



ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

SCIENCE @ DIRECT®

Behaviour Research and Therapy 44 (2006) 27–42

**BEHAVIOUR  
RESEARCH AND  
THERAPY**

[www.elsevier.com/locate/brat](http://www.elsevier.com/locate/brat)

## Predicting bulimic symptoms: An interactive model of self-efficacy, perfectionism, and perceived weight status

A.M. Bardone-Cone<sup>a,\*</sup>, L.Y. Abramson<sup>b</sup>, K.D. Vohs<sup>c</sup>,  
T.F. Heatherton<sup>d</sup>, T.E. Joiner Jr.<sup>e</sup>

<sup>a</sup>*Department of Psychological Sciences, University of Missouri-Columbia, 210 McAlester Hall,  
Columbia, MO 65211, USA*

<sup>b</sup>*Department of Psychology, University of Wisconsin, Madison, Wisconsin, USA*

<sup>c</sup>*Sauder School of Business, University of British Columbia, Canada*

<sup>d</sup>*Department of Psychology, Dartmouth College, Hanover, New Hampshire, USA*

<sup>e</sup>*Department of Psychology, Florida State University, Tallahassee, FL, USA*

Received 1 April 2003; received in revised form 30 August 2004; accepted 8 September 2004

---

### Abstract

An interactive model of perfectionism, perceived weight status, and self-efficacy was tested on 406 women to predict the bulimic symptoms of binge eating and inappropriate compensatory behaviors separately. This longitudinal study assessed hypothesized vulnerabilities of high perfectionism and low self-efficacy and the stressor of feeling overweight at Time 1 and then gathered weekly assessments of binge eating, vomiting, laxative use, fasting, and diet pill use for 11 weeks. As predicted, results showed that perfectionism, weight perception, and self-efficacy interacted to prospectively predict binge eating. In particular, women high in perfectionism who felt they were overweight and who had low self-efficacy reported the most number of weeks of binge eating. This interactive model did not predict inappropriate compensatory behaviors. Future directions and clinical implications are discussed.

© 2005 Elsevier Ltd. All rights reserved.

*Keywords:* Self-efficacy; Perfectionism; Body dissatisfaction; Bulimic behaviors

---

\*Corresponding author. Tel.: +1 573 884 0710; fax: +1 573 882 7710.

E-mail address: [bardonecone@missouri.edu](mailto:bardonecone@missouri.edu) (A.M. Bardone-Cone).

## Introduction

Prevalence data clearly identify college women as a population exhibiting bulimic symptoms. Studies consistently report high rates of disordered eating (notably, binge eating) and both subclinical and clinical eating disorders among college women (Fairburn & Beglin, 1990; Kurth, Krahn, Nairn, & Drewnowski, 1995; Schwitzer, Rodriguez, Thomas, & Salimi, 2001; Wolff & Wittrock, 1998). However, while the college population is a sub-culture that appears to exhibit heightened bulimic behaviors, not all young college women experience disordered eating. What individual characteristics and experiences put women at risk for disordered eating? How do these individual variables operate together to produce risk, and how can that inform intervention and prevention? One model that attempts to answer these questions is a three-factor interactive model highlighting the confluence of high perfectionism, low self-esteem, and body dissatisfaction in predicting bulimic symptoms (Bardone, Vohs, Abramson, Heatherton, & Joiner, 2000). The current paper extends research on this model by testing the role of self-efficacy in place of self-esteem in the interaction. Additionally, this study is the first to test the interactive model separately for binge eating and inappropriate compensatory behaviors, that is, to go beyond predicting bulimic symptoms as an entity.

### *A three-factor interactive model of bulimic symptoms*

Perfectionism, body dissatisfaction, and self-esteem are variables that have independently been associated with bulimic symptoms. Regarding the importance of body dissatisfaction, two separate longitudinal studies (Killen et al., 1994, 1996) demonstrated a prospective link between weight/shape concerns and eating disorder symptoms. Numerous studies have found a link between low self-esteem and bulimic behavior (Fairburn, 1995; Fryer, Waller, & Kroese, 1997; Heatherton, Herman, & Polivy, 1991; Polivy, Heatherton, & Herman, 1988). The personality variable of perfectionism, however, has shown more of an inconsistent relationship with bulimia (e.g., Calam & Waller, 1998; Joiner, Heatherton, & Keel, 1997a), although recent meta-analytic work concluded that the weight of the evidence supports perfectionism as a potential risk and maintenance factor for eating pathology (Stice, 2001).

Since main effects do not adequately communicate the complexity of disorders, investigating how independent variables may combine to identify disordered behavior is an important line of research. Joiner, Heatherton, Rudd, and Schmidt (1997b) sought to understand under what circumstances perfectionism may be linked to bulimic symptoms, finding support for a vulnerability-stress model, whereby perfectionism acts as a vulnerability factor for bulimic symptoms but only for women who experience the stressor of feeling overweight. While this finding helps clarify a potential pathway, it also raises questions. Why wouldn't perfectionists who perceived themselves to be overweight re-double their efforts to lose weight and approach perfection, instead of engaging in binge eating behavior, which is self-defeating for attaining "perfection" in appearance? What additional vulnerability factor distinguishes the perfectionist who responds to an unmet body standard with bulimic symptoms from the perfectionist who, when faced with an unmet body standard, persists in attempts to achieve the standard or self-acceptance?

Vohs, Bardone, Joiner, Abramson, and Heatherton (1999) hypothesized that low self-esteem would function as such a vulnerability factor. In their longitudinal study of women transitioning from high school to college, Vohs et al. found that being perfectionistic and feeling overweight predicted bulimic symptoms only among women with low self-esteem. These results were replicated by Vohs et al. (2001), using different measures of self-esteem and body dissatisfaction, and by Denoma et al. (in press) in a sample of older women. However, Shaw, Stice, and Springer (2004) did not find such an interactive effect in their group of adolescents. Given the limited number of multivariate models and the paucity of tests of these models, further research is warranted on the three-factor interactive model, including testing theoretically and empirically motivated variations of the model.

