

Features Associated With Laxative Abuse in Individuals With Eating Disorders

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Objective: Laxative abuse is common in patients with anorexia and bulimia nervosa and has been associated with longer duration of illness, suicide attempts, impulsivity, and greater eating and general psychopathology. We explored the extent to which laxative abuse was associated with specific psychopathological features across eating disorder subtypes. **Methods:** Participants were 1021 individuals from the multisite, International Price Foundation Genetic Studies. Axis I disorders, personality disorders and traits, and obsessive compulsive features were assessed. **Results:** Laxative abuse was associated with worse eating disorder and general psychopathology and higher prevalence of borderline personality disorder (BPD). Symptom level analyses revealed that specific features of BPD, including suicidality and self-harm, feelings of emptiness, and anger, were most strongly associated with laxative abuse. **Conclusions:** The function of laxative abuse may differ across individuals with eating disorders, alternatively serving as a method of purging and a form of self-harm. **Key words:** eating disorders, laxatives, borderline personality, self-harm.

ED = eating disorder; **AN** = anorexia nervosa; **BN** = bulimia nervosa; **PAN** = purging anorexia nervosa; **BAN** = binge-purge anorexia nervosa; **PBN** = purging bulimia nervosa; **EDNOS** = eating disorders not otherwise specified; **ANBN** = individuals with both a history of anorexia and bulimia nervosa; **BPD** = borderline personality disorder; **PTSD** = posttraumatic stress disorder; **BMI** = body mass index; **DSM-IV** = Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; **SCID-I and -II** = Structured Clinical Interview for DSM-IV for Axis I and Axis II disorders; **SIAB** = Structured Inventory of Anorexia Nervosa and Bulimic Syndromes; **TCI** = Temperament and Character Inventory; **MPS** = Multidimensional Perfectionism Scale; **YBOCS** = Yale-Brown Obsessive Compulsive Scale; **YBC-EDS** = Yale-Brown-Cornell Eating Disorder Scale; **GEE** = generalized estimating equations.

INTRODUCTION

Individuals with eating disorders (EDs) often use inappropriate compensatory behaviors in an attempt to control their weight or counteract the effects of binge-eating. Common compensatory behaviors include fasting, excessive exercising, and purging behaviors. Purging behaviors, such as self-induced vomiting, abuse of laxatives, diuretics, and enemas, can occur both after an episode of binge-eating, after eating seemingly normal amounts of food, or as an independent behavior unrelated to food intake. Purging behaviors are associated with substantial medical and dental morbidity (1,2) and constitute a relevant clinical issue.

Several studies have assessed the prevalence of purging behaviors in both community and clinical samples. The re-

ported prevalence of laxative abuse varies widely. The abuse of laxatives as a purging method appears to be relatively rare in large community samples, ranging from 0.7% to 5.5% (3–8). The prevalence of laxative abuse in individuals with anorexia nervosa (AN) and bulimia nervosa (BN) has been reported to be between 3% and 70% (3,9–14).

Only a minority of individuals with EDs who abuse laxatives use them as their sole purging method, with most also self-inducing vomiting and using other purging strategies as well (e.g., diuretics, enemas, and saunas) (11,13,15). There is some evidence of greater laxative abuse in individuals with AN who purge without bingeing (hereafter, we will refer to them as purging subtype) in comparison to individuals with AN who binge and purge (hereafter, binge-purge subtype) and individuals with the purging subtype of BN (9,10,16). Also, it is more common to see laxative abuse as the sole method of purging in individuals with the purging subtype of AN (9).

Laxative abuse has been associated with greater general psychopathology, a history of depression and anxiety (17,18), borderline personality features and other personality disturbances (11,19,20), and greater eating symptomatology, such as body dissatisfaction, drive for thinness, and eating concerns (11,21–23). Additional associations with self-injurious behaviors, suicide attempts, and other impulsive behaviors (18,24–28) have been noted.

Despite the association between laxative abuse and serious medical complications, a more complex clinical presentation, and possibly a poorer treatment response, the behavior remains understudied. Given the unusual nature of laxative abuse, including the delayed purging effect (in comparison to the immediacy of self-induced vomiting), the frequent pain associated with self-administration, the very modest actual sustained weight loss, the social effects, effects on sleep, and the deleterious long-term consequences on bowel function (29,30), it is critical to understand the characteristics of individuals who choose this purging method. Enhanced understanding of factors associated with laxative abuse has clinical relevance for detection and treatment of laxative abuse in individuals with EDs. Consequently, the goal of this study was to explore factors associated with the abuse of laxatives across diagnostic subtypes of EDs using the largest informative sample to date.

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LAXATIVE ABUSE IN EATING DISORDERS

METHODS

Participants

Participants were from the multisite International Price Foundation Genetic Study of BN (31) and AN Trios studies, which were designed to identify susceptibility loci involved in risk for EDs. Probands and affected relatives were assessed for psychological and personality features that have been shown to be associated with, and may underlie vulnerability to, EDs. Informed consent was obtained from all study participants, and all sites received approval from their local institutional review board.

BN Study

Probands and male and female biological relatives with a lifetime diagnosis of AN, BN, or eating disorder not otherwise specified (EDNOS) were recruited between 1998 and 2000 from 10 sites in North America and Europe, including Pittsburgh (W.K.), New York (K.H.), Los Angeles (MS), Toronto (A.K., B.W.), Munich (M.F.), Philadelphia (W.B.), Pisa (A.R.), Fargo (J.M.), Minneapolis (S.C.), and Boston (P.K.).

Probands from the BN study were required to meet the following criteria: (1) modified *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* (32) lifetime diagnosis of BN, purging type (PBN) (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); and (2) age 13 to 65 years.

