

A Test of an Interactive Model of Bulimic Symptomatology in Adult Women

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An interactive model of bulimic symptom development, first suggested by Vohs et al. (1999), was tested in adult women (mean age = 45.19). The following hypothesis was examined in a longitudinal design over 2.5 years: Women high in perfectionism, low in self-esteem, and who perceive themselves as overweight would be the most likely to experience an increase in bulimic symptoms. Results supported the model with regard to maintenance and exacerbation, but not onset, of bulimic symptoms. Furthermore, the interactive model was tested to see if it showed specificity to bulimic, versus depressive or anxious, symptoms. Some support for the model's specificity to bulimic symptoms was observed; however, the increase of anxious symptoms was also observed. Clinical and theoretical implications are discussed.

MANY BIOLOGICAL, interpersonal, and sociocultural factors have been implicated in the development and maintenance of bulimia nervosa. Additionally, a variety of intrapersonal variables, such as perfectionism, self-esteem, and body dissatisfaction, have been posited to contribute to bulimia's onset. Previous research by Joiner, Heatherton, Rudd, and Schmidt (1997) found that perfectionism served as a risk factor for bulimic symptoms in women who perceived themselves as overweight, but not in those who did not describe themselves as overweight. Vohs, Bardone, Joiner, Abramson, and Heatherton (1999) and Vohs et al. (2001) extended that finding by providing empirical support for an interactive model of bulimic development that identified perfectionism, perceived overweight status,

and low self-esteem as causal factors. The combination of perfectionism and perceived overweight status increased the rate of bulimic symptoms among college-aged women with low self-esteem, but not among those with high self-esteem, over a period of 9 months and 5 weeks, respectively.

Bardone, Abramson, Vohs, Heatherton, and Joiner (in press) reported a similar pattern in undergraduates when examining self-efficacy as a moderator variable. Self-efficacy, which is one facet of the broader category of self-esteem, concerns the cognitive appraisal of one's abilities. In this study, over 11 weeks, perfectionism, self-efficacy, and weight perception interacted to predict the presence of and change in binge eating, such that college-aged women with high levels of perfectionism and who felt overweight engaged in binge eating only if they were low in self-efficacy (for alternative models of bulimic symptom development, see Fairburn, Cooper, & Cooper, 1986; Stice & Agras, 1998).

The Relationship Between Perfectionism and Bulimia

Perfectionism has been documented as a risk factor for many disorders, and is hypothesized to function as both a mediator and moderator variable that induces stress and results in the onset or maintenance of many forms of psychopathology (Hewitt & Flett, 2002). The specific role of perfectionism in bulimia has also been explored. Beede (1994) suggested that perfectionism may be a cause of dieting and aversive self-awareness (a construct tied to binge eating). Joiner et al. (1997) and Steiger, Leung, Puentes-Neuman, and Gottheil (1992) reported that high levels of perfectionism led to more bulimic symptoms than low levels of perfectionism. However, others have not found this pattern (e.g., Fryer, Waller, & Kroese, 1997; Hurley, Palmer, & Stretch, 1990).

Recently, Goldner, Cockell, and Srikameswaran (2002) introduced an integrative, theoretical model of perfectionism and eating disorders that shares

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some similarities with that advanced by Vohs et al. (1999, 2001; cf. Joiner et al., 1997). They proposed that perfectionism is a necessary setting condition for the development of a variety of disorders. When a perfectionist is confronted with either a concerted attempt at self-improvement or a need for diminution of self-awareness, he or she engages in compulsive behaviors. The exact form of these compulsive behaviors is moderated by a variety of sociocultural (such as culture-specific weight norms) and physical factors (such as history of being overweight). When a perfectionistic person feels that his or her shape or weight contributes substantially to his or her self-esteem (as a result of sociocultural or physical influences), the person is at increased risk for the development of an eating disorder. Perfectionists who are rigid and overcontrolled in personality are more likely to emerge with anorexic symptoms, whereas those who are impulsive are more likely to emerge with bulimic symptoms, according to this model.

Empirical support has also been reported for perfectionism as a vulnerability factor in a diathesis-stress model of bulimic symptom development (Joiner et al., 1997). In an undergraduate sample, Joiner et al. found that perfectionism (a diathesis), when exhibited in combination with perceived overweight status (a stressor), was predictive of bulimic symptoms.

Self-Esteem as a Moderator Variable

The finding reported by Joiner et al. (1997) on perfectionism, perceived weight status, and bulimic symptoms was not apparent when actual weight status was used as the stressor variable, indicating that an individual's *perceived* weight is the more integral predictive factor. Vohs et al. (2001) expanded upon Joiner et al.'s findings by hypothesizing the presence of a moderator variable in this interaction, namely self-esteem. Following other researchers who have identified self-esteem as a risk factor for bulimia (e.g., Polivy & Herman, 2002), they reasoned that individuals with high levels of self-esteem would engage in positive, goal-directed weight-loss strategies, whereas those with low levels of self-esteem may employ counterproductive methods such as bingeing and purging. Results supported the prediction that over a 9-month period, undergraduate women who were perfectionistic and perceived themselves as overweight exhibited increased levels of bulimic symptoms if they had low self-esteem, but not if they had high self-esteem. Furthermore, this model was specific to the development of bulimic and depressive symptoms and did not predict the development of anxiety symptoms.