### *Self-efficacy in the interactive model*

Recent investigators (e.g., Tafarodi & Swann, 1995; Tafarodi & Milne, 2002; Vohs & Heatherton, 2001) have emphasized that self-esteem is a multi-faceted construct that includes self-efficacy as an integral component. Conceptually, Franks and Marolla (1976) have argued that global self-esteem is experienced two-dimensionally, as a generalized sense of self-worth and as a generalized sense of self-efficacy. Empirically, factor analyses of the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), an extensively used and purportedly unidimensional measure of self-esteem, have yielded two correlated but distinct factors, conceptualized by Tafarodi and Swann (1995) as self-competence (self-efficacy) and self-liking (sense of self-worth). In recent work by Bardone, Perez, Abramson, and Joiner (2003), the correlation between the self-liking and self-competence components of the RSES were .21 and .55 (both significant) in two different samples. Furthermore, Tafarodi and Milne (2002) found that self-competence and self-liking (as measured with Tafarodi & Swann's (1995) Self-Competence/Self-Liking Scale) had unique associations with negative life events. For example, negative achievement-related events occurring by Time 2 were associated with decreases in self-competence from Time 1, while negative interpersonal events (e.g., rejection, conflict) were found to diminish self-liking.

This view of self-efficacy as a key but distinct component of self-esteem, suggests the need to test whether self-efficacy in particular “works” in the three-factor model. Because self-efficacy involves a cognitive appraisal of one's abilities, it is particularly well-suited to the scenario of being perfectionistic and failing to meet one's standards. According to Bandura and Cervone (1986), those who distrust their capabilities (low self-efficacy) tend to feel daunted and easily discouraged by perceived discrepancies between standards and attainments, while those with confidence in their abilities (high self-efficacy) tend to respond to discrepancies with intensified efforts and perseverance until they succeed. Thus, Bandura and Cervone postulate that self-efficacy plays an important role in determining cognitive, affective, and behavioral responses following a discrepancy between standards and attainments.

A variety of studies have demonstrated an association between self-efficacy and bulimic behaviors (Etringer, Altmaier, & Bowers, 1989; Gormally, Black, Daston, & Rardin, 1982; Striegel-Moore, Silberstein, Frensch, & Rodin, 1989). For example, Etringer et al. (1989) found that women with bulimia had a much lower sense of general efficacy, including less confidence in problem-solving capacities, than non-bulimic women. In the treatment outcome literature, a number of treatments for bulimia either target self-efficacy directly or appear to contribute to

symptom reduction via improved self-efficacy (Garner & Garfinkel, 1997; Schneider, O'Leary, & Agras, 1987; Wilson, Fairburn, Agras, Walsh, & Kraemer, 2002). For example, in their study of the mechanisms of action of cognitive behavioral therapy for bulimia, Wilson et al. (2002) reported that self-efficacy at midtreatment predicted posttreatment outcome and proposed that self-efficacy may be a mediator of change. In order to see if the model can be integrated into the self-efficacy literature and because self-efficacy may be the component of self-esteem most amenable to change, it is important to test self-efficacy in the model.

It is important to note that we are not pitting self-efficacy against self-esteem. Nor are we dismissing the value of self-esteem. Rather, in beginning the necessary work of examining the facets of self-esteem, we posit that self-efficacy may be an important construct with a good theoretical fit in the model of bulimic symptoms.

### *Predicting binge eating*

While bulimia is composed of two key behaviors, binge eating and inappropriate compensatory behaviors (e.g., vomiting), research to date has not teased apart whether the three-factor interactive model applies to both components of bulimia. We hypothesize that high perfectionism and the perception of being overweight would predict binge eating among women with low self-efficacy, but not among those with high self-efficacy. This may be because perfectionistic women who encounter a weight discrepancy and who doubt their abilities to achieve their standards (low self-efficacy) will likely experience aversive self-awareness and negative affect whose relief might be sought in binge eating according to escape theory (Heatherton & Baumeister, 1991) and mood modulation theory (Fairburn, Cooper, & Shafran, 2003). Binge eating may serve an escape, self-soothing, or mood-neutralizing function in the face of this emotional distress (Fairburn et al., 2003; Johnson, Lewis, & Hagman, 1984). In contrast, it seems likely that perfectionistic women who encounter a self-standard discrepancy for weight but who believe they can achieve their standards (i.e., those with high self-efficacy) will not demonstrate binge eating. Instead, they might more vigorously attend to a healthy balance of diet and exercise.

### *Predicting inappropriate compensatory behaviors*

It is unclear if the same confluence of high perfectionism, body dissatisfaction, and low self-efficacy hypothesized to predict binge eating would also be a useful model in predicting the inappropriate compensatory behaviors component of bulimia. Since these behaviors (e.g., vomiting, fasting) would likely be viewed by the individual as behaviors aimed at reaching a weight goal or at least minimizing movement away from the goal (in contrast to binge eating, which clearly moves a person away from a weight goal), these behaviors may be perceived as a way to feel self-efficacious or in control.

### *The present study*

The present study uses a longitudinal design to prospectively examine the effect of the interaction of self-efficacy, perfectionism, and feeling overweight on binge eating and inappropriate compensatory behaviors separately among young female college students. This

research attempts to answer two important unanswered questions. First, given that the logic of the three-factor model described by Vohs and colleagues includes whether or not an individual feels she can reduce a discrepancy (i.e., between standards and a perceived state), would self-efficacy capture this key concept and thereby work in the model? Second, does the model predict both of the behavioral components of bulimia: binge eating and inappropriate compensatory behaviors?

