

# Impulsivity and Compulsivity in Bulimia Nervosa

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## ABSTRACT

**Objective:** A primary objective of the current article is to investigate the relationship between impulsivity and compulsivity in patients with bulimia nervosa (BN). A second goal is to explore the relationship between impulsivity and compulsivity and related psychiatric problems.

**Method:** Two-hundred four females with BN completed several measures of impulsivity and compulsivity as well as measures of personality, substance use, eating pathology, and depression.

**Results:** Participants reported considerable variability on measures of impul-

sivity and compulsivity and these scores were positively correlated with each other. Impulsive-compulsive groups differed in personality, substance use, eating, and depression.

**Conclusion:** These findings suggest that impulsivity and compulsivity can coexist in BN patients and that both traits may provide useful information about comorbid problems in women with BN. © 2005 by Wiley Periodicals, Inc.

**Keywords:** impulsivity; compulsivity; bulimia nervosa; psychiatric problems

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## Introduction

The categorical approach to diagnosis taken by the 4th ed. of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) has dominated much of the recent study of psychopathology. However, for some time, there has been interest in alternatives to this categorical approach that typically involve studying variables on a continuum. Oldham, Hollan-

der, and Skodol (1996), for example, have written of a spectrum of impulsive and compulsive behavioral traits. These authors suggest that although not all DSM-IV disorders fit neatly into this impulsive-compulsive spectrum, a number of "core" disorders do fit well and that bulimia nervosa (BN) is a disorder of impulsivity. The conceptual model of Oldham et al. suggests that impulsivity and compulsivity are on opposite ends of a single continuum. Therefore, those who score high on impulsivity would necessarily score low on compulsivity (and vice versa). Given the Oldham et al. continuum-based conceptual model and their belief that BN is primarily a disorder of impulsivity, one would predict that individuals with BN would display elevations in impulsivity indicators and low scores on compulsivity measures. This model would further predict that individuals with BN would have very low levels of comorbidity with compulsive disorders. Finally, a continuum model would also predict that impulsivity and compulsivity are highly negatively correlated because high scores on one variable necessitate low scores on the other variable.

Despite the fact that the Oldham et al. (1996) conceptual model of BN is clear, concise, and conceptually possible, several sources of existing empirical data appear to contradict the model. For example, studies of psychiatric comorbidity in BN subjects suggest that psychopathology reflecting compulsive behavior, such as obsessive-compulsive disorder and anxious-fearful personality disorders, is relatively common in BN. Also contradicting the

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Oldham et al. continuous model of BN are studies by Westen and Hamden-Fischer (2001), Espelage, Mazzeo, Sherman, and Thompson (2002), and Wonderlich et al. (in press), which suggest that BN may be characterized by various subtypes that differ on underlying compulsive and impulsive personality traits. These studies have generally found three naturally occurring groups of bulimic participants. These three groups can be described as having impulsive, compulsive, and low comorbid-psychopathology traits.

Generally, empiric studies have examined the relationship of eating disorders and either compulsivity or impulsivity. Rarely have both behavioral traits been simultaneously investigated in relation to disordered eating symptoms. One study that did investigate the relationship between both compulsivity and impulsivity in eating-disordered subjects was conducted by Raymond et al. (1999) who found both traits elevated in patients with an eating disorder (binge eating or BN patients). Another study that investigated both impulsive and compulsive traits in eating-disordered individuals was conducted by Claes, Vandereycken, and Vertommen (2002). In a sample of anorexia nervosa (AN), BN, and control subjects, they found that patients who reported binge-purge behavior (BN and AN-binge/purge subtype) displayed higher levels of both impulsivity and compulsivity than restricting anorexic subjects or controls. This finding again suggests that impulsivity and compulsivity are not mutually exclusive in eating-disordered patients and recent data suggest that the combination of increased impulsivity and compulsivity may be associated with certain comorbid conditions (e.g., alcohol use disorders; Bulik et al., 2004).