Related Variables of Interest

Perfectionism has been implicated in the development of both depressive and anxious symptoms (Hewitt & Flett, 1991), and anxiety and depression have been implicated in the development of bulimic symptoms (Benkert, Wetzell, & Szegedi, 1993; Frost, Merten, Lahart, & Rosenblate, 1990). Additionally, there are high comorbidity rates between anxiety, depression, and bulimia (Brewerton, Lydiard, Ballenger, & Herzog, 1993; Hewitt & Flett, 1991; Mineka, Watson, & Clark, 1998). It is therefore possible that perfectionism, perceived weight status, and self-esteem interact to predict mood, anxiety, and eating disorder symptoms. Previous researchers have found perfectionism, low self-esteem, and perceived overweight status to be specific to the prediction of bulimic and depression symptoms, but not anxiety symptoms (Vohs et al., 2001). This study will revisit the issue of this model's predictive specificity to assess whether or not it specifically predicts the onset of eating, but not anxiety or depressive, disorders.

Eating Disorders in Adult Populations

Although the Perfectionism \times Body Dissatisfaction \times Self-Esteem interaction has predicted bulimic symptoms in undergraduate women, it has not been examined in the context of relatively older age groups. In fact, few data exist regarding the nature of bulimia in adult women. Cosford and Arnold (1992) reason that eating disorders in older populations may be poorly recognized because doctors do not suspect the onset of late-life eating disorders and eating disorder symptoms are assumed to be secondary to other physical and psychological diagnoses.

Despite the paucity of research on disordered eating symptoms in adult women, there is evidence to support their existence. For example, at least six case reports of recent-onset bulimia in women over 55 years old have been published (Hsu & Zimmer, 1988; Jonas, Pope, Hudson, & Satlin, 1984). In an American epidemiological study, Rand and Kuldau (1992) reported the existence of bulimia in women over the age of 45. Results of an Australian epidemiological study suggest that problematic eating behaviors, such as purging, are more common than expected and deserve more empirical attention (Hay, 1998). Furthermore, previous researchers have reported that well-supported risk factors for bulimic symptom development, such as dieting and the desire to lose weight, may be prevalent across the life span (Hetherington, 1994; Polivy & Herman, 1985, 1987; Steiger et al., 1996). Pliner et al. (1990) reported that across a broad age span (10 to 79 years), females were much more concerned

about eating, body weight, and physical appearance than men, while Allaz et al. (1998) reported that among a community sample of women aged 30 to 74, 71% reported that they desired to be thinner, despite the fact that 73% were of normal weight. The evidence suggests that women do not simply overcome maladaptive thoughts and behaviors related to food as a function of aging. However, research by Keel, Heatherton, Joiner, and Dorner (2005) reported that between adolescence and midlife, most women exhibit dramatic decreases in disordered eating symptoms. This study will contribute to existing knowledge by prospectively examining how bulimic symptoms vary over time in an adult sample.

The current study will examine the interactive nature of perfectionism, perceived weight status, and self-esteem in predicting increases of bulimic symptoms in adult women over a relatively long time period. It is hypothesized that this model will predict the increase of bulimic symptoms in adult women over a period of 2.5 years. The current study will also assess the model with regard to symptom specificity. It is predicted that the interactive model will specifically predict the increase of bulimic, but not depressive or anxious, symptoms.

Method

PARTICIPANTS

This study examined 150 women who participated in two waves of data collection between 1999 and 2002. In the fall of 1999 (Time 1; T1), a large sample ($N = 2,383$) of men and women who attended seminars on mood disorders and related conditions were asked to complete anonymous questionnaires regarding their moods and behaviors. The sample was composed primarily of health professionals from a diverse range of occupations (e.g., social workers, dentists, nurses, counselors, etc.). These individuals came from 10 states in the Midwest and southern regions of the United States. They were asked to provide contact information if they would be willing to complete future research. The participants' mean age was 45.19 ($SD = 11.02$). Although the participants' age range was large (19 to 84), 67% of the sample was between the ages of 34 and 56. Seventy-nine percent of the sample was female. No information regarding ethnicity was available at T1.

Two and a half years later, in the spring of 2002 (Time 2; T2), approximately 15% of the original female participants ($n = 265$) were selected randomly for follow-up exam. These T2 participants did not differ from their unselected counterparts on any study variables: perfectionism, $t(2, 329) = -.11, p = ns$; self-esteem, $t(2, 326) = -.17, p = ns$; perceived

weight status, $t(2, 215) = -.73, p = ns$; depressive symptoms, $t(2, 253) = 1.32, p = ns$; anxiety symptoms, $t(2, 183) = 1.30, p = ns$, and bulimic symptoms, $t(2, 321) = .54, p = ns$. Questionnaires, informed consent forms, and anonymity reminders identical to those completed at T1 were mailed to the participants. Response rate was 58.9%.