Thus, this study builds and improves upon previous studies in several respects. Most importantly, this study is the first to examine self-efficacy in the interactive model of bulimic symptoms, and the first to assess this model's predictive value separately for binge eating and inappropriate compensatory behaviors. In addition, in the current study, bulimic symptoms were assessed using a measure of actual bulimic behaviors (i.e., binge eating, engaging in inappropriate compensatory behaviors) rather than a measure more representative of bulimic thoughts and attitudes (like Vohs et al., 1999) or a composite measure of bulimic symptoms (like Shaw et al., 2004). Furthermore, assessments were obtained weekly, thereby reducing recall difficulties and providing more accurate responses, whereas all prior work has been limited to two time points of data collection. In sum, this study tests whether high perfectionism, feeling overweight, and low self-efficacy (assessed at Time 1) combine to prospectively predict binge eating (assessed over 11 weeks post-Time 1). This interactive model also will be tested with the outcomes of inappropriate compensatory behaviors, but no particular prediction is made.

## Method

### *Participants*

Four hundred and twenty-six women attending a Midwestern university were selected randomly from the undergraduates taking Introductory Psychology to participate in this study. Participants were recruited via phone and offered course credit in exchange for their participation. Of the participants who began the study, 20 did not complete it or were dropped from the analyses due to reasons such as illness, habitually late data, and not needing course credit. The descriptive statistics and analyses that will be presented refer to the 406 completers (95.3% retention rate).

The participants who completed the study ranged in age from 17 to 25 with a mean age of 18 years 7 months ( $SD = .97$  years). The majority of the participants (92.4%) self-reported as Caucasian, 3.2% as Asian, 2% as Hispanic, 1.2% as African-American, and 1.1% as Other. Based on their self-report of current height and weight at the start of the study, participants averaged a body mass index (BMI) of 22.00 ( $SD = 3.01$ ) with a range of 14.76–40.35. (BMI results from dividing weight in kilograms by height in meters squared to control for variations in weight because of height, and can be considered a measure of relative weight.)

### *Procedure*

At Time 1, participants were asked to report on their levels “in general” of the following: perfectionism, perceived weight status, and self-efficacy. Subsequent to Time 1, participants dropped off 11 packets of questionnaires on assigned dates, spaced weekly. All packets were labeled with only an identification number, contributing to anonymity and encouraging honest

responding. Weekly packets reported on the previous week's behaviors related to bulimia (including binge eating, vomiting, laxative use, fasting, and diet pill use), among other variables. Thus, 11 continuous and non-overlapping weeks of data were collected post-Time 1.

### *Measures*

#### *Self-efficacy*

Self-efficacy was measured at Time 1 using the General Self-efficacy subscale (GSES) of the Self-efficacy Scale developed by Sherer et al. (1982). The Self-efficacy Scale is the most extensively researched and most commonly used scale of general self-efficacy (Stanley & Murphy, 1997). The GSES is composed of 17 items (e.g., "When I make plans, I am certain I can make them work") not tied to specific situations or behavior. Participants used a 5-point scale (1 = disagree, 5 = agree) to rate the extent to which the GSES items were true of them. The GSES has adequate reliability (alpha of .86) and validity (Bosscher & Smit, 1998; Sherer et al., 1982). In this sample, coefficient alpha was .87.

#### *Perfectionism*

General perfectionism was measured at Time 1 using the Eating Disorder Inventory (EDI) Perfectionism subscale (Garner, Olmstead, & Polivy, 1983). The EDI-Perfectionism subscale is a perfectionism scale developed to measure excessive personal expectations in general. It consists of six items (e.g., "I hate being less than best at things") rated on a 6-point scale ranging from 1 (never) to 6 (always). Reliability (Cronbach alpha values greater than .70) and validity of the EDI-Perfectionism subscale have been adequately demonstrated (Eberenz & Gleaves, 1994; Garner et al., 1983). In this sample, the EDI-Perfectionism subscale had a coefficient alpha of .80.

#### *Perceived weight status*

Perceived weight status was defined as the participant's perception of her weight. At Time 1, participants were asked to use the following categories to classify what their weight had been most like in the past month: very underweight, underweight, average, overweight, and very overweight. Following Joiner et al. (1997b) and Vohs et al. (1999), this variable was dichotomized so that participants who categorized themselves as "overweight" or "very overweight" were grouped as perceiving themselves to be overweight, while all other participants were grouped as not perceiving themselves as overweight. Participants' Time 1 BMIs confirmed that participants who perceived themselves as overweight had higher BMIs ( $M = 24.79$ ,  $SD = 3.76$ ) than participants who perceived themselves as average weight or underweight ( $M = 21.15$ ,  $SD = 2.11$ ),  $t(404) = -11.98$ ,  $p < .001$ .

#### *Binge eating*

Binge eating was assessed weekly using the Eating Disorder Examination questionnaire (EDE-Q; Fairburn & Beglin, 1994). The EDE-Q is a self-report measure adapted from the Eating Disorder Examination interview (Fairburn & Cooper, 1993) that has adequate reliability and validity (Black & Wilson, 1996; Luce & Crowther, 1999). For this study, the EDE-Q was modified so that the time frame reported on was the past week. In particular, in the EDE-Q each participant was asked the number of days in the past week that she ate "what other people would

regard as an unusually large amount of food” and then asked how many of these days the consumption of large amounts of food was accompanied by a sense of “loss of control”. This combination of an objectively large amount of food combined with a loss of control represents binge eating. The dependent variable used in these analyses is the number of weeks (from 11 weeks, post-Time 1) that participants reported any binge eating.