In the current study, we sought to determine if impulsivity and compulsivity were best characterized as unidimensional (i.e., impulsivity vs. compulsivity) or bidimensional (i.e., impulsivity and compulsivity). We hypothesized that impulsivity and compulsivity would be relatively orthogonal constructs and not represent a single continuum in BN participants. Second, after determining the best factor structure for impulsivity and compulsivity in BN, we sought to examine the relationship between the factor (if unidimensional) or factors (if not unidimensional) and other measures of psychopathology. We hypothesized that both impulsivity and compulsivity would be associated with greater levels of comorbid psychopathology. More specifically, we predicted that participants who scored high on both impulsivity and compulsivity would demonstrate the greatest level of psychiatric comorbidity.

## Method

### Participants

Two hundred and four females participated in the study. Their ages ranged from 18 years to 57 years ( $M = 25.67$ ,  $SD = 8.85$ ). Participants were recruited from five sites (Madison, WI; Minneapolis, MN; Fargo, ND; Chicago, IL; and Columbia, MO) through community advertising and local eating disorder clinics. Individuals with current psychotic disturbances, organic brain syndromes, or those unable to read were excluded from the study.

Of the 204 participants in the study, 139 (68.4%) met DSM-IV diagnostic criteria for BN-purging subtype. Four subjects (2.0%) met DSM-IV diagnostic criteria for BN-nonpurging subtype. Thirty-two subjects (15.8%) did not meet diagnostic threshold for BN, but reported bulimic symptomatology and were categorized as subclinical BN. Twenty-nine subjects (14.3%) displayed purging behavior, but their binges did not meet objective binge eating criteria. These participants were included in the category of subjective BN.

Participants were mostly single (75% not married) and had some college education (67% attended at least some college). The majority of participants were Caucasian (91% of participants described themselves as Caucasian). Most participants categorized themselves as full-time college students, but many were employed full-time (60% were full-time college students, 23% were full-time wage earners).

### Measures

**Measures Entered in Factor Analysis.** The Impulsive Behavior Scale (IBS) is a 25-item self-report questionnaire that assesses the presence of different impulsive behaviors (Rossotto, Yager, & Rorty, 1998). The frequency of each behavior is rated on a 5 point Likert-type scale ranging from 1 = *never* to 5 = *regularly*. The total score indicates a global level of impulsive behavior. The coefficient alpha value in the current study was .87.

The Barratt Impulsivity Scale (BIS-11) is a 30-item self-report measure of impulsiveness, currently in its 11th revision (Barratt, 1985). Items are rated on a 4 point Likert-type scale ranging from 1 = *rarely/never* to 4 = *almost always/always*. The BIS-11 consists of three impulsivity scales: motor, cognitive, and nonplanning. The BIS-11 has discriminated successfully the degree of impulse control in subgroups of women with eating disorders (Bulik, Sullivan, Fear, & Pickering, 1997; Steiger, Koerner, et al., 2001; Steiger, Young, et al., 2001). The coefficient alpha value for the total score was .85.

The Frost Multi-Dimensional Perfectionism Scale (MPS) is a 35-item self-report questionnaire designed to assess the major dimensions of perfectionism. Items are rated on a 5 point Likert-type scale ranging from

1 = *strongly disagree* to 5 = *strongly agree* (Frost, Marten, Lahart, & Rosenblate, 1990). The MPS has demonstrated excellent internal consistency, high correlations with other measures of perfectionism, and high subscale reliabilities (Frost et al., 1990). The coefficient alpha value for the total perfectionism score was .93.

The Spielberger State-Trait Anxiety Inventory (STAI/SSAI) consists of two scales: state anxiety and trait anxiety (Spielberger, 1983). The SSAI scale consists of 20 items that evaluate how respondents feel "right now, at this very moment." The STAI scale consists of 20 items that assess how people "generally feel." The statements are rated from 1 = *almost never/not at all* to 4 = *almost always/very much so*. Both scales tap feelings of apprehension, tension, nervousness, and worry for different time frames. The coefficient alpha value was .95 for the SSAI and .94 for the STAI.