There were no significant differences between T2 responders and nonresponders regarding initial rates of perfectionism, $t(258) = -.39, p = ns$; self-esteem, $t(259) = -.26, p = ns$; perceived weight status, $t(254) = -1.51, p = ns$; depressive symptoms, $t(243) = -.44, p = ns$; anxiety symptoms, $t(243) = .23, p = ns$; or bulimic symptoms, $t(255) = -.83, p = ns$. The authors excluded 6 respondents from analyses for reasons such as major, external life events that were hypothesized to affect the respondent's moods (e.g., respondent was undergoing chemotherapy). Of the 150 total participants analyzed at T2, 135 (90.0%) of the sample were Caucasian, 7 (4.7%) were African American, 2 (1.3%) were Asian American, 1 (0.7%) was classified as Other, and 5 (3.3%) did not report their ethnicity. Mean age at T2 was 47.35 ($SD = 10.4$). Although the T2 sample's age range was relatively large (range = 25 to 72), 67% of the sample was between the ages of 37 and 58.

PREDICTOR VARIABLES

Perfectionism. Perfectionistic tendencies were assessed using the Eating Disorder Inventory (EDI) Perfectionism Subscale (Garner, Olmsted, & Polivy, 1983). This subscale is a measure of general perfectionism developed to measure excessive personal expectations for achievement, and has performed as hypothesized in past tests of the present model (e.g., Vohs et al., 2001). It is comprised of six items (e.g., "I feel that I must do things perfectly, or not do them at all") rated on a 6-point scale. Higher scores indicate higher levels of perfectionism. Adequate reliability (Cronbach's $\alpha \geq .70$) and validity of this subscale have been demonstrated (Ebernez & Gleaves, 1994; Garner et al., 1983). In this study, the EDI-Perfectionism Subscale had an internal consistency coefficient of .83 at T1 and .84 at T2. Test-retest reliability analysis revealed that scores remained highly stable over time ($r = .81, p < .001$).

Self-esteem. Global self-esteem was measured using the Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965). The 10-item RSE measures self-esteem via statements, such as "I take a positive attitude toward myself," on a 4-point scale. Higher scores indicate higher self-esteem. Adequate reliability and validity of this measure have been reported (Blascovich & Tomaka, 1991). In this study, the RSE had an in-

ternal consistency coefficient of .90 at T1 and .89 at T2. This variable was significantly stable over the 2.5-year assessment period ($r = .55, p < .001$).

Perceived weight status. Perceived weight status was defined as the individual's perception of her own current weight, classified as *very underweight*, *underweight*, *average*, *overweight*, or *very overweight*. As was done in previous studies by Joiner et al. (1997), Vohs et al. (1999), and Bardone et al. (in press), the perceived weight status variable was dichotomized such that individuals who reported themselves as overweight or very overweight were categorized as perceiving themselves as overweight, while the remaining individuals were categorized as not perceiving themselves as overweight. Women's perceptions of their weight status remained stable over time ($r = .64, p < .001$).

DEPENDENT MEASURES

Bulimic symptoms. The EDI-Bulimia Subscale was used to assess bulimic symptoms (Garner et al., 1983). This 6-item subscale specifically measures bulimic attitudes and behaviors on a 6-point scale. Respondents are asked to rate items such as "I have gone on eating binges where I have felt that I could not stop." Higher scores reflect greater bulimic tendencies, although they do not replace measures of clinical psychopathology. This EDI subscale has been shown to be reliable and valid (Ebernez & Gleaves, 1994; Garner et al., 1983). In this study, the internal consistency coefficient was .87 at T1 and .84 at T2. Scores remained stable over the 2.5-year time period ($r = .67, p < .001$). It is notable that this level of stability will make for a stringent test of our hypothesis that the model will predict changes in bulimic symptoms over time.

Depressive symptoms. Respondents were asked to complete a short version of the Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979), a measure of depressive symptoms. Nine items were selected on the basis of their high loadings in past research on a general depression factor. In previous research samples, the 9-item BDI version has correlated highly with the full BDI ($r = .92, p < .0001$; Joiner, 2004). This 9-item self-report instrument is comprised of items that are rated on a scale of 0 to 3. Higher scores on the BDI are indicative of higher levels of depressive symptoms, although they do not always indicate clinically significant pathology. The BDI has been shown to be reliable and valid (see Beck, Steer, & Garbin, 1998, for a review). The internal consistency coefficient for this brief measure was .84 at T1 and .85 at T2. This variable was found to be stable over time ($r = .64, p < .001$).