#### *Inappropriate compensatory behaviors*

Four inappropriate compensatory behaviors were assessed. All were assessed weekly using the modified version of the EDE-Q (Fairburn & Beglin, 1994). The purging behavior of *vomiting* was assessed by asking each participant the number of days in the past week that she “made [herself] sick (vomited) as a means of controlling [her] shape or weight, or to counteract the effects of eating”. For the purging behavior of *laxative use*: the number of days in the past week that she had “taken laxatives as a means of controlling [her] shape or weight, or to counteract the effects of eating”. For the non-purging behavior of *fasting*: the number of days in the past week that she had “fasted (not eaten for a period of 24 h) as a means of controlling [her] shape or weight, or to counteract the effects of eating”. Finally, for the non-purging behavior of *diet pill use*: the number of days in the past week that she had “taken diet pills as a means of controlling [her] shape or weight, or to counteract the effects of eating”. (While these questions about fasting and diet pill use are not in the original EDE-Q, they were included as a way of assessing non-purging behaviors associated with bulimia.) Responses to these weekly questions yielded two dependent variables: the number of weeks (from 11 weeks, post-Time 1) that participants reported any inappropriate compensatory behavior (vomiting, laxative use, fasting, or diet pill use), and the number of weeks that participants reported any purging behavior (vomiting or laxative use). Analyses were done for purging behaviors in addition to inappropriate compensatory behaviors in general because research supports the distinction of a purging subtype as a more severe type of bulimia (American Psychiatric Association, 1994; Garfinkel, 2002).

## **Results**

### *Descriptive analyses*

Table 1 provides the means and standard deviations for the predictors and dependent variables, as well as their intercorrelations. The intercorrelations among predictor variables was not high enough to raise concerns about multicollinearity (all  $r$ 's < 0.1). Based on the EDE-Q, 11% ( $n = 44$ ) of the sample reported any binge eating during the study interval, 7% ( $n = 28$ ) reported any purging behavior (vomiting or laxative use), and 10% ( $n = 42$ ) reported any inappropriate compensatory behavior (vomiting, laxative use, fasting, or diet pill use).

### *Overview of data analytic strategies*

To test the hypotheses presented, we conducted a series of hierarchical multiple regression analyses following the guidelines prescribed by Cohen and Cohen (1983). The analytic strategy was as follows. *Step 1*: simultaneous entry of the three Time 1 main effects (perfectionism,

Table 1  
Descriptive data and intercorrelations for predictor and dependent measures

Measure	1	2	3	4	5	6
1. Perfectionism <i>M</i> = 24.53 <i>SD</i> = 5.12	—					
2. Self-efficacy <i>M</i> = 64.50 <i>SD</i> = 8.71	.06	—				
3. Perceived weight status	.09	-.07	—			
4. # of weeks of binge eating <i>M</i> = .29 <i>SD</i> = 1.21	.03	-.10*	.17**	—		
5. # of weeks of purging <i>M</i> = .23 <i>SD</i> = 1.13	.02	-.01	.10*	.39***	—	
6. # of weeks of inappropriate compensatory behaviors <i>M</i> = .39 <i>SD</i> = 1.58	.09	-.04	.09	.27***	.83***	—

*Note:* Perfectionism, self-efficacy, and perceived weight status refer to Time 1 assessments. For perfectionism and self-efficacy, higher scores reflect more of the construct. Perceived weight status is a dichotomous variable with 0 = do not feel overweight and 1 = feel overweight. 23.4% of the sample reported thinking they were overweight. Since this variable is dichotomous, means and standard deviations are not very meaningful and thus not presented here. # of weeks of binge eating, of purging, and of inappropriate compensatory behaviors come from the Eating Disorders Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) asked weekly for 11 weeks, post-Time 1.

\* $p < .05$ ;

\*\* $p < .01$ ;

\*\*\* $p < .001$ .

self-efficacy, and perceived weight status); *Step 2*: simultaneous entry of all two-way interactions between Time 1 main effects; and *Step 3*: entry of the three-way interaction of the Time 1 main effects. The dependent variables were number of weeks of binge eating and number of weeks of inappropriate compensatory behaviors. Logarithmic transformations were performed on the skewed dependent variables (per Tabachnick & Fidell, 1996) and regression analyses were conducted on both the original and the transformed variables. In all cases the results were similar; the results using the original variables are reported here.

### Prediction of binge eating

The results of the analysis to predict the presence of binge eating support the hypothesis and are contained in Table 2. Perceived weight status was the only significant main effect,  $t(402) = 3.19$ ,  $p < .01$  (although self-efficacy was marginally significant,  $t(402) = -1.83$ ,  $p = .07$ ), and the two-way interaction between perfectionism and perceived weight status was the only significant two-way interaction,  $t(399) = 2.59$ ,  $p < .05$  (replicating Joiner et al., 1997b). In addition, and particularly important for the current prediction, the three-way interaction of perfectionism,



Table 2

Perfectionism, perceived weight status, self-efficacy, and the three-way interaction with number of weeks of binge eating as the dependent measure

Order of entry of predictors	<i>F</i> for set	<i>t</i> for within set predictors	<i>df</i> for each test	$\Delta R^2$
1. Main effects	4.91**		3402	.04
Perfectionism (EDI-P)		.38	402	
Perceived weight status		3.19**	402	
Self-efficacy (GSES)		-1.83	402	
2. Two-way interactions	2.95*		3399	.02
EDI-P × Perceived weight status		2.59*	399	
EDI-P × GSES		.82	399	
Perceived weight status × GSES		-1.49	399	
3. Three-way interaction	4.47*		1398	.01
EDI-P × Perceived weight status × GSES		-2.11*	398	

Note: Perfectionism (EDI-P), perceived weight status, and self-efficacy (GSES) refer to Time 1 assessments. Perceived weight status is a dichotomous variable for which 0 = do not feel overweight and 1 = feel overweight.  $\Delta R^2$  = change in  $R^2$  with the addition of each step in the regression.

\* $p < .05$ ;

\*\* $p < .01$ .

