enns & Cox, 1999). Lower organization may reflect underlying disorganization that itself may increase the risk of engaging in vomiting rather than less chaotic and considered approaches to achieving appetite regulation or may result from the chaos of having suffered from an illness marked by alternating episodes of eating and vomiting.

Vomiting remains an intriguing symptom of ED. The fact that it is reliably measured and heritable (Sullivan et al., 1998) adds to its intrigue as a potential behavioral marker of ED. Anecdotally, many individuals with nonpurging forms of ED report having tried to vomit unsuccessfully. This suggests, but does not prove, that the ability to self-induce vomiting may itself lie on a continuum. Vomiting plays an important role in survival in ridding the body of toxic substances and may also have had substantial evolutionary significance in species where it figures prominently in the feeding of the young. Thus, it is a behavior that may have been preserved via evolutionary advantage. Yet, on the surface, self-induced vomiting as present in ED serves no such evolutionary purpose. The symptom may be temporarily functional for those with ED on an individual level. Indeed, one's liability to developing the symptom may be related to the biologically mediated ease with which one is able to self-induce vomiting.

The results of the current study must be interpreted within the context of limitations. First, all individuals in our sample were from families that included more than one individual with ED. Although unknown, it is unclear whether such individuals differ from sporadic cases. Also, given the cross-sectional nature of our design, it is possible that individuals who were identified as not engaging in vomiting may indeed develop the symptom over time. Finally, our design may not be optimal to understand fully the emergence of the symptom of vomiting. More in-depth qualitative studies that inquire as to the development of or avoidance of the symptom of self-inducing vomiting may shed light on underlying psychological or physiologic

processes that influence whether this particular mode of purging becomes part of the core features of an individual's ED.

Professionals in the ED field may become immune to the presence of self-induced vomiting as it is such a commonly observed symptom—reflected in a large percentage of individuals in this sample who engaged in the behavior. However, it remains a dramatic and potentially destructive symptom, with associated medical and dental morbidity. Treatment aimed at decreasing duration of exposure to this symptom remains an important therapeutic goal.

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