Anxiety symptoms. An abbreviated version of the Beck Anxiety Inventory (BAI) was used to assess anxiety symptoms. This 6-item, self-report inventory is used to assess general symptoms of anxiety, and emphasized the items used by Joiner et al. (1999). This short version of the BAI has been shown to correlate highly with the full BAI ($r = .87, p < .0001$; Joiner, 2004). Items are rated on a scale of 0 to 3, such that higher scores indicate higher levels of anxiety symptoms (although scores do not indicate clinical psychopathology). The BAI's reliability and validity have been supported in clinical and nonclinical populations (Beck, Epstein, Brown, & Steer, 1988; Beck & Steer, 1993; Clark & Watson, 1991). The internal consistency coefficient was .73 at both T1 and T2. Anxiety symptoms were found to be stable over time ($r = .53, p < .001$).

DATA ANALYTIC STRATEGIES

As recommended by Cohen and Cohen (1983), we conducted a series of multiple regression/correlation analyses. Our principal regression focused on T2 EDI-Bulimia scores as predicted by T1 EDI-Perfectionism, RSE, perceived weight status scores, and their interactions, while controlling for T1 EDI-Bulimia scores and for T1 and T2 BAI and BDI scores. This technique allowed us to assess the predictive effects of perfectionism, self-esteem, and perceived weight status, and their interactions, on bulimic symptom development, independently of anxiety and depression symptoms. Secondary regression analyses included: (a) T2 BDI scores as predicted by T1 EDI-Perfectionism, RSE, perceived weight status scores, and their interactions, controlling for T1 BDI scores and for T1 and T2 BAI and EDI-Bulimia scores and (b) T2 BAI scores as predicted by T1 EDI-Perfectionism, RSE, perceived weight status scores, and their interactions, controlling for T1 BAI scores and for T1 and T2 BDI and EDI-Bulimia scores. Homogeneity of covariance analyses were conducted for any three-way interaction that was significant. This analysis assessed the assumption that association of the predictor variables with the dependent variable was constant across levels of the covariate.

Results

DESCRIPTIVE ANALYSES

Means and standard deviations for predictors and dependent variables, as well as their intercorrelations, are provided in Table 1. Initial levels of self-esteem, perfectionism, bulimic symptoms, anxious symptoms, and depressive symptoms in the current sample were similar to those reported in other studies of younger samples (Vohs et al., 1999, 2001).

TABLE 1 Descriptive Data and Intercorrelations for Predictor and Dependent Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. BAI (T1)	—											
2. BDI (T1)	.48**	—										
3. SEQ (T1)	.31**	.61**	—									
4. EDI-Bulimia (T1)	.34**	.39**	.39**	—								
5. EDI-Perfectionism (T1)	.19*	.24**	.25**	.31**	—							
6. Perceived Weight Status (T1)	.30**	.21*	.21*	.52**	.14	—						
7. BAI (T2)	.53**	.39**	.31**	.24**	.19*	.21*	—					
8. BDI (T2)	.38**	.69**	.55**	.23**	.22**	.16*	.52**	—				
9. SEQ (T2)	.29**	.58**	.55**	.25**	.17*	.08	.42**	.75**	—			
10. EDI-Bulimia (T2)	.47**	.38**	.36**	.67**	.31**	.30**	.30**	.36**	.38**	—		
11. EDI-Perfectionism (T2)	.10	.12	.17*	.27**	.81**	.06	.09	.16	.11	.34**	—	
12. Perceived Weight Status (T2)	.24**	.19*	.20*	.36**	.08	.66**	.29**	.22**	.11	.39**	.06	—
Means	2.8	4.6	8.0	12.2	20.5	N/A	2.6	2.9	7.4	11.4	20.0	N/A
Standard Deviations	3.0	3.6	5.5	5.2	6.1	N/A	2.7	3.2	5.8	4.5	6.1	N/A

Note. T1 = Time 1 assessment; T2 = Time 2 assessment. BAI = Beck Anxiety Inventory; higher scores indicate greater levels of anxiety; BDI = Beck Depression Inventory; higher scores indicate greater levels of depressive symptoms. RSE = Rosenberg Self-Esteem Scale; higher scores indicate lower self-esteem. EDI-Bulimia and EDI-Perfectionism refer to subscales of the Eating Disorders Inventory (Garner et al., 1983); higher scores indicate higher levels of bulimic symptomatology and perfectionism, respectively. Perceived weight status is a dichotomous variable.
* $p < .05$; ** $p < .01$.

TABLE 2 Three-Way Interaction of Perfectionism, Perceived Weight Status, and Self-Esteem and Their Prediction of T2 EDI-Bulimia Scores

Set Order	Predictors in Set	F for Set	t for Within-Set Predictors	df for Each Test	Partial Correlation	Model R ² (Δ R ²)
1.	Time 1 EDI-Bulimia	111.05***	10.54***	1, 117	.70	.487
2.	Dep. Anx covariates	5.88***		4, 113		.575 (.088)
	Time 1 BAI		3.47**	113	.31	
	Time 2 BAI		-2.22*	113	-.20	
	Time 1 BDI		-.76	113	-.07	
	Time 2 BDI		2.64**	113	.24	
3.	Simple effects	.25		3, 110		.578 (.003)
	EDI-Perfectionism		.71	110	.07	
	Perceived Weight		-.45	110	-.04	
	RSE		.09	110	.01	
4.	Two-way interactions	2.86*		3, 107		.609 (.031)
	Perfectionism × Perceived Weight		1.54	107	.15	
	Perfectionism × RSE		1.65	107	.16	
	Perceived Weight × RSE		.44	107	.04	
5.	Three-way interaction	5.67*		1, 106		.629 (.020)
	Perfectionism × Perceived Weight × RSE		2.38*	106	.23	