Affected relatives were biologically related to the proband (e.g., siblings, half-siblings, cousins, etc.). The inclusion criteria for affected relatives were 1) age 13 to 65 years and 2) having met at least one lifetime ED diagnosis. The ED diagnoses were defined as follows: 1) *DSM-IV* BN, purging type or nonpurging type; 2) modified *DSM-IV* AN (i.e., criterion D not required); 3) EDNOS: EDNOS-1, defined as subthreshold AN with the presence of at least two of the three criterion symptoms of low body weight, extreme fear of fatness, or body image disturbance (i.e., undue influence of body weight and shape on self-evaluation or denial of the seriousness of low body weight), no lifetime history of binge eating, and a lifetime ideal body weight (IBW) <125% according to the Metropolitan Height and Weight Tables (1959); EDNOS-2, defined as subthreshold BN in which the frequency or duration of eating binges and/or purging fell below the specified *DSM-IV* criteria (twice per week and 3 months, respectively); and EDNOS-3, defined as a clinical mix, in which individuals of normal weight purged (e.g., vomited or abused laxatives, diuretics, enemas), fasted, or exercised excessively due to extreme fear of weight gain or undue influence of body weight on self-esteem but did not binge eat.

Individuals were included in the study regardless of their illness status or enrollment in treatment programs. Potential participants were identified through clinic databases, referral from clinicians with knowledge of the study, and advertisement in a variety of different media at local and national levels. Further details on inclusion/exclusion criteria and description of assessment and diagnoses are included in Kaye et al. (31).

AN Trios Study

Male and female probands with a lifetime diagnosis of AN were recruited from nine sites in North America and Europe, including Pittsburgh (W.K.), New York (K.H.), Los Angeles (MS), Toronto (A.K., B.W.), Munich (M.F.), Pisa (A.R.), Fargo (J.M.), Baltimore (H.B., S.C.), and Tulsa (C.J.), between 2000 and 2003. Probands were required to meet the following criteria: 1) modified *DSM-IV* (32) lifetime diagnosis of AN, with or without the amenorrhea criterion; 2) low weight must be (have been) less than 5th percentile of body mass index (BMI) for age and gender on the Hebebrand et al. (33) chart from the National Health and Nutrition Examination Survey epidemiological sample; 3) AN onset must have been before age 25; 4) weight must have been controlled through restricting and/or purging, including vomiting, abuse of laxatives, diuretics, enemas, suppositories, or ipecac; 5) age between 13 and 65; 6) Caucasian (participants could be included with one non-Caucasian grandparent); 7) all of the above study criteria were met at least 3 years before study entry.

Affected male and female relatives were included if they met the following criteria: 1) same biological mother and father as the proband; 2) a lifetime

diagnosis of modified *DSM-IV* AN (with or without amenorrhea), BN, or EDNOS; and 3) age 13 to 65. Further details on inclusion/exclusion criteria and description of assessment and diagnoses are included in Reba et al. (34).

If the affected relative was a nonsibling, the inclusion criteria for participation were the same as for probands, with the additional criterion that the percent relatedness to the proband must be greater than or equal to 12.5% (e.g., half-siblings, grandparents, aunts, uncles, first cousins, but not second cousins or first cousins once removed).

Individuals from both the BN and the AN Trios samples with any combination of AN, BN, or EDNOS were included in this study ($N = 1496$). Males ($N = 28$) were excluded from the analyses because there were too few for meaningful comparison. Individuals with AN restricting subtype ($N = 388$), AN who binge without purging (bingeing-only subtype) ($N = 26$), nonpurging BN ($N = 22$), and EDNOS 1 (subthreshold AN, $N = 11$) were excluded because, by definition, they engaged in no purging behaviors. Individuals classified as AN had either purging-only AN or binge-purge AN. Individuals classified as ANBN had both a history of AN and BN. Participants were classified as EDNOS if their only lifetime diagnosis was EDNOS. The resulting sample size was 1021 (diagnostic breakdown is listed below) who had information regarding laxative abuse.

By including only individuals who, by virtue of their diagnosis, engaged in purging behaviors, we were able to explore specific features associated with laxative use while eliminating any potential confounds that would have been introduced had we included individuals who did not have purging as part of their ED symptom profile (e.g., personality traits that differentiate purging versus nonpurging individuals, in comparison to personality traits that differentiate between individuals who use laxatives versus other forms of purging).

Assessment

Demographic and Clinical Variables

Data relative to current age; age at ED onset; current, minimum, and maximum lifetime BMI; and duration of illness were included in the analyses.

ED Diagnoses

Lifetime histories of EDs in probands and affected relatives were assessed with the Structured Inventory of Anorexia Nervosa and Bulimic Syndromes (SIAB) (35), a semistructured clinical interview with detailed questions on weight and eating history able to establish *DSM-IV* and *International Classification of Diseases, 10th Edition (ICD-10)* ED diagnoses. Additional ED behaviors (e.g., dieting, bingeing, purging), was obtained by an expanded version of Module H of the Structured Clinical Interview for DSM-IV for Axis I Disorders (SCID-I) (36). Training procedures for the SIAB and SCID are described in Kaye et al. (31).

Axis I Diagnoses

Additional Axis I diagnoses, including mood and anxiety disorders, were assessed with the (SCID-I).

Personality Disorders and Traits

Personality disorders from Clusters B and C¹ were assessed with the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II) (37). Based on extant studies, we anticipated an association between laxative abuse and borderline personality disorder (BPD). Thus, to further understand this association, we expanded analyses to include a symptom level analysis for this disorder in order to determine whether specific features of borderline personality were associated with laxative abuse.

