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Risk Factors of Disordered Eating Symptoms:
A Longitudinal Study with First-Semester Freshman Women

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Abstract

Disordered eating and body image issues are prevalent problems among female college students. First semester freshman women completed a short-term longitudinal study that spanned from the beginning of the semester to approximately half-way through the semester. The study examined the impact that neuroticism and self-esteem, individually and in interaction with rushing a sorority, had on disordered eating patterns during the transition to college. Cross-sectional results suggest that disordered eating was positively associated with neuroticism and negatively associated with self-esteem. Additionally, women who chose to rush a sorority reported significantly higher scores for eating disorder symptoms at baseline assessment relative to women who did not rush; sorority involvement, however, did not moderate the associations between neuroticism and self-esteem and eating disorder symptoms. Neither neuroticism nor self-esteem were associated with changes in eating disorder symptoms, and sorority involvement was not a significant moderator of these longitudinal associations. Despite the finding that there were no significant mean changes in disordered eating symptoms from baseline to follow-up, about 1 out of 4 women in the sample population demonstrated changes in symptoms during this short