Note. Perfectionism, body dissatisfaction, and self-esteem refer to T1 assessments. RSE = Rosenberg Self-Esteem Scale; higher scores represent higher self-esteem levels. EDI = Eating Disorder Inventory. Perfectionism represents scores on the EDI-Perfectionism scale. Perceived Weight Status represents subject's perception of body weight. BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory. ΔR² = change in R² with the addition of each step in the regression. *pr* = partial correlation for within set predictors.
* $p < .05$; ** $p < .01$; *** $p < .001$.

PREDICTION OF BULIMIC SYMPTOMS BY THE INTERACTION OF PERFECTIONISM, PERCEIVED WEIGHT STATUS, AND SELF-ESTEEM

In prediction of T2 EDI–Bulimia, the following predictors were entered:

- Step 1: entry of T1 EDI–Bulimia to control for initial levels;
- Step 2: entry of T1 and T2 scores on the BAI and BDI to control for the effect of anxious and depressive symptoms;
- Step 3: simultaneous entry of the three main effects (perfectionism, self-esteem, and perceived weight status) to assess the simple effects of the predictor variables;
- Step 4: simultaneous entry of all two-way interactions (Perfectionism \times Self-Esteem; Self-Esteem \times Perceived Weight Status; Perceived Weight Status \times Perfectionism);
- Step 5: entry of the three-way interaction (Perfectionism \times Self-Esteem \times Perceived Weight Status).

The three-way interaction is the critical test of the main hypothesis. Table 2 displays the results of the regression analysis that support our hypothesis that perfectionism, perceived weight status, and self-esteem interact to predict an increase in bulimic symptoms, $pr = .23$, $p < .02$.

To appraise the nature of this interaction, we calculated EDI–Bulimia residual change scores by using “high” and “low” combinations of each of the main effect variables (using values that were one standard deviation above or below the mean for each predictor variable). Mean values were entered for T1 EDI–Bulimia scores, and T1 and T2 BDI and BAI scores. The findings supported our prediction that women with high levels of perfectionism and low self-esteem who saw themselves as overweight were most likely to experience increased levels of bulimic symptoms between T1 and T2 (see Figure 1). Analyses indicated that the interaction did not vary as a function of the participants’ ages, $t = -1.46$, $p = .15$ (*ns*); $pr = -.15$.

Homogeneity of covariance analyses. As recommended by Joiner (1994), homogeneity of covariance analyses (Cohen & Cohen, 1983) were conducted to assess the assumption that association of the predictor variables with the dependent variable is constant across levels of the covariate. Thus, we examined the assumption that self-esteem, perfectionism, and perceived weight status are related to later bulimic symptomatology consistently across all levels of initial bulimic symptomatology. To the extent that prediction

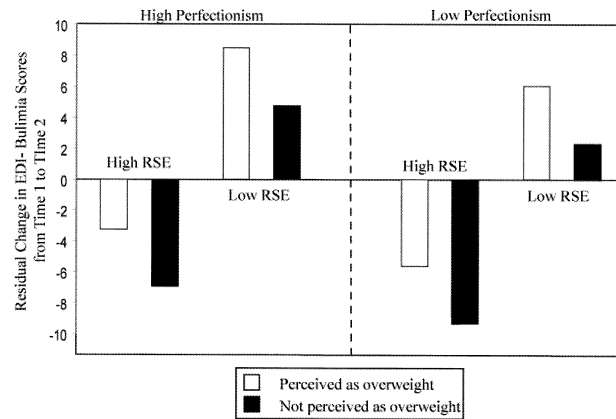


FIGURE 1 Residual changes in EDI–Bulimia scores as a function of the interaction between perceived weight status and RSE scores among women with high and low EDI–Perfectionism scores. *Note.* Perfectionism, body dissatisfaction, and self-esteem refer to T1 assessments. RSE = Rosenberg Self-Esteem Scale; higher scores represent higher levels of self esteem. EDI = Eating Disorder Inventory. *Perfectionism* represents scores on the EDI–Perfectionism scale; higher scores indicate higher levels of perfectionism. *Perceived Weight Status* represents subject’s perception of body weight. Individuals predicted to show the greatest increase in bulimic symptoms from T1 to T2 are represented in the bar that indicates high perfectionism, low RSE, high PWS group (i.e., perfectionistic women who perceived themselves as overweight and have low self-esteem).

of symptom change implies causality, if the interactions that involve the baseline symptom measure do not produce significant results, such a finding would apply to both the onset of bulimic symptoms undetected at T1 and exacerbation of bulimic symptoms present at T1. By contrast, if the interactions that involve the baseline symptom measure are significant, such a finding might apply only to onset of previously undetected symptoms or to exacerbation of preexisting symptoms.