Participants also completed the Temperament and Character Inventory (TCI) (38), the Frost Multidimensional Perfectionism Scale (MPS) (39), and the State-Trait Anxiety Inventory (STAI Form Y-1) (40). Obsessive-compulsive symptoms were assessed with two different measures: the Yale-Brown Obsessive Compulsive Scale (YBOCS) (41), and the Yale-Brown-Cornell Eating Disorder Scale (YBC-EDS) (42). The YBOCS is a semistructured

¹Cluster A personality disorders were not assessed in any of the original studies, because of the low prevalence of these disorders in individuals with eating disorders (20).

interview designed to assess presence and severity of obsessive thoughts and compulsive behaviors typically found among individuals with obsessive-compulsive disorder. The YBC-EDS assesses obsessive-compulsive features specific to ED (e.g., those related to food, eating, weight, and exercise).

Definition of Lifetime Laxative Abuse and Other Purging Behaviors

Participants were divided into laxative abuse groups based on their response to the question (SIAB interview): "Did you use laxatives to avoid gaining weight?" Those who endorsed the "never" response option were considered to be nonlaxative abusers; those who used laxatives rarely (less than twice a week and/or in low doses), sometimes (at least twice a week and/or in moderate doses), frequently (up to once daily and/or in high doses), or very frequently (several times a day and/or in very high doses) were considered to be laxative abusers. It is important to note that individuals who reported "rare" usage of laxative abuse were also included in the laxative group. Although this response option was below the threshold of clinical significance based on *DSM-IV* criterion for compensatory behaviors (criterion C of BN diagnosis), it nonetheless identifies individuals who may have used laxatives more than experimentally and somewhat regularly. The presence of other purging behaviors was also evaluated, and rates and combinations of different purging techniques were calculated. The classifications of vomiting behavior and diuretic abuse were similarly defined using the same frequency criteria, based on responses to the respective SIAB questions. Other purging methods (e.g., enemas, thyroid hormones) were not considered because of the rarity with which they were used.

Interviewers at each site of recruitment completed a training program for the administration of the SIAB, the Y-BOCS, and the YBC-EDS. Best estimates diagnoses were obtained by several independent confirmations of diagnoses. First, all ED diagnoses were confirmed by each principal investigator at each satellite after reviewing the SIAB. Second, the project coordinator of the data core independently reviewed every subject's SIAB interview to confirm diagnoses (31,43).

Statistical Analyses

Demographic parameters, ED course and symptom variables, standardized scores on the self-report scales, and diagnostic variables were included in a logistic regression with laxative abuse status as the outcome variable and corrections for nonindependence using generalized estimating equations (GEE) (44–46). GEE is a statistical approach based on regression technique that is used to investigate correlated data, such as panel studies and the affected relative-pair data used in the current study. In the current study, biologically related family members composed each cluster in the GEE analyses. However, because the current study included family members of varying degrees of relatedness (i.e., first-, second-, and third-degree relatives), the GEE analyses were conducted in two steps. First, models were fit to the data for probands and their siblings via the GEE

method to obtain an estimate of the familial correlation among these first-degree relatives. Second, models were refit to the entire dataset of relatives (probands and siblings included) using familial correlations estimated from the probands and siblings as the user-defined working correlation matrix. The model parameters and statistics from the models from this second step 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 (47). Because variation of some of the psychopathological features included in the analyses may be correlated with ED diagnoses, ED subtype was included in the analyses as a covariate. All significance tests were two-tailed. All continuous measures were standardized to have a mean of zero and unit variance before analyses. The false discovery rate method was used to correct for multiple statistical tests within each group of comparisons. Variables that emerged in the initial logistic regressions as significantly associated with laxative use were then entered into a stepwise logistic regression.

RESULTS

Sample Description and Prevalence of Purging Behaviors

The sample comprised 222 (21.7%) individuals with purging anorexia nervosa (PAN), 115 (11.3%) with binge-purge anorexia nervosa (BAN), 258 (25.3%) participants with PBN, 372 (36.4%) ANBN, and 54 (5.3%) individuals with a diagnosis of EDNOS (subthreshold ED with binge eating and/or purging; EDNOS I were excluded). Across the entire sample, vomiting was the most frequently reported purging behavior, followed by laxatives (see Table 1). Comparisons across diagnostic subgroups were not performed, because sample size for some of the groups was too small to yield meaningful results. However, it is noteworthy that the PAN group had the highest frequency of laxative abuse (71.6% used laxatives alone or in combination with other purging behaviors). Furthermore, although cell sizes were too small for meaningful analysis, individuals in the PAN and BAN groups had numerically higher rates of use laxatives as the sole method of purging with respect to other ED groups. Excluding probands (those required to have used vomiting as a compensatory behavior) from the above analyses, 3.6% and 6.6% of participants with PBN and ANBN, respectively, used laxatives as the sole purging method.

TABLE 1. Prevalence of Laxative Abuse, Vomiting, and Diuretic Use by Eating Disorder Type

	PAN, N = 222, % (n)	BAN, N = 115, % (n)	PBN, N = 258, % (n)	ANBN, N = 372, % (n)	EDNOS, N = 54, % (n)	Total Sample
Laxative use only	17.1 (38)	13.9 (16)	1.2 (3)	3.5 (13)	7.4 (4)	7.2 (74)
Vomiting only	22.5 (50)	40.9 (47)	48.1 (124)	36.8 (137)	33.3 (18)	36.8 (376)
Diuretic use only	1.8 (4)	1.7 (2)	0.8 (2)	0.3 (1)	0.0 (0)	0.9 (9)
Laxative use and vomiting	28.8 (64)	28.7 (33)	32.6 (84)	34.7 (129)	11.1 (6)	31.0 (316)
Laxative and diuretic use	6.3 (14)	3.5 (4)	1.6 (4)	0.8 (3)	3.7 (2)	2.6 (27)
Vomiting and diuretic use	2.3 (5)	3.5 (4)	4.7 (12)	2.4 (9)	3.7 (2)	3.1 (32)
All 3 purging methods	19.4 (43)	7.8 (9)	11.2 (29)	19.6 (73)	7.4 (4)	15.5 (158)
Other purging behaviors ^a	1.8 (4)	0.0 (0)	0.0 (0)	1.9 (7)	33.3 (18)	2.8 (29)
Any laxative use ^b	71.6 (159)	53.9 (62)	46.5 (120)	58.6 (218)	29.6 (16)	56.3 (575)