The Maudsley Obsessive-Compulsive Inventory (MOCI) is a 30-item true-false, self-report questionnaire that assesses overt rituals and obsessions (Hodgson & Rachman, 1977). The scale has good test-retest reliability ( $r = .80$ ) and internal consistency (.80; Rachman & Hodgson, 1980). The coefficient alpha value for the total score was .85.

**External Validation Measures of Psychopathology.** The Structured Clinical Interview for DSM-IV, Patient Edition (SCID-P)-eating disorder module is a widely used semi-structured interview that was administered to assess eating pathology (First, Spitzer, Gibbon, & Williams, 1995) in our bulimic sample. Past reliability studies for the SCID have found kappa coefficients that typically ranged from .7 to .8, and test-retest coefficients that ranged from .37 to .89 (for the eating disorder modules; Segal, Hersen, & Van Hasselt, 1994).

The Dimensional Assessment of Personality Pathology-Basic Questionnaire (DAPP-BQ) offers a dimensional assessment of personality traits that are believed to be associated with personality disorders (Livesley, Jackson, & Schroeder, 1992). Items are rated on a 5 point Likert-type scale ranging from 1 = *very unlike me* to 5 = *very like me*. The instrument consists of 290 self-report items and scales of relevance to the current study (i.e., stimulus seeking, compulsiveness). Estimates of internal consistency range from .87 to .94 in both the general population as well as samples of personality-disordered patients (Livesley et al., 1992). The coefficient alpha values ranged from .81 (conduct problems) to .95 (self harm) for the scales.

The Eating Disorders Examination Questionnaire-Version 4 (EDE-Q4) is a 36-item self-report measure adapted from the EDE interview (Fairburn & Beglin, 1994; Fairburn, Cooper, & Wilson, 1993). The EDE-Q4 items are similar to the EDE interview, but are suitable for administration as a self-report questionnaire. Sub-

jects are asked to recall the frequency of various symptoms over different time intervals. The concurrent validity of the EDE-Q4 with the EDE appears to be quite good. The EDE-Q4 also appears to have excellent internal consistency and test-retest reliabilities for the subscales (i.e., Weight Concern, Shape Concern, Eating Concern, Restraint; Luce & Crowther, 1999). The EDE-Q4 coefficient alpha values ranged from .72 (Eating Concerns) to .83 (Shape Concerns) for the subscales.

The Michigan Assessment Screening Test/Alcohol-Drug (MAST/AD) is a 25-item self-report measure designed to assess the severity of drug and alcohol problems (Westermeyer, Yargic, & Thuras, 2004). Various behaviors related to alcohol and drug use are rated as being present or absent. The MAST/AD is a modification of the original Michigan Assessment Screening Test (Selzer, 1971). It has shown good convergent validity with a number of other alcohol and drug screening measures (Westermeyer et al., in press). The coefficient alpha value of the MAST/AD was .75.

The Inventory for Depressive Symptomatology-Self Report (IDS-SR) is a 30-item severity scale that is specific to depression (Rush et al., 1986). Subjects rate the extent to which depressive symptoms have been present over the previous week. It is designed to measure the specific signs and symptoms of depression. The IDS-SR has been found to be both valid and reliable (Rush et al., 1986) and demonstrated a coefficient alpha value of .90.

### Procedure

Potential participants interested in the research project contacted research personnel by telephone. The study was then described to them and if the participants remained interested in the study, a brief diagnostic phone screen was then completed. The phone screen included questions from the Structured Clinical Interview for DSM-IV (SCID-P; First, Gibbon, Spitzer, Williams, & Benjamin, 1997) for both the BN and AN modules, as well as a brief portion of the EDE-Q4 to discern objectively large portions of food from smaller portions of food. Participants who either met current DSM-IV diagnostic criteria for BN or displayed clinically significant bulimic symptomatology (i.e., displayed sub-clinical BN) were invited to participate in the study. After it was determined that a participant was eligible for the study, an appointment was made in which she gave informed consent and completed the questionnaires. The assessments took 2–3 hr. At the completion of these assessments, participants were paid \$50.