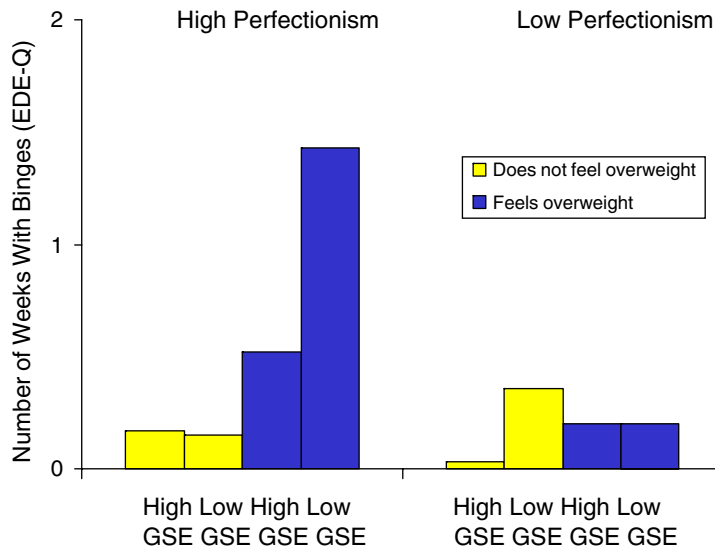


Fig. 1. Number of weeks reporting binge eating (EDE-Q) as a function of the interaction between perceived weight status and self-efficacy (GSE) among women with high and low perfectionism (EDI-Perfectionism).

perceived weight status, and self-efficacy was significantly associated with number of weeks of binge eating,  $t(398) = -2.11, p < .05$ . As expected, women high in perfectionism and low in self-efficacy who felt they were overweight reported the most weeks of binge eating (see Fig. 1, derived using median splits for high and low levels of perfectionism and self-efficacy).

### *Prediction of inappropriate compensatory behaviors*

#### *Inappropriate compensatory behaviors in general*

To test how well the interactive model predicts inappropriate compensatory behaviors in general (grouping together purging and non-purging behaviors), the number of weeks (from 11 possible weeks, post-Time 1) participants reported vomiting or laxative use or fasting or diet pill use was used as the dependent variable. There was a marginally significant main effect of perfectionism,  $t(402) = 1.73, p = .08$ , however, the three-way interaction was not significant,  $t(398) = -.51, p > .60$ . Thus, perfectionism, perceived weight status, and self-efficacy did not interact to predict frequency of inappropriate compensatory behaviors in general.

#### *Purging behaviors*

To test how well the interactive model predicts purging behaviors, the number of weeks (from 11 possible weeks, post-Time 1) participants reported vomiting or laxative use was used as the dependent variable. There was a marginally significant main effect of perceived weight status,  $t(402) = 1.92, p = .06$ , however, the three-way interaction was not significant,  $t(398) = -1.08, p > .28$ . Thus, perfectionism, perceived weight status, and self-efficacy did not interact to predict frequency of purging.

## **Discussion**

The interactive model of perfectionism, perceived weight status, and self-efficacy predicted the binge eating component of bulimia. In particular, women high in perfectionism who felt they were overweight reported the most number of weeks of binge eating only if they had a low sense of self-efficacy. A different pattern of results emerged for inappropriate compensatory behaviors, where the interactive model did not predict these component behaviors of bulimia, either when only purging behaviors were considered or when purging and non-purging behaviors were combined.

The effect size for the significant three-way interactive finding is small, accounting for 1% of the variance in the frequency of binge eating above main effects and lower-order effects (small effect size; Cohen, 1992). Importantly, according to McClelland and Judd (1993), and especially in relation to prospective research using continuous variables, “moderator effects are so difficult to detect that even explaining as little as 1% of the total variance should be considered important”. Thus, considering the complex but theoretically based interactive hypothesis tested and the prospective design, the significant effect, though small numerically, warrants serious consideration. Indeed, inspection of the figure depicting the three-way interaction (Fig. 1) reveals a rather dramatic and meaningful three-way interaction; highly perfectionistic women with low self-efficacy who felt they were overweight stand out from the other seven groups with respect to number of weeks engaged in binge eating. It remains to be seen if the effect sizes for this interactive model are larger when predicting bulimic symptoms in clinical samples.

#### *The role of self-efficacy*

Theoretically, self-efficacy appears to be a good fit in the three-factor model. Bandura (1977) and other theorists have posited that self-efficacy plays an important role in determining

cognitive, affective, and behavioral responses following a discrepancy. Carver and Scheier (1981) propose that when faced with an unmet standard, and low subjective probability of successful discrepancy reduction, then negative affect ensues, efforts to reduce the discrepancy are halted (at least temporarily), and attempts are made to escape self-focus. Applied to the situation where a woman with high standards feels she is overweight (yielding a discrepancy), it would seem that self-efficacy would help determine the response to the discrepancy (Abramson, Bardone, Vohs, Joiner, & Heatherton, *in press*). The current findings suggest that low self-efficacy in the face of the discrepancy in the three-factor model is associated with the maladaptive behavior of binge eating.

We are not presenting self-efficacy as an alternative to self-esteem but rather as a key facet of it in the three-factor interactive model. Recent research seeking to clarify the relationship between the theorized self-competence and self-liking components of self-esteem and bulimic symptomatology found that while both facets of self-esteem were associated with higher levels of bulimic symptoms cross-sectionally, it is self-competence rather than self-liking that predicts changes in bulimic symptoms (Bardone et al., 2003). We also note that there is likely a reciprocal relationship between low self-efficacy and binge eating. Low self-efficacy may be both a predictor of bingeing (in concert with high perfectionism and feeling overweight) and a consequence (with binge eating contributing to a decreased sense of self-efficacy; see Heatherton & Polivy, 1992, for a similar spiral model).