PAN = purging anorexia nervosa; BAN = binge anorexia nervosa; PBN = purging bulimia nervosa; ANBN = individuals with lifetime diagnoses of both anorexia and bulimia; EDNOS = eating disorders not otherwise specified (excluding EDNOS I).

^a Other purging behaviors include enemas, ipecac, thyroid medication abuse, and insulin abuse.

^b Laxative use alone and in combination with other purging methods.

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Chronology of Onset of Laxative Abuse Relative to Vomiting

There are 474 participants who provided information on the age of onset of laxative abuse and the age of onset of self-induced vomiting behavior. Of these, 108 (23%) abused laxatives first, 130 (27%) commenced both behaviors at the same age, and 236 (50%) reported vomiting first. It was not possible to compare diagnostic subgroups relative to age of onset of purging methods due to small cell sizes.

Features Associated With Laxative Abuse

In all models, ED subtype had a significant effect ($p < .001$). The regression analysis revealed that longer duration of illness and earlier appearance of ED symptoms (but not earlier age at onset of a formal ED diagnosis) were associated with the abuse of laxatives. The analysis also indicated that high trait-anxiety, high scores on most of the perfectionism dimensions, and high scores on worst rituals and preoccupations were also associated

with laxative abuse ($p < .001$ [see Table 2]). Obsessions on the YBOCS ($p < .02$), high harm avoidance, and low self-directedness on the TCI ($p < .05$) were also associated with laxative abuse. When all significant personality variables were entered into a stepwise regression, YBC-EDS worst rituals ($\beta = 0.37$ (0.09); $\chi^2_{df1} = 18.73, p < .001$) and MPS concern over mistakes ($\beta = 0.23$ (0.08); $\chi^2_{df1} = 8.90, p = .003$) remained in the model. These two variables also had the highest point-biserial correlations with the presence of laxative use, 0.25 and 0.22, respectively, indicating small or no suppressor effects.

Among DSM Axis I (mood and anxiety disorders) and II diagnoses (Cluster B and C personality disorders) included in the study, posttraumatic stress disorder (PTSD), specific phobia, and BPD were significantly associated with laxative abuse (see Table 3).

Given prior observations and the fact that BPD emerged as significantly associated with laxative abuse in this study, we conducted additional analyses at the individual symptom

TABLE 2. Results From Logistic Regression Analyses (Using GEE) Predicting Laxative Abuse From BMI Measures, Duration of Illness, Age, Age of Onset, Psychological and Personality Features^a

Variable	Laxative Users, (<i>n</i> = 575) Mean (SD)	Nonusers, (<i>n</i> = 446) Mean (SD)	χ^2 (<i>p</i> Value) ^b	OR (95% CI)
Age	28.3 (8.3)	27.4 (8.9)	2.47 (.16)	—
Current BMI	19.9 (3.1)	20.6 (3.4)	0.17 (.71)	—
Maximum BMI	23.1 (3.2)	23.3 (3.2)	3.80 (.08)	—
Minimum BMI	15.5 (2.8)	16.5 (3.0)	3.72 (.08)	—
Age of first ED symptoms	15.1 (3.5)	15.8 (3.5)	5.45 (.044)	0.86 (0.75–0.98)
Age of onset	16.9 (3.7)	17.2 (3.4)	0.47 (.55)	—
ED duration	10.4 (7.7)	8.6 (7.8)	8.33 (.014)	1.24 (1.07–1.45)
Menarche	13.1 (1.9)	13.0 (1.8)	0.00 (.95)	—
State-Trait Anxiety Inventory-Form Y				
Trait anxiety	52.9 (14.0)	48.4 (13.1)	14.74 (<0.001)	1.29 (1.13–1.47)
Temperament and Character Inventory				
Harm avoidance	21.1 (7.8)	19.3 (7.9)	5.22 (.046)	1.17 (1.02–1.33)
Novelty seeking	19.8 (6.9)	19.9 (6.9)	1.24 (.31)	—
Reward dependence	16.6 (3.9)	16.8 (3.9)	0.36 (.59)	—
Persistence	5.5 (2.1)	5.5 (2.0)	1.51 (.27)	—
Cooperativeness	33.9 (6.0)	34.3 (5.9)	4.06 (.08)	—
Self-directedness	25.0 (9.4)	26.6 (9.3)	7.78 (.014)	0.83 (0.73–0.95)
Self-transcendence	15.2 (2.1)	14.9 (6.9)	2.35 (.16)	—
Multidimensional Perfectionism Scale				
Concern over mistakes	33.8 (9.0)	29.6 (9.8)	31.81 (<.001)	1.47 (1.29–1.67)
Doubts about actions	13.6 (3.9)	12.0 (4.2)	25.64 (<.001)	1.42 (1.24–1.62)
Personal standards	27.1 (5.9)	25.9 (6.5)	2.84 (.13)	—
Organization	24.2 (5.5)	22.9 (6.0)	6.30 (.030)	1.19 (1.04–1.36)
Parental criticism	12.2 (4.9)	10.7 (4.7)	15.65 (<.001)	1.31 (1.15–1.50)
Parental expectations	15.7 (5.9)	14.2 (6.0)	7.84 (.014)	1.22 (1.06–1.40)
Yale-Brown-Cornell Eating Disorder Scale				
Worst ritual	12.7 (2.8)	11.0 (3.8)	32.57 (<.001)	1.56 (1.34–1.82)
Worst preoccupation	13.0 (2.4)	11.9 (3.1)	18.93 (<.001)	1.36 (1.18–1.57)
Worst motivation to change	18.1 (5.4)	16.8 (5.9)	3.78 (.08)	—
Yale-Brown Obsessive Compulsive Scale				
Obsessions	7.0 (6.3)	5.4 (6.1)	8.11 (.014)	1.22 (1.06, 1.39)
Compulsions	7.6 (6.6)	6.1 (6.5)	4.18 (.08)	—