### Statistical Analyses

A number of commonly used and accepted measures of psychopathology that frequently accompany BN and may be believed to reflect either impulsivity (total and subscale

**TABLE 1. Factor analysis of impulsive and compulsive measures**

Measure	Factor 1	Factor 2
Frost total	.939	-.170
MOCI total	.830	.056
MOCI doubting	.782	-.145
Spielberger Trait Anxiety	.716	.208
Spielberger State Anxiety	.603	.268
MOCI washing	.540	.178
BIS-II total	.071	.955
BIS-II nonplanning	-.175	.849
BIS-II motor	.138	.745
BIS-II attention	.313	.681
IBS Total	.004	.501

Note: MOCI = Maudsley Obsessive-Compulsive Inventory; BIS-II = Barratt Impulsivity Scale; IBS = Impulsive Behavior Scale.

scores from the BIS-11 and IBS) or compulsivity (total and subscale scores from the MOCI, MPS, and the STAI/SSAI) were administered in the current study. To reduce the number of constructs in the analysis, we conducted a principal component factor analysis with oblique (oblimin) rotation on the subscales or full scales of the BIS-11, IBS, MOCI, MPS, and STAI/SSAI. Factor loadings revealed a two-factor solution. Examining the content of each factor clearly indicated that the factors represented measures of impulsivity and compulsivity (Table 1).

Next, aggregate measures of impulsivity and compulsivity were created by first creating *z* scores of the items in each

factor for each participant and summing impulsive and compulsive scores separately as suggested by the factor analysis. Each participant's impulsivity and compulsivity score was plotted on an impulsivity-by-compulsivity matrix (Figure 1). Participants were then dichotomized into high versus low impulsivity and high versus low compulsivity based on a median split. Four groups were then created, representing high impulsivity/high compulsivity ( $n = 59$ ), high impulsivity/low compulsivity ( $n = 41$ ), low impulsivity/high compulsivity ( $n = 42$ ), and low impulsivity/low compulsivity ( $n = 60$ ). Finally, a series of multivariate analyses of variance (MANOVA) and/or univariate analyses of variance (ANOVA) with Tukey's *b* post-hoc comparisons were conducted to examine the differences among these four groups in personality, substance use, eating pathology, and depression.