The four-way interaction test of T1 Bulimic Symptoms \times Perfectionism \times Self-Esteem \times Perceived Weight Status was significant ($pr = .20$; $t = 1.99$, $p < .05$), indicating that that homogeneity of covariance assumption had been violated. Thus, follow-up tests were conducted. The sample was split into thirds based upon cumulative frequencies of scores. Group 1 included women with T1 scores on EDI–Bulimia of 8 or less (low scores), Group 2 included women with scores between 9 and 12 (medium scores), and Group 3 had scores of 13 or greater (high scores). When the three-way interaction was conducted on the low- and high-scoring groups independently, results revealed that the interaction of high perfectionism, self-esteem, and perceived overweight status predicted the increase of bulimic symptoms in women who already exhibited

TABLE 3 Interaction of Perfectionism, Perceived Weight Status, and Self-Esteem in Predicting T2 BDI Scores

Set Entry Order	Predictors in Set	F for Set	t for Within-Set Predictors	df for Each Test	Partial Correlation	Model R ² (Δ R ²)
1.	Time 1 BDI	92.35***	9.61***	1, 117	.66	.441 (.441)
2.	Anx, Bul covariates	5.70***		4, 113		.535 (.094)
	Time 1 BAI		-.69	113	-.07	
	Time 2 BAI		3.90***	113	.34	
	Time 1 EDI-Bulimia		-2.40*	113	-.22	
	Time 2 EDI-Bulimia		2.64**	113	.24	
3.	Simple effects	3.99*		3, 110		.581 (.046)
	EDI-Perfectionism		.47	110	.05	
	Perceived Weight		.51	110	.05	
	RSE		3.19**	110	.29	
4.	Two-way interactions	.69		3, 107	.41	.589 (.008)
	Perfectionism × Perceived Weight		-.49	107	-.05	
	Perfectionism × RSE		-1.11	107	-.11	
	Perceived Weight × RSE		-.07	107	-.01	
5.	Three-way interaction	3.53		1, 106		.602 (.013)
	Perfectionism × Perceived Weight × RSE		-1.88	106	-.18	

Note. Perfectionism, body dissatisfaction, and self-esteem refer to T1 assessments. RSE = Rosenberg Self-Esteem Scale; higher scores represent higher self-esteem levels. EDI = Eating Disorder Inventory. *Perfectionism* represents scores on the EDI-Perfectionism scale. *Perceived Weight Status* represents subject's perception of body weight. BDI = Beck Depression Inventory. BAI = Beck Anxiety Inventory. ΔR² = change in R² with the addition of each step in the regression. *pr* = partial correlation for within set predictors.
* *p* < .05; ** *p* < .01; *** *p* < .001.

TABLE 4 Interaction of Perfectionism, Perceived Weight Status, and Self-Esteem in Predicting T2 BDI Scores

Set Entry Order	Predictors in Set	F for Set	t for Within-Set Predictors	df for Each Test	Partial Correlation	Model R ² (Δ R ²)
1.	Time 1 BDI	48.99***	7.00***	1, 117	.54	.295 (.295)
2.	Dep, Bul covariates	6.41***		4, 113		.425 (.130)
	Time 1 BAI		-.68	113	-.06	
	Time 2 BAI		3.90***	113	.34	
	Time 1 EDI-Bulimia		2.74**	113	.25	
	Time 2 EDI-Bulimia		-2.22*	113	-.20	
3.	Simple effects	.15		3, 110		.427 (.002)
	EDI-Perfectionism		.43	110	.04	
	Perceived Weight		-.00	110	.00	
	RSE		.45	110	.04	
4.	Two-way interactions	.42		3, 107		.434 (.007)
	Perfectionism × Perceived Weight		-.29	107	-.03	
	Perfectionism × RSE		-.54	107	-.05	
	Perceived Weight × RSE		1.01	107	.10	
5.	Three-way interaction	9.49**		1, 106		.480 (.046)
	Perfectionism × Perceived Weight × RSE		3.08**	106	.29	

Note. Perfectionism, body dissatisfaction, and self-esteem refer to T1 assessments. RSE = Rosenberg Self-Esteem Scale; higher scores represent higher self-esteem levels. EDI = Eating Disorder Inventory. *Perceived Weight Status* represents subject's perception of body weight. *Perfectionism* represents scores on the EDI-Perfectionism scale. BDI = Beck Depression Inventory. BAI = Beck Anxiety Inventory. ΔR² = change in R² with the addition of each step in the regression. *pr* = partial correlation for within set predictors.
* *p* < .05; ** *p* < .01; *** *p* < .001.

relatively high levels of symptoms at T1 ($pr = .40$; $t[1, 37] = 2.61$; $p < .05$), but not in those who initially were experiencing little bulimic symptomatology ($pr = .01$; $t[1, 56] = .09$, $p = ns$).