OR = odds ratio; CI = confidence interval; BMI = body mass index.

^a Eating disorder subgroup (RAN, PAN, BAN, ANBN, BN, EDNOS) was entered into the model as a covariate. Continuous variables were standardized prior to fitting the model.

^b *df* = 1; *p* Values have been corrected by the method of false discovery rate; odds ratios are indicated if significant.

TABLE 3. Results from Logistic Regression Analyses (Using GEE) Predicting Laxative Abuse From DSM-IV Axis I and Axis II Disorders^a

Variable	Laxative Users, % (n)	Nonusers, % (n)	χ^2 (<i>p</i> Value) ^b	OR (95% CI)
Axis I disorder				
Major depression	77.1 (427)	67.6 (288)	5.75 (.06)	—
Bipolar I	2.3 (13)	0.9 (4)	1.92 (.30)	—
Bipolar II	2.9 (16)	1.8 (8)	1.26 (.37)	—
Agoraphobia	3.0 (17)	1.8 (8)	0.81 (.49)	—
GAD	10.8 (61)	10.0 (44)	0.01 (.93)	—
OCD	51.0 (284)	39.9 (176)	5.29 (.06)	—
Panic disorder	13.7 (77)	11.0 (48)	0.62 (.51)	—
PTSD	22.5 (121)	12.6 (52)	8.32 (.020)	1.70 (1.18–2.46)
Social phobia	22.1 (125)	17.1 (75)	2.29 (.26)	—
Specific phobia	14.1 (79)	8.0 (35)	8.70 (.020)	1.88 (1.22–2.92)
Any anxiety disorder	68.9 (396)	57.4 (256)	6.57 (.042)	1.44 (1.09–1.89)
Axis II disorder				
Cluster B	19.1 (103)	10.3 (43)	15.14 (.001)	2.10 (1.43–3.08)
BPD	17.2 (93)	8.9 (37)	14.76 (.001)	2.18 (1.45–3.29)
ASPD	1.1 (6)	1.0 (4)	0.33 (.63)	—
HPD	1.5 (8)	1.0 (4)	0.69 (.51)	—
NPD	2.0 (11)	1.2 (5)	1.37 (.37)	—
Cluster C	36.9 (200)	29.6 (123)	2.83 (.21)	—
APD	23.8 (129)	16.8 (70)	4.24 (.10)	—
DPD	4.4 (24)	4.1 (17)	0.03 (.91)	—
OCPD	22.7 (123)	17.6 (73)	1.39 (.37)	—

OR = odds ratio; CI = confidence interval; GAD = generalized anxiety disorder; OCD = obsessive compulsive disorder; PTSD = posttraumatic stress syndrome; BPD = borderline personality disorder; ASPD = antisocial personality disorder; HPD = histrionic personality disorder; NPD = narcissistic personality disorder; APD = avoidant personality disorder; DPD = dependent personality disorder; OCPD = obsessive compulsive personality disorder.

^a Eating disorder group (AN, ANBN, BN, EDNOS) was entered as a covariate.

^b *df* = 1; *p* Values are corrected for multiple testing using the false discovery rate method; odds ratios are indicated if significant.

level. Regression analysis revealed that all symptoms except identity disturbance were significantly associated with laxative abuse (see Table 4). When the BPD symptoms were entered into a stepwise regression, self-harm/suicide ($\chi^2_{df1} = 7.88, p = .005$), feelings of emptiness ($\chi^2_{df1} = 7.42, p = .007$), and anger ($\chi^2_{df1} = 6.00, p = .01$) remained in the model.

DISCUSSION

We evaluated the association of laxative abuse with clinical and psychopathological variables across subtypes of EDs. To

our knowledge, this is the largest study of the correlates of laxatives abuse and one of the few that included a broad spectrum of ED diagnostic subgroups. Results indicate that individuals with EDs are heterogeneous with respect to purging strategies. Vomiting was the most frequent method, and the sole method used by about one third of the sample. The use of multiple purging methods was also a frequent pattern, occurring in approximately 50% of the sample. Only a minority of individuals used laxatives as their sole method of purging (about 7% of the total sample); however, nearly 55%

TABLE 4. Results From Logistic Regression Analyses (Using GEE) Predicting Laxative Abuse From Borderline Personality Disorder Symptoms^a

BPD Symptom ^b	Laxative Users, % (n)	Nonusers, % (n)	χ^2 (<i>p</i> Value) ^c	OR (95% CI)
Abandonment	16.8 (88)	12.2 (49)	5.72 (.022)	1.60 (1.08–2.37)
Unstable relationships	27.2 (141)	18.3 (73)	1.17 (.012)	1.67 (1.21–2.30)
Identity disturbance	21.3 (112)	16.4 (66)	2.88 (.09)	—
Impulsivity	18.9 (100)	11.8 (47)	1.56 (.002)	1.82 (1.26–2.62)
Self-harm/suicide	24.2 (127)	13.7 (55)	13.70 (<.001)	1.91 (1.34–2.71)
Affective instability	37.0 (193)	29.8 (120)	5.10 (.027)	1.40 (1.04–1.87)
Emptiness feelings	39.6 (206)	25.7 (104)	15.81 (<.001)	1.79 (1.34–2.39)
Anger	20.1 (104)	10.4 (41)	14.57 (<.001)	2.11 (1.42–3.15)
Dissociation/paranoid ideation	20.4 (105)	10.3 (41)	15.81 (<.001)	2.21 (1.48–3.29)

BPD = borderline personality disorder; OR = odds ratio; CI = 95% confidence interval.