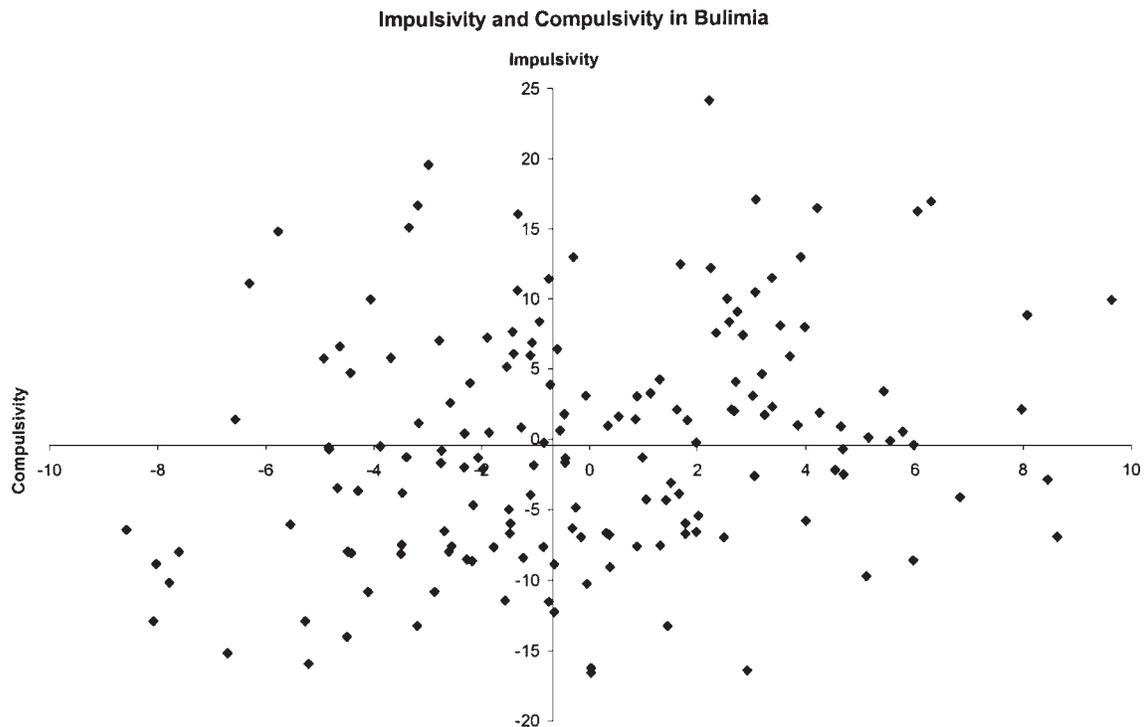
This research was reviewed and approved by an institutional review board.

## Results

### *Factor Structure of Impulsivity and Compulsivity*

Principal components analysis with oblique rotation on the total and subscale scores of the BIS-11,

**FIGURE 1. Scatter plot of each participant's impulsivity and compulsivity scores.**



IBS, MOCI, MPS, and the STAI/SSAI revealed a two-factor solution accounting for 40.7% (Eigenvalue = 6.9) and 16.7% (Eigenvalue = 2.8) of the variance, respectively (Table 1). Inspection of the scales loading on each factor suggests an anxious-compulsive factor (Factor 1) and an impulsive factor (Factor 2). The Cronbach alpha values for each factor were .91 and .85, respectively. The correlation between factors was .33. Support for a two-factor solution versus a one-factor solution came from examination of the scree plot (i.e., Eigenvalues greater than one for each of the two factors) and each of the two factors, accounting for a substantial percentage of the variance.

The creation of the four impulsivity-compulsivity groups varying in levels of compulsivity and impulsivity was conducted as described in the Statistical Analysis section (i.e., median splits). These groups were characterized as having low impulsivity-low compulsivity, low impulsivity-high compulsivity, high impulsivity-low compulsivity, and high impulsivity-high compulsivity. The basic demographic characteristics of these four groups are displayed in Table 2. Groups did not differ in their basic demographic characteristics. They also did not differ in their likelihood of being either full or subclinical BN, suggesting that groups did not differ in severity of BN symptomatology,  $\chi^2(3) = 6.36, p = .095$ ; Table 2.

**Impulsivity-Compulsivity and Personality, Substance Use, Eating Pathology, and Depression**

A one-way MANOVA was used to determine whether the four groups differed in personality pathology as measured by the 18 subscales of the DAPP-BQ. In fact, the four impulsivity-compulsivity groups did differ in personality pathology: multivariate,  $F(54, 540) = 5.57, p < .001$ ; Table 3. Follow-up univariate ANOVAs revealed significant group differences among groups on all of the subscales with the lone exception of the Rejection subscale ( $p = .11$ ). Post-hoc analyses revealed that the low impulsive-low compulsive group had the least personality pathology whereas the high impulsive-

high compulsive group had the most personality pathology. Three exceptions to this pattern of data can be found in the following subscales: Stimulus Seeking, Conduct Problems, and Compulsivity. High impulsivity groups, regardless of compulsivity level, scored higher on Stimulus Seeking and Conduct Problems whereas high compulsivity groups, regardless of impulsivity level, scored higher on the Compulsivity subscale of the DAPP-BQ.