#### *Non-applicability of the three-factor model to inappropriate compensatory behaviors?*

Whereas the interactive model predicted binge eating, it did not predict inappropriate compensatory behaviors. While it could be that the confluence of psychosocial variables is associated specifically with the binge eating component of bulimia, it also could be that over time this confluence will also apply to inappropriate compensatory behaviors. It could be that certain inappropriate compensatory behaviors (especially vomiting) may develop into escape responses and mood modulating behaviors (from negative feelings potentially arising from the confluence of high perfectionism, feeling overweight, and low self-efficacy) later in the course of the disorder. Some have suggested that vomiting may be initiated as a seemingly pragmatic attempt to counter the effects of a binge, but, over time, become more reinforcing on its own and become a habitual means of mood modulation (Fairburn et al., 2003; Johnson et al., 1984). Further research is needed to replicate and understand the current pattern of findings. Interestingly, while feeling overweight emerged from the main effects as marginally related to purging behavior, it was perfectionism that was marginally related to inappropriate compensatory behaviors in general (behaviors that included fasting and diet pill use). One additional possibility to consider in future work is whether there is a fourth factor that may differentiate those who only binge from those who binge and purge. For example, perhaps perfectionistic women with low self-efficacy who feel overweight will both binge and purge if they are also high in traits related to impulsivity.

#### *Connections with existing multivariate models*

How does the three-factor model compare to other multivariate models of bulimic symptomatology? Two multivariate models in particular are relevant comparisons: the dual

pathway model and the spiral model. The dual pathway model of bulimic pathology proposes that pressures from family, peers, and the media to be thin, as well as the internalization of the thin ideal, contributes to body dissatisfaction which fosters dieting and negative affect (Stice, 2001). According to this model, individuals initiate bulimic behavior because of extreme dieting, intense negative affect (with bingeing as an attempt to distract from emotional distress), or both. In the spiral model, Heatherton and Polivy (1992) suggest that dieting (emerging from body dissatisfaction, in particular among those with low self-esteem) typically leads to dietary failure, and that successive dietary failures lead to decreased self-esteem and increased negative affect, which, in turn, make future diet failures more likely. According to the model, over time, this diet/negative affect/low self-esteem spiral propels the dieter toward more extreme efforts at weight loss (e.g., more severe restriction, the initiation of purging). While the three-factor model is simpatico with elements of the dual pathway model and the spiral model, compared to these two models, the three-factor model focuses more on psychosocial factors than on behavioral factors (i.e., dieting) and paints a clearer picture of the vulnerabilities (i.e., perfectionism and self-efficacy) important in interaction with body dissatisfaction that contribute to binge eating.

#### *Future directions*

Why would the confluence of high perfectionism, low self-efficacy, and the appearance ego threat of feeling overweight identify binge eaters? It could be that the confluence of these variables generates negative affect and aversive self-awareness, with binge eating as a “dysfunctional mood modulatory behavior” (Fairburn et al., 2003) or an escape behavior from these negative states (Heatherton & Baumeister, 1991). For individuals with high standards but low confidence in their abilities who encounter an appearance ego threat, the resulting emotional distress may spur high motivation to feel better immediately, and they may expect to find (at least temporary) relief from their bad feelings in eating. Future research is needed to test if the three-factor model works in the context of escape theory and affect regulation by investigating whether the three-factor model predicts negative affect and aversive self-awareness which in turn predicts binge eating. Research should also consider the intermediate variable of dieting to see whether those high in perfectionism and low in self-efficacy who feel overweight are more likely to turn to ineffective dieting (e.g., overly rigid attempts to restrict eating) which increases likelihood for binge eating (Patton, Selzer, Coffey, Carlin, & Wolfe, 1999; Ruderman, 1986).

#### *Limitations and strengths*

There are some limitations to this study. First, although identifying factors related to subclinical bulimic symptoms is arguably important, the non-clinical population used makes it unclear how well these findings generalize to a clinical population and whether the model will explain additional variance among bulimic individuals. Future studies will want to consider how the interactive model applies to bulimic behaviors in clinical samples. Second, data gathered were all self-reports. However, given the efforts to preserve confidentiality, the use of weekly assessments, and the convergence of these findings with some of those of related models (e.g., Joiner et al., 1997b; Vohs et al., 2001), it is likely that any measurement concern related to

self-report is negligible. The strengths of this study include the examination of self-efficacy in the three-factor model thus enabling an integration of this model with both descriptive and clinical intervention work on the role of self-efficacy in bulimia, the separate examination of the bingeing and inappropriate compensatory behavior components of bulimia, the explicit assessment of behaviors using a well-regarded instrument, the large sample size, the high retention rate, and the theoretical basis for the study hypotheses. Additionally, the weekly assessment of bulimic symptoms improves upon relying strictly on Time 1 and Time 2 assessments by reducing recall difficulties and promoting greater accuracy.

### *Clinical implications*

One clinical implication from the interactive finding for binge eating is that the nature of an interaction provides flexibility in where to focus preventive and therapeutic efforts (Bardone et al., 2000). It suggests that altering any of the three variables will alter the outcome, meaning that reducing perfectionism, decreasing body dissatisfaction, or increasing self-efficacy ought to reduce binge eating. This notion of targets of modification is reflected in Fairburn and colleagues' recent work extending their cognitive-behavioral theory and therapy of bulimia (CBT-BN). While CBT-BN is currently considered the treatment of choice for bulimia (Wilson, Fairburn, & Agras, 1997), the extension of this theory and treatment into a "transdiagnostic" theory of eating disorders is intended to broaden treatment success by identifying mechanisms that may be obstacles to change (Fairburn et al., 2003). In this extended theory, four maintaining mechanisms are thought to be important in the maintenance of bulimia. Two of these are clinical perfectionism and core low self-esteem. Fairburn et al. (2003) argue that the "correction" of perfectionism or self-esteem would facilitate improvement by removing a maintenance mechanism. It should be noted that in their discussion of self-esteem, Fairburn et al. (2003) highlight the self-efficacy component of self-esteem (e.g., "low self-esteem ... creates in patients hopelessness about their capacity to change"). In their description of transdiagnostic treatment, they explicitly propose the assessment of perfectionism and self-esteem (as well as the other maintaining mechanisms) leading to a therapeutic formulation based on these assessments, and they include treatment modules focused on clinical perfectionism and low self-esteem. Thus, this extension of CBT-BN (and, to a less explicit degree, the original CBT-BN) targets for change some of the key variables in the interactive model tested in the current study.