^a Eating disorder group (AN, ANBN, BN, EDNOS) was entered as a covariate. The % of laxative users indicates the % of laxative users who endorsed the indicated BPD symptom.

^c *df* = 1; *p* Values are corrected for multiple testing using the false discovery rate method; odds ratios are indicated if significant.

^b Cluster B symptoms: Scores were classified as follows: 1 = not present, 2 = some indication of the symptom is present but is either not severe or frequent enough to be coded a “3”, 3 = present.

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of the sample used laxatives either alone or in combination with other methods. Although this figure in part reflects our sampling strategy (presence of vomiting was required as inclusion criteria for BN probands), it is consistent with prior research (3–6,8) and suggests that, in the majority of cases, laxatives are used as an auxiliary purging method.

One explanation for this observation may be that laxatives are not an effective weight loss method. In fact, vomiting has been shown to be a more effective weight-control method (48–50), whereas laxatives have only a marginal impact on caloric absorption (48–50). Individuals who adopt laxatives as the first method of purging may note their ineffectiveness and include other purging methods in order to achieve weight control. It is possible that individuals who are more ill tend to engage in multiple methods of purging because they are never satisfied with the results obtained. This concurs with the observation that multiple purging strategies are associated with more unhealthy eating attitudes, including higher drive for thinness and body dissatisfaction (15). The persistence of laxative abuse, despite negligible weight control efficacy, allows for the possibility that this behavior may serve an additional function, independent of weight control.

Confirming previous results (9,10,16), our data suggest that individuals with AN who regularly purge but do not binge have a higher prevalence of laxative abuse and tend to use laxatives as the sole purging method more frequently than other ED subtypes. Only a few studies have characterized the cognitive and behavioral features of individuals with AN who regularly purge but never binge (9,10,51), so little is known about the underlying motivations for purging in these individuals. It is possible that some of these individuals are effective in maintaining a low weight through dietary restraint and/or excessive exercise. In such individuals, laxative abuse might be more strongly associated with self-harm and only marginally related to weight control. In fact, available data suggest that this group of patients may be particularly self-destructive and present with greater psychopathology (9,10).

In addition to examining the prevalence of laxative abuse among ED subtypes, we also examined relationships between laxative use and course of illness, comorbidity, and personality traits. Corroborating previous studies (9,16,22), individuals who use laxatives had a longer duration of illness than those who do not, possibly suggesting that laxative abuse may be a marker of chronicity and greater eating psychopathology. In contrast, laxative abuse was not associated with the age of onset for threshold EDs, but individuals who abused laxatives did tend to have an early onset of self-reported initial ED symptoms. Given previous findings suggesting that individuals who abuse laxatives are older than those who do not (9,16,22), these results require replication and further explication.

We also examined patterns of comorbidity for categorical diagnoses and dimensional traits in women who abuse laxatives. Individuals who engage in these behaviors have personalities and presentations marked by both extreme anxiety and neurotic traits, as well as impulsive behaviors. Using dimensional measures, we found that women who abuse laxatives

have higher levels of perfectionism and eating-related rituals than those who do not. Impressions from these dimensional measures were then confirmed when Axis I disorder diagnoses were examined; here, women who use laxatives were found to have higher rates of PTSD and specific phobia, confirming the presence of an anxiety-spectrum disposition in these women.

Interestingly, this anxious personality profile appears to be supplemented with impulsive traits as well. We corroborated findings from previous research (11,19,20,28) showing relationships between laxative abuse and BPD; however, we extended those findings with more fine-grained symptom-level analyses of the BPD diagnosis. We found that laxative abuse is most strongly associated with the BPD symptoms of suicidality/self-harm and feelings of emptiness. Previous studies of non-eating-disordered psychiatric and nonclinical populations reported an association among self-injurious behaviors, impulsivity, anxiety, dissociative phenomena, anger, and feelings of emptiness (52–55), indicating a link among these symptoms, independent from EDs. These previous findings, in conjunction with our results, suggest that laxative abuse may be part of a complex ensemble of anxious, perfectionistic traits and self-harming behaviors and attitudes.

In the context of EDs, laxative abuse is usually conceptualized as purging or as a weight-control method; however, the self-harm and potentially anxiolytic features should not be overlooked. Indeed, although all forms of purging are physically destructive, laxative abuse is one of the more physically self-abusive methods of purging, and laxative abuse is often described as self-punishing or self-aggressive by patients themselves. And, much like other methods of self-harm (e.g., cutting), the abuse of laxatives likely has an anxiolytic effect that allows patients to decrease fears of weight gain and anxiety and instead focus on the pain and consequences of the laxative abuse. If one of the driving forces behind laxative abuse is self-harm and decreased anxiety rather than weight loss, then a therapeutic intervention emphasizing the ineffectiveness of laxative abuse as a weight-control method misses the mark and would logically fail. Interventions would instead need to focus on the self-harmful aspects and teaching other, more adaptive strategies for achieving the ends that the laxative abuse is addressing.