A one-way ANOVA with the four groups was conducted on the MAST/AD to determine if group status based on impulsivity and compulsivity levels predicted alcohol and drug use and abuse. The groups differed in drug and alcohol use,  $F(3, 198) = 4.52, p = .004$ . The two impulsive groups had higher scores on the MAST-AD than the two compulsive groups (Table 3).

A one-way MANOVA with the four groups was conducted on the four subscales of the EDE-Q4 to determine if the impulsivity-compulsivity groups differed in eating pathology. Significant differences among the four groups occurred for the subscales of the EDE-Q4: multivariate,  $F(12, 514) = 4.78, p < .001$ . The follow-up univariate ANOVAs revealed significant differences for all four subscales of the EDE-Q4: Restraint,  $F(3, 198) = 5.36, p = .001$ ; Eating Concerns,  $F(3, 197) = 9.61, p < .001$ ; Shape Concerns,  $F(3, 198) = 12.67, p < .001$ ; and Weight Concerns,  $F(3, 198) = 14.60, p < .001$ . Post-hoc analyses showed that the high impulsive-high compulsive group had the greatest levels of eating pathology whereas the low impulsive-low compulsive group had the lowest levels on the EDE-Q4 (Table 3).

A one-way ANOVA with the four groups was conducted on the IDS to determine if the impulsive-compulsive groups differed on depression. Groups differed markedly on depression scores,  $F(3, 197) = 46.78, p < .001$ . Post-hoc analyses again showed the same pattern of data with the group that scored low in both impulsivity and compulsivity having the lowest depression scores and the group that scored high in both impulsivity and compulsivity having the highest depression scores (Table 3).

**TABLE 2. Demographics for impulsivity-compulsivity groups**

	N	Age	Caucasian (%)	Married (%)	With at least Some College (%)	With Full BN (%)
High impulsivity-high compulsivity	59	24.7 (8.1)	86	10	92	76.3
High impulsivity-low compulsivity	41	26.7 (9.4)	98	10	93	80.5
Low impulsivity-high compulsivity	42	24.1 (6.9)	86	10	93	66.7
Low impulsivity-low compulsivity	60	27.0 (10.3)	93	17	80	60.0

Note: BN = bulimia nervosa.