### *Summary*

In sum, this study provides evidence that women with high perfectionistic standards and a low sense of self-efficacy who think they are overweight are most likely to experience binge eating compared to women with any other combination of levels of these variables. No evidence was found that the model predicts inappropriate compensatory behaviors. Currently, the weight of the evidence supports related interactive models as valid; additional research will help bolster or refine the three-factor interactive model. Future research should explore how it is that this combination of psychosocial variables is associated with binge eating, including investigating negative affect and dieting as possible moderators or mediators.

## Acknowledgments

This research was supported in part by a University of Wisconsin Advanced Level Fellowship to Anna M. Bardone-Cone, the National Institute of Mental Health Grant 43866 to Lyn Y. Abramson, and the NIMH Grant 12794 to Kathleen D. Vohs.

## References

- Abramson, L. Y., Bardone, A. M., Vohs, K. D., Joiner, T. E., & Heatherton, T. F. (in press). The paradox of perfectionism and bulimia: Toward a resolution. In: L. B. Alloy, & J. H. Riskind (Eds.), *Cognitive vulnerability to emotional disorders*. Hillsdale, NJ: Erlbaum.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*, 193–215.
- Bandura, A., & Cervone, D. (1986). Differential engagement of self-reactive influences in cognitive motivation. *Organizational Behavior and Human Decision Processes*, *38*, 92–113.
- Bardone, A. M., Perez, M., Abramson, L. Y., & Joiner, T. E., Jr. (2003). Self-competence and self-liking in the prediction of change in bulimic symptoms. *International Journal of Eating Disorders*, *34*, 361–369.
- Bardone, A. M., Vohs, K. D., Abramson, L. Y., Heatherton, T. F., & Joiner, T. E., Jr. (2000). The confluence of perfectionism, body dissatisfaction, and low self-esteem predicts bulimic symptoms: Clinical implications. *Behavior Therapy*, *31*, 265–280.
- Black, C. M. D., & Wilson, G. T. (1996). Assessment of eating disorders: Interview versus questionnaire. *International Journal of Eating Disorders*, *20*, 43–50.
- Bosscher, R. J., & Smit, J. H. (1998). Confirmatory factor analysis of the General Self-Efficacy Scale. *Behaviour Research and Therapy*, *36*, 339–343.
- Calam, R., & Waller, G. (1998). Are eating and psychosocial characteristics in early teenage years useful predictors of eating characteristics in early adulthood? A 7-year longitudinal study. *International Journal of Eating Disorders*, *24*, 351–362.
- Carver, C., & Scheier, M. (1981). *Attention and self-regulation*. New York: Springer.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*, 155–159.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Denoma, J. M., Gordon, K. H., Bardone, A. M., Vohs, K. D., Abramson, L. Y., Heatherton, T. F., et al. A test of an interactive model of bulimic symptomatology in adult women. *Behavior Therapy*, in press.
- Eberenz, K. P., & Gleaves, D. H. (1994). An examination of the internal consistency and factor structure of the Eating Disorder Inventory-2 in a clinical sample. *International Journal of Eating Disorders*, *16*, 371–379.
- Etringer, B. D., Altmaier, E. M., & Bowers, W. (1989). An investigation into the cognitive functioning of bulimic women. *Journal of Counseling and Development*, *68*, 216–219.
- Fairburn, C. G. (1995). *Overcoming binge eating*. New York: Guilford Press.
- Fairburn, C. G., & Beglin, S. J. (1990). Studies of the epidemiology of bulimia nervosa. *American Journal of Psychiatry*, *147*, 401–408.
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders*, *16*, 363–370.
- Fairburn, C. G., & Cooper, Z. (1993). The eating disorder examination (12th edition). In C. G. Fairburn, & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, and treatment* (pp. 317–332). New York: Guilford Press.
- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A “transdiagnostic” theory and treatment. *Behaviour Research and Therapy*, *41*, 509–528.
- Franks, D. D., & Marolla, J. (1976). Efficacious action and social approval as interacting dimensions of self-esteem: A tentative formulation through construct validation. *Sociometry*, *39*, 324–341.