Although this study's strengths include the large, diagnostically well-characterized sample and the extensive assessment battery, significant limitations have to be noted. The cross-sectional design forced us to rely on retrospective reports and may have incurred recall biases. Moreover, we did not assess physical or sexual abuse, which may have been relevant, given the significant association with PTSD. Finally, it is likely that our assessment of purging behaviors may underestimate their frequency, as laxative abuse and other purging behaviors are commonly associated with secrecy and shame.

In conclusion, laxative abuse in individuals with EDs is associated with self-harm behaviors, an anxious disposition, and a more severe clinical presentation. It is noteworthy that the association between laxative use and self-harm appears to be specific because it does not appear to characterize vomiting (34) or excessive exercise (56). Thus, it appears that different

purging behaviors may serve different functions. The understanding of the specific cognitive and emotional function of specific purging methods is of clinical utility as more tailored interventions may be required that include a broader understanding of the primary and secondary functions of the various purging methods.

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REFERENCES

- Montecchi PP, Custereri V, Polimeni A, Cordaro M, Costa L, Marinucci S, et al. Oral manifestations in a group of young patients with anorexia nervosa. *Eat Weight Disord* 2003;8:164–7.
- Studen-Pavlovich D, Elliott MA. Eating disorders in women's oral health. *Dent Clin North Am* 2001;45:491–511.
- Ben Tovim DI, Subbiah N, Scheutz B, Morton J. Bulimia: symptoms and syndromes in an urban population. *Aust N Z J Psychiatry* 1989;23:73–80.
- Heatherton TF, Nichols P, Mahamedi F, Keel P. Body weight, dieting, and eating disorder symptoms among college students, 1982 to 1992. *Am J Psychiatry* 1995;152:1623–9.
- Jones JM, Bennett S, Olmsted MP, Lawson ML, Rodin G. Disordered eating attitudes and behaviours in teenaged girls: a school-based study. *CMAJ* 2001;165:547–52.
- Killen JD, Taylor CB, Telch MJ, Saylor KE, Maron DJ, Robinson TN. Self-induced vomiting and laxative and diuretic use among teenagers: precursors of the binge-purge syndrome? *JAMA* 1986;255:1447–9.
- Neims DM, McNeill J, Giles TR, Todd F. Incidence of laxative abuse in community and bulimic populations: a descriptive review. *Int J Eat Disord* 1995;17:211–28.
- Phelps L, Andrea R, Rizzo FG, Johnston L, Main CM. Prevalence of self-induced vomiting and laxative/medication abuse among female adolescents: a longitudinal study. *Int J Eat Disord* 1993;14:375–8.
- Garner DM, Garner MV, Rosen LW. Anorexia nervosa "restricters" who purge: implications for subtyping anorexia nervosa. *Int J Eat Disord* 1993;13:171–85.
- Nagata T, McConaha C, Rao R, Sokol MS, Kaye WH. A comparison of subgroups of inpatients with anorexia nervosa. *Int J Eat Disord* 1997;22:309–14.
- Pryor T, Wiederman MW, McGilley B. Laxative abuse among women with eating disorders: an indication of psychopathology? *Int J Eat Disord* 1996;20:13–8.
- Post G, Crowther JH. Restrictor-purger differences in bulimic adolescent females. *Int J Eat Disord* 1987;6:757–61.
- Tobin DL, Johnson CL, Dennis AB. Divergent forms of purging behavior in bulimia nervosa patients. *Int J Eat Disord* 1992;11:17–24.
- Walters EE, Neale MC, Eaves LJ, Heath AC, Kessler RC, Kendler KS. Bulimia nervosa: a population-based study of purgers versus nonpurgers. *Int J Eat Disord* 1993;13:265–72.
- Tobin DL, Griffing A, Griffing S. An examination of subtype criteria for bulimia nervosa. *Int J Eat Disord* 1997;22:179–86.
- Favaro A, Santonastaso P. Purging behaviors, suicide attempts, and psychiatric symptoms in 398 eating disordered subjects. *Int J Eat Disord* 1996;20:99–103.
- Swain B, Shisslak CM, Crago M. Clinical features of eating disorders and individual psychological functioning. *J Clin Psychol* 1991;47:702–8.
- Mitchell JE, Boutacoff LI, Hatsukami D, Pyle RL, Eckert ED. Laxative abuse as a variant of bulimia. *J Nerv Ment Dis* 1986;174:174–6.
- Johnson C, Tobin D, Enright A. Prevalence and clinical characteristics of borderline patients in an eating-disordered population. *J Clin Psychiatry* 1989;50:9–15.
- Bulik CM, Sullivan PF, Joyce PR, Carter FA. Temperament, character, and personality disorder in bulimia nervosa. *J Nerv Ment Dis* 1995;183:593–8.
- Waller DA, Newton PA, Hardy BW, Svetlik D. Correlates of laxative abuse in bulimia. *Hosp Community Psychiatry* 1990;41:797–9.
- Turner J, Batik M, Palmer LJ, Forbes D, McDermott BM. Detection and importance of laxative use in adolescents with anorexia nervosa. *J Am Acad Child Adolesc Psychiatry* 2000;39:378–85.
- Kovacs D, Palmer RL. The association between laxative abuse and other symptoms among adults with anorexia nervosa. *Int J Eat Disord* 2004;36:224–8.
- Wiederman MW, Pryor T. Multi-impulsivity among women with bulimia nervosa. *Int J Eat Disord* 1996;20:359–65.
- Favaro A, Santonastaso P. Impulsive and compulsive self-injurious behavior in bulimia nervosa: prevalence and psychological correlates. *J Nerv Ment Dis* 1998;186:157–65.
- Favazza AR, DeRosear L, Conterio K. Self-mutilation and eating disorders. *Suicide Life Threat Behav* 1989;19:352–61.
- Bruce KR, Koerner NM, Steiger H, Young SN. Laxative misuse and behavioral disinhibition in bulimia nervosa. *Int J Eat Disord* 2003;33:92–7.
- Anderson C, Carter FA, McIntosh VV, Joyce PR, Bulik CM. Self-harm and suicide attempts in individuals with bulimia nervosa. *Eat Disord Prevent Treat* 2002;10:227–44.
- Baker EH, Sandle GI. Complications of laxative abuse. *Annu Rev Med* 1996;47:127–34.
- Wald A. Is chronic use of stimulant laxatives harmful to the colon? *J Clin Gastroenterol* 2003;36:386–9.
- Kaye W, Devlin B, Barbarich N, Bulik CM, Thornton L, Bacanu SA, Fichter MM, Halmi KA, Kaplan AS, Strober M, Woodside DB, Bergen AW, Crow S, Mitchell J, Rotondo A, Mauri M, Cassano A, Keel P, Plotnicov K, Pollice C, Klump KL, Lilienfeld L, Ganjel JK, Quadflieg N, Berrettini WH. Genetic analysis of bulimia nervosa: Methods and sample description. *Int J Eat Disord* 2004;35:556–70.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*, Fourth Edition. Washington, DC: American Psychiatric Association; 1994.
- Hebebrand J, Himmelmann GW, Hesecker H, Schafer H, Remschmidt H. Use of percentiles for the body mass index in anorexia nervosa: diagnostic, epidemiological, and therapeutic considerations. *Int J Eat Disord* 1996;19:359–69.
- Reba L, Thornton L, Tozzi F, Klump KL, Brandt H, Crawford S, et al. Relationships between features associated with vomiting in purging-type eating disorders. *Int J Eat Disord* 2005;38:287–94.
- Fichter MM, Herpertz S, Quadflieg N, Herpertz-Dahlmann B. Structured Interview for Anorexic and Bulimic disorders for DSM-IV and ICD-10: updated (third) revision. *Int J Eat Disord* 1998;24:227–49.
- First MB, Spitzer RL, Gibbon M, Williams JBM. *Structured Clinical Interview for DSM-IV Axis-I Disorders (SCID-I)*. Washington, DC: American Psychiatric Press; 1996.
- First MB, Gibbon M, Spitzer RL, Williams JBM, Benjamin LS. *Structured Clinical Interview for DSM-IV Axis-II Personality Disorders (SCID-II)*. Washington, DC: American Psychiatric Press; 1997.
- Cloninger CR, Svrakic DM, Przybeck TR. A psychobiological model of temperament and character. *Arch Gen Psychiatry* 1993;50:975–90.
- Frost RO, Marten P, Lahart C, Rosenblate R. The dimensions of perfectionism. *Cognit Ther Res* 1990;14:449–68.
- Spielberger CD, Gorsuch RL, Lushene RE. *STAI Manual for the State Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1970.
- Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, et al. The Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), I: development, use and reliability. *Arch Gen Psychiatry* 1989;46:1006–11.
- Sunday SR, Halmi KA, Einhorn A. The Yale-Brown-Cornell Eating Disorder Scale: a new scale to assess eating disorder symptomatology. *Int J Eat Disord* 1995;18:237–45.
- Kaye WH, Lilienfeld LR, Berrettini WH, Strober M, Devlin B, Klump KL, et al. A search for susceptibility loci for anorexia nervosa: methods and sample description. *Biol Psychiatry* 2000;47:794–803.
- Diggle PJ, Liang KY, Zeger SL. *Analysis of Longitudinal Data*. Oxford: Oxford Science; 1994.