SPECIFICITY OF MODEL TO BULIMIC SYMPTOMS

Predicting the increase of BDI scores. A regression analysis similar to that described above was conducted to determine whether the triple interaction of EDI–Perfectionism \times RSE \times Perceived Weight Status predicted a change in BDI scores (see Table 3). The three-way interaction did not predict the change of BDI scores from T1 to T2, $pr = -.18$, $p = ns$. Although the magnitude of the partial correlation for depressive symptoms is similar to the partial correlation for bulimic symptoms ($-.18$ versus $.23$), the direction of the correlation for depressive symptoms is negative. This fact indicates that the form of the interaction differs from that predicted by the model for bulimic symptoms (cf. Figure 1).

Predicting the increase of BAI scores. A regression analysis similar to that described above was conducted to determine whether the triple interaction of EDI–Perfectionism \times RSE \times Perceived Weight Status predicted a change in BAI scores (see Table 4). Results indicated that the interaction predicted change in BAI scores, $pr = .29$, $p < .01$. Additional analyses indicated that this interaction did not vary as a function of the participants' ages ($t = .26$, $p = ns$; $pr = .03$). To assess the nature of the interaction in predicting BAI scores, we computed BAI residual change using “high” and “low” combinations of each predictor variable by entering values of one standard deviation above and below the mean. Mean values were entered for T1 BAI scores and T1 and T2 BDI and EDI–Bulimia scores. These computations revealed that women with high EDI–Perfectionism scores, low RSE scores, and who perceived themselves as overweight were most likely to experience an increase in anxious symptoms over the 2.5-year time period. The homogeneity of covariance assumption was supported for anxious symptoms ($pr = 16$; $t = 1.41$, $p = ns$), indicating that High Perfectionism \times Low Self-Esteem \times Perceived Overweight Status predicted both onset and exacerbation of anxious symptoms in adult women.

Discussion

Following results by Vohs et al. (1999; 2001) and Bardone et al. (in press), the current study provides support for an interactive model of perfectionism, perceived weight status, and self-esteem predicting the increase of bulimic symptoms in adult women.

Specifically, adult women who initially had high levels of bulimic symptomatology and perfectionism, low levels of self-esteem, and perceived themselves as overweight were most likely to experience the increase of bulimic symptoms over a 2.5-year time period. However, adult women with initially low or average levels of bulimic symptoms did not show an increase in these symptoms even if they had high levels of perfection, low levels of self-esteem, and perceived themselves as overweight. Thus, this model predicts the exacerbation, but not onset, of bulimic symptoms in an understudied sample of adult women. The finding stands to reason, as bulimic symptoms usually develop between the ages of 15 and 25. In the current sample, logic dictates that few new cases of bulimic symptomatology would appear, as the participants were 45 years old, on average.

To our knowledge, the homogeneity of covariance assumption has been largely unexplored in regard to the interactive model as it applies to younger samples. Future researchers should assess this assumption in college-aged samples to see if the model in fact predicts both the onset and exacerbation of bulimic symptoms in that population, or if it predicts only exacerbation (as it does in adult women). It is interesting to note that the interaction was not affected when age was considered as a moderator variable in the prediction of bulimic symptoms. In the current study, the youngest person at T2 was 25 years old (and thus, 22 years old at T1). More importantly, 90% of our T2 sample was over 30 years old. Therefore, it seems that even toward the lower end of the current sample's age distribution, participants were older than those in college samples.

Some previous studies have shown that many of the characteristics of younger women with eating disorders are likely present in older women with bulimia nervosa. For example, in a review of case studies, Cosford and Arnold (1992) reported that symptom presentation of women over age 50 was similar to that of adolescents and young women diagnosed with eating disorders. Our study's results, when combined with those of Vohs et al. (1999, 2001) and Bardone et al. (in press), would support the conclusions of Cosford and Arnold. They also may explain the results of a study by Keel et al. (2005), who reported that while the majority of women exhibited a decrease in disordered eating symptoms over time, a sizeable minority of their sample (14%) did not display reduced symptoms. Future researchers may examine alternative models of bulimic symptoms development (e.g., Stice and Agras's dual pathway model, 1998) to determine whether or not they, too, appear to describe accurately the nature of bulimia in adult samples.

In addition to exploring the nature of bulimic symptom development in adult women, the current study examined the interactive model's specificity in regards to depressive and anxious symptoms. After controlling for the baseline occurrences of symptoms (e.g., T1 BAI and EDI-Bulimia scores when predicting the development of depressive symptoms), the interactive model did not predict an increase of depressive symptoms. However, the three-way interaction predicted both the onset and exacerbation of anxious symptoms. The current study's finding that the model predicts anxiety symptoms but not depressive symptoms opposes the findings of Vohs et al. (2001). In that study, the three-way interaction predicted the development of both bulimic and depressive symptoms, but *not* anxious symptoms.