- Fryer, S., Waller, G., & Kroese, B. S. (1997). Stress, coping, and disturbed eating attitudes in teenage girls. *International Journal of Eating Disorders*, 22, 427–436.
- Garfinkel, P. E. (2002). Classification and diagnosis of eating disorders. In C. G. Fairburn, & K. D. Brownell (Eds.), *Eating disorders and obesity: A comprehensive handbook*, (2nd ed.) (pp. 155–161). New York: Guilford.
- Garner, D. M., & Garfinkel, P. E. (Eds.). (1977). *Handbook of treatment for eating disorders*. New York: Guilford Press.
- Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International Journal of Eating Disorders*, 2, 15–34.
- Gormally, J., Black, S., Daston, S., & Rardin, D. (1982). The assessment of binge eating severity among obese persons. *Addictive Behaviors*, 7, 47–55.
- Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, 110, 86–108.
- Heatherton, T. F., Herman, C. P., & Polivy, J. (1991). Effects of physical threat and ego threat on eating behavior. *Journal of Personality and Social Psychology*, 60, 138–143.
- Heatherton, T. F., & Polivy, J. (1992). Chronic dieting and eating disorders: A spiral model. In J. H. Crowther, S. E. Hobfall, & M. A. P. Tennenbaum (Eds.), *The etiology of bulimia nervosa: The individual and familial context* (pp. 133–155). Washington, DC: Hemisphere.
- Johnson, C., Lewis, C., & Hagman, J. (1984). The syndrome of bulimia: Review and synthesis. *Psychiatric Clinics of North America*, 7, 247–273.
- Joiner, T. E., Jr., Heatherton, T. F., & Keel, P. K. (1997a). Ten-year stability and predictive validity of five bulimia-related indicators. *American Journal of Psychiatry*, 154, 1133–1138.
- Joiner, T. E., Jr., Heatherton, T. F., Rudd, M. D., & Schmidt, N. B. (1997b). Perfectionism, perceived weight status, and bulimic symptoms: Two studies testing a diathesis-stress model. *Journal of Abnormal Psychology*, 106, 145–153.
- Killen, J. D., Taylor, C. B., Hayward, C., Haydel, K. F., Wilson, D. M., Hammer, L., et al. (1996). Weight concerns influence the development of eating disorders: A 4-year prospective study. *Journal of Consulting and Clinical Psychology*, 64, 936–940.
- Killen, J. D., Taylor, C. B., Hayward, C., Wilson, D. M., Haydel, K. F., Robinson, T. N., et al. (1994). The pursuit of thinness and onset of eating disorders symptoms in a community sample of adolescent girls: A three year prospective analysis. *International Journal of Eating Disorders*, 16, 227–238.
- Kurth, C. L., Krahn, D. D., Nairn, K., & Drownowski, A. (1995). The severity of dieting and bingeing behaviors in college women: Interview validation of survey data. *Journal of Psychiatric Research*, 29, 211–225.
- Luce, K. H., & Crowther, J. H. (1999). The reliability of the Eating Disorder Examination—Self-report questionnaire version (EDE-Q). *International Journal of Eating Disorders*, 25, 349–351.
- McClelland, G. H., & Judd, C. M. (1993). Statistical difficulties of detecting interactions and moderator effects. *Psychological Bulletin*, 114, 376–390.
- Patton, G. C., Selzer, R., Coffey, C., Carlin, B., & Wolfe, R. (1999). Onset of adolescent eating disorders: Population-based cohort study over three years. *British Medical Journal*, 318, 765–768.
- Polivy, J., Heatherton, T. F., & Herman, C. P. (1988). Self-esteem, restraint, and eating behavior. *Journal of Abnormal Psychology*, 97, 354–356.
- Rosenberg, S. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- Ruderman, A. J. (1986). Dietary restraint: A theoretical and empirical review. *Psychological Bulletin*, 99, 247–262.
- Schneider, J. A., O’Leary, A., & Agras, W. S. (1987). The role of perceived self-efficacy in recovery from bulimia: A preliminary examination. *Behaviour Research and Therapy*, 25, 429–432.
- Schwitzer, A. M., Rodriguez, L. E., Thomas, C., & Salimi, L. (2001). The Eating Disorders NOS diagnostic profile among college women. *Journal of American College Health*, 49, 157–166.
- Shaw, H. E., Stice, E., & Springer, D. W. (2004). Perfectionism, body dissatisfaction, and self-esteem in predicting bulimic symptomatology: Lack of replication. *International Journal of Eating Disorders*, 36, 41–47.
- Sherer, M., Maddux, J. E., Mercandante, B., Prentice-Dunn, S., Jacobs, B., & Rogers, R. W. (1982). The Self-efficacy Scale: Construction and validation. *Psychological Reports*, 51, 663–671.
- Stanley, K. D., & Murphy, M. R. (1997). A comparison of general self-efficacy with self-esteem. *Genetic, Social, and General Psychology Monographs*, 123, 81–99.

- Stice, E. (2001). A prospective test of the dual-pathway model of bulimic pathology: Mediating effects of dieting and negative affect. *Journal of Abnormal Psychology, 110*, 124–135.
- Striegel-Moore, R. H., Silberstein, L. R., Frensch, P., & Rodin, J. (1989). A prospective study of disordered eating among college students. *International Journal of Eating Disorders, 8*, 499–509.
- Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper Collins.
- Tafarodi, R. W., & Milne, A. B. (2002). Decomposing global self-esteem. *Journal of Personality, 70*, 443–483.
- Tafarodi, R. W., & Swann, W. B., Jr. (1995). Self-liking and self-competence as dimensions of global self-esteem: Initial validation of a measure. *Journal of Personality Assessment, 65*, 322–342.
- Vohs, K. D., Bardone, A. M., Joiner, T. E., Jr., Abramson, L. Y., & Heatherton, T. F. (1999). Perfectionism, perceived weight status, and self-esteem interact to predict bulimic symptoms: A model of bulimic symptom development. *Journal of Abnormal Psychology, 108*, 695–700.
- Vohs, K. D., & Heatherton, T. F. (2001). Self-esteem and threats to self: Implications for self-construals and interpersonal perceptions. *Journal of Personality and Social Psychology, 81*, 1103–1118.
- Vohs, K. D., Voelz, Z. R., Pettit, J. W., Bardone, A. M., Katz, J., Abramson, L. Y., et al. (2001). Perfectionism, body dissatisfaction, and self-esteem: An interactive model of bulimic symptom development. *Journal of Social and Clinical Psychology, 20*, 476–497.
- Wilson, G. T., Fairburn, C. G., & Agras, W. S. (1997). Cognitive-behavioral therapy for bulimia nervosa. In D. M. Garner, & P. E. Garfinkel (Eds.), *Handbook of treatment for eating disorders* (pp. 67–93). New York: Guilford Press.
- Wilson, G. T., Fairburn, C. G., Agras, W. S., Walsh, B. T., & Kraemer, H. (2002). Cognitive-behavioral therapy for bulimia nervosa: Time course and mechanisms of change. *Journal of Consulting and Clinical Psychology, 70*, 267–274.
- Wolff, G. E., & Wittrock, D. A. (1998). *A description of eating behavior in a college population using the questionnaire of eating and weight patterns*. Poster presented at the 19th annual Society of Behavioral Medicine Conference, New Orleans, LA.