TABLE 3. Impulsivity × compulsivity and the DAPP-BQ

	High Impulsivity				Low Impulsivity				<i>F</i> ( <i>df</i> = 3)	<i>p</i>	Post-Hoc Test
	High Compulsivity (Group 1)		Low Compulsivity (Group 2)		High Compulsivity (Group 3)		Low Compulsivity (Group 4)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
DAPP-BQ											
Submissiveness	59.5	10.0	53.6	8.4	56.3	8.0	50.9	8.8	9.9	.001	4 < 3,1; 2 < 1
Cognitive Distort	63.4	8.2	53.4	8.3	57.5	7.6	50.7	7.2	28.9	.001	4,2 < 3,1; 3 < 1
Identity Problems	65.3	7.3	56.5	8.3	62.2	7.0	54.2	7.4	25.9	.001	4,2 < 3,1
Affective Lability	63.0	7.9	55.2	7.9	57.3	8.8	50.3	9.7	22.0	.001	4 < 3,2,1; 3,2 < 1
Stimulus Seeking	58.1	9.8	58.5	8.2	45.5	9.1	50.1	9.7	21.5	.001	3, < 4,2,1; 4 < 2,1
Compulsivity	53.6	10.6	43.2	9.1	58.6	10.2	51.7	9.4	17.6	.001	2 < 4,3,1; 4,1 < 3
Restrict Express	62.2	9.0	51.1	9.3	61.5	10.2	52.5	9.4	19.1	.001	4 < 2,1; 2 < 1
Callousness	54.5	10.1	56.3	8.6	55.4	10.4	49.1	8.9	6.3	.001	4 < 3,2,1
Passive Aggressive	61.5	8.6	56.2	7.6	53.6	6.6	50.3	6.3	23.9	.001	4 < 3,1; 3,2 < 1
Intimacy Problems	58.9	11.2	49.8	9.8	57.2	11.0	51.6	9.2	9.0	.001	4,2 < 3,1
Rejection	51.5	11.7	52.6	9.7	52.1	12.3	47.7	11.7	2.0	.111	
Anxiousness	64.8	6.6	55.3	6.9	61.6	7.3	54.4	7.9	26.5	.001	4,2 < 3,1
Conduct Problems	60.7	7.5	61.4	7.0	54.6	8.3	52.9	9.3	14.4	.001	4,3 < 2,1
Suspiciousness	60.7	10.5	52.2	10.8	60.4	8.2	49.9	9.1	17.5	.001	4,2 < 3,1
Social Avoidance	62.8	8.3	53.9	9.2	59.9	9.8	52.9	8.8	15.5	.001	4,2 < 3,1
Narcissism	60.0	9.3	58.0	7.2	58.6	8.6	54.0	8.4	5.5	.001	4 < 3,2,1
Insecure Attach	57.3	9.7	52.5	10.3	56.6	8.7	51.3	8.5	5.5	.001	4 < 3,1; 2 < 1
Self-Harm	62.5	7.8	57.5	5.4	59.7	7.0	55.4	5.9	12.1	.001	4 < 3,1; 2 < 1
MAST/AD	10.9	10.8	13.1	14.0	6.7	6.0	6.8	8.9	4.5	.004	4,3 < 2
EDE-Q4 subscales											
Restraint	4.4	1.0	3.6	1.3	4.1	1.4	3.6	1.2	5.4	.001	4,2 < 1
Eating Concern	4.3	1.1	3.2	1.4	3.6	1.2	3.1	1.3	9.6	.001	4,3,2 < 1
Shape Concern	5.2	0.9	4.3	1.1	5.1	1.0	4.2	1.2	12.7	.001	4,2 < 3,1
Weight Concern	5.0	1.0	3.8	1.2	4.7	1.1	3.8	1.2	14.6	.001	4,2 < 3,1
IBS	40.2	10.3	25.7	9.3	32.3	11.0	19.6	8.6	46.8	.001	4 < 2 < 3 < 1

Note: DAPP-BQ = Dimensional Assessment of Personality Pathology-Basic Questionnaire; MAST/AD = Michigan Assessment Screening Test/Alcohol-Drug; EDE-Q4 = Eating Disorders Examination Questionnaire-Version 4; IBS = Impulsive Behavior Scale.

## Conclusion

To summarize, our findings suggest that both impulsivity and compulsivity are common behavioral traits in BN patients. Also, we found that grouping bulimic patients on levels of impulsivity and compulsivity led to meaningful group differences in variables assessing personality, substance use, eating pathology, and depression. On several measures (e.g., most DAPP-BQ subscales, EDE-Q4 subscales, and the IDS), we found that those who were high in both impulsivity and compulsivity reported the most impairment whereas those who were low in both reported the least impairment. However, there were other variables that were not uniquely elevated in the high impulsivity-high compulsivity group. For example, as would be expected, the MAST/AD was associated with high impulsivity, regardless of compulsivity level. This differential pattern of responding suggests that participants were not merely adhering to a particular response style (e.g., all symptomatic or all not symptomatic).

Although past research has suggested that impulsive traits are associated with greater problems in eating-disordered individuals (Sohlberg, Norring,

Holmgren, & Rosmark, 1989), the current findings indicate that both measures of impulsivity and compulsivity are significantly associated with impairment in personality, drug and alcohol use, eating pathology, and depression in female patients with BN. In fact, these indicators of impairment appear to be associated with a considerable proportion of these outcome measures (average  $R^2$  across subscales of the DAPP-BQ = .19, and the EDE-Q4 = .14,  $R^2$  for the MAST/AD = .06, and the IDS = .42). The current data also suggest that it is not merely the presence of one trait or the other that predicts comorbid psychopathology in BN, but rather the additive effect of both impulsivity and compulsivity appear to be associated with the greatest amount of impairment on numerous indices.