Taken together, these findings suggest that the interactive model is predictive of bulimic symptom development across studies (Bardone et al., in press; Vohs et al., 1999, 2001) and more sporadically related to anxious and depressive symptomatology. Thus, the "common denominator" across studies is the prediction of the development of bulimic symptoms. The fact that the model sporadically predicts increases in depressive or anxious symptoms is not very surprising, considering high comorbidity rates between depression and bulimia (e.g., Hewitt & Flett, 1991), depression and anxiety (e.g., Mineka et al., 1998), and anxiety and bulimia (see below). The fact that these disorders share a multitude of personality and interpersonal characteristics may explain why they are related, to some degree, in our interactive framework. Another possibility is that certain patterns of comorbidity are more likely to occur during different developmental life stages. For example, depressive and bulimic symptoms may co-occur more often during the college years, while anxious and bulimic symptoms may coexist more often in adult women. Future studies will have to further investigate these possibilities.

Previous research has noted the high rate of comorbidity between anxiety disorders and bulimia (Brewerton et al., 1993). For example, Laessle, Kittl, Fitcher, and Wittchen (1987) reported that 56% of women diagnosed with bulimia had at least one anxiety disorder. A subsequent study by the same research team found that 91% of bulimic individuals had an anxiety disorder as compared to 18% of the general population (Laessle, Wittchen, Fitcher, & Pirke, 1989). Finally, Hudson et al. (1987) reported that 43% of women diagnosed with bulimia had an anxiety disorder. These studies clearly demonstrate the potential for women diagnosed with bulimia to experience anxious symptoms. Given this trend, it is possible that our interactive model

may predict the onset of both bulimic and anxious symptoms in some individuals, though it should be noted that we statistically controlled for bulimic symptoms in prediction of anxious symptoms.

Our study possessed strengths that deserve mention. First, it is unique in that it examined the increase of bulimic symptoms in an understudied population. Our sample was also valuable because it examined women from a variety of geographical locations, which allowed us to gain confidence that the model will accurately predict bulimic symptom increases in populations from a wide range of geographical locations. Additionally, the model was able to predict symptom development over a substantial time interval (around 2.5 years). The stable qualities of the predictor variables may have facilitated this tendency.

There are, however, limitations that should be considered when evaluating our results. Many criticisms have been made regarding the exclusive use of self-report measures (Fairburn & Beglin, 1994). Although these are valid concerns, the potential problems with this measurement technique are thought to be minimal based upon the convergent results between the current study and those done by Vohs et al. (1999, 2001) and Bardone et al. (in press). This interactive model is therefore believed to be largely valid. Our study was conducted on a sample that was also more highly educated and likely higher functioning than the general population. They may have additionally been more accepting of or knowledgeable about mental health treatment than the general public. However, specific groups of highly educated people have been shown to suffer from rates of mental disorders that are equal to or higher than the population at large. For example, physicians (Lindeman, Laeerae, Hakko, & Loennqvist, 1996) and dentists (Stack, 1996) are known to have relatively high rates of suicide when compared to those of other occupations. Therefore, it seems that the health practitioners in this study may not systematically differ from other adult women in regard to disordered eating. Also, the present sample was not ethnically diverse, which limits the generalizability of these results to non-Caucasians. Finally, although the model did not predict increases in depression scores in our study, it is possible that we did not have the power to detect an existing increase in scores.

Also, our sample may have been biased in that we only followed up on those who indicated a willingness to be contacted again. Although this should be considered, it is hard to see that this factor would systematically bias the results in favor of or against our predictions. Relatedly, our response rate (58.9%) was lower than desired; therefore, at-

trition biases are possible. However, when analyses on this point were conducted, no differences were found regarding initial levels of the predictor or dependent variables. Finally, this study examined psychopathological symptomatology rather than actual clinical disorders. The bulimic, depressive, and anxious symptoms measured likely exist at subclinical levels in the vast majority of our participants.

Clinical implications should be considered. The nature of a three-way interaction suggests that altering any of the predictor variables should change the outcome. Thus, reducing perfectionistic tendencies, raising self-esteem, or eliciting a more positive body concept in women who are experiencing bulimic symptoms may serve to decrease their symptoms. It is possible that particular variables may be more amenable to change or be more effective targets of intervention for clinicians. For example, as discussed by Bardone, Vohs, Joiner, Abramson, and Heatherton (2000), reducing perfectionistic tendencies may reduce negative affect or cognitions, but may also simultaneously decrease the adaptive perfectionistic strivings needed to achieve goals (whether the goals are positive or negative). However, improving self-esteem may reduce negative affect and cognitions without suppressing one's achievement-motivated behavior.

In summary, this study found that for women who were initially experiencing relatively high levels of bulimic symptomatology, the combination of high perfectionism, low self-esteem, and perceived overweight status may have exacerbated their bulimic symptoms. However, women who initially were not suffering from many bulimic symptoms did not develop these symptoms even if they were perfectionistic, had low-self-esteem, and perceived themselves to be overweight. Additionally, results showed that adult women who had high levels of perfectionism, low self-esteem, and perceived themselves as overweight were most likely to experience the onset or exacerbation of anxiety symptoms, but not depressive symptoms, over an interval of 2.5 years. Future studies should continue to refine and expand upon this model, especially in regards to diverse populations.

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