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45. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika* 1986;73:13–22.
46. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 1986;42:121–30.
47. SAS Institute, Inc. SAS, V8. Cary, NC: SAS Institute, Inc.; 1996.
48. Bo-Linn GW, Santa Ana CA, Morawski SG, Fordtran JS. Purging and calorie absorption in bulimic patients and normal women. *Ann Intern Med* 1983;99:14–7.
49. Lacey JH, Gibson E. Does laxative abuse control body weight? a comparative study of purging and vomiting bulimics. *Hum Nutr Appl Nutr* 1985;39:36–42.
50. Lacey JH, Gibson E. Controlling weight by purgation and vomiting: a comparative study of bulimics. *J Psychiatr Res* 1985;19:337–41.
51. Klump KL, Bulik CM, Pollice C, Halmi KA, Fichter MM, Berrettini WH, et al. Temperament and character in women with anorexia nervosa. *J Nerv Ment Dis* 2000;188:559–67.
52. Briere J, Gil E. Self-mutilation in clinical and general population samples: prevalence, correlates, and functions. *Am J Orthopsychiatry* 1998;68:609–20.
53. Klonsky ED, Oltmanns TF, Turkheimer E. Deliberate self-harm in a nonclinical population: prevalence and psychological correlates. *Am J Psychiatry* 2003;160:1501–8.
54. Simeon D, Stanley B, Frances A, Mann JJ, Winchel R, Stanley M. Self-mutilation in personality disorders: psychological and biological correlates. *Am J Psychiatry* 1992;149:221–6.
55. Zlotnick C, Mattia JI, Zimmerman M. Clinical correlates of self-mutilation in a sample of general psychiatric patients. *J Nerv Ment Dis* 1999;187:296–301.
56. Shroff H, Reba L, Thornton L, Tozzi F, Klump KL, Berrettini W, Brandt H, Crawford S, Crow S, Fichter MM, Goldman D, Halmi KA, Johnson C, Kaplan AS, Keel P, Lavia M, Mitchell J, Rotondo A, Strober M, Treasure J, Woodside DB, Kaye WH, Bulik CM. Features associated with excessive exercise in eating disorders. *Int J Eat Disord*. In Press.