The low impulsivity-low compulsivity group is associated with the lowest levels of comorbid psychopathology whereas the high impulsivity-high compulsivity group has the greatest level of comorbid psychopathology. The low impulsivity-high compulsivity and high impulsivity-low compulsivity groups also differ on several measures. For example, the high impulsivity-low compulsivity

group has the highest level of alcohol and drug-related problems. However, the low impulsivity-high compulsivity group generally scores higher on indicators of eating disorder symptomatology and depression. This finding again suggests that the participants are not merely responding with a particular response set, but also suggests that the level of impulsivity and compulsivity is meaningfully related to comorbid psychopathology.

One interesting finding from the current data is that impulsivity and compulsivity correlate positively ( $r = .33$ ). If impulsivity and compulsivity were on opposite ends of a continuum (Oldham et al., 1996), this positive correlation should not exist. In fact, if they were on opposite ends of a continuum, impulsivity and compulsivity should be strongly, negatively correlated. Hollander (1998) states that although impulsive and compulsive disorders are on opposite ends of one continuum, they share one characteristic; they involve some repetitive behavior and a defective mechanism that should inhibit or delay acting on these behaviors. It could be this commonality that partially explains our positive correlation between impulsivity and compulsivity. An alternative explanation could involve serotonin functioning in patients with BN (e.g., Kaye et al., 2000). The functioning of the serotonin system has been implicated in the level of impulsivity seen in patients with BN (Steiger, 2001). Particularly relevant is Brewerton's (1995) serotonin dysregulation hypothesis, which suggests that the dysregulation of serotonin may be partly responsible for elevated rates of both impulsivity and compulsivity.

In related work, Steiger, Israël, Gauvin, Kin, and Young (2003) investigated the implications of serotonin functioning in BN patients. Research generally finds that impulsivity is linked to reduced serotonin functioning, but compulsivity is associated with an increase in serotonin functioning (this compulsivity-serotonin finding is, admittedly, less clear). The findings of Steiger et al. (2003) suggested that, in BN patients, reduced serotonin neurotransmission was characteristic of subjects high in impulsivity, subjects high in both impulsivity and compulsivity, and those low in both traits. However, those who were high in compulsivity and low in impulsivity showed increased serotonin activity. This finding is consistent with the idea that impulsivity and compulsivity are independent traits. Steiger et al. (2003) also found that impulsivity and compulsivity did not correlate significantly ( $r = .08$ ) in their BN sample and that they may be best thought of as orthogonal dimensions. These findings, in conjunction with the current findings,

suggest that impulsivity and compulsivity appear to be independent constructs in both neurobiology and personality.

It should be noted that although the sample in the current study consists of bulimic participants, the findings may not be limited to patients with eating disorders. McKay, Kulchysky, and Danyko (2000), for example, reported on obsessive-compulsive symptoms in borderline personality disorder (BPD), a disorder that is typically associated with impulsivity. Consistent with the current findings, they found that patients with BPD who were also compulsive tended to be the most severely disordered and demonstrated the highest level of self-mutilation. Similarly, Markovitz (2001) has recommended that BPD patients who have obsessive-compulsive behaviors should receive different pharmacotherapy treatments than those who do not. Again, this recommendation suggests that impulsive and compulsive indicators can coexist in an individual.

One limitation of the current study is that all of the data collected are based on self-report measures. Another limitation is that no comparison group is available with which to compare our bulimic subjects. Therefore, no definite conclusions can be reached regarding how impulsivity and compulsivity levels in our sample differ from normal controls. Future research should expand our investigations of impulsivity and compulsivity to other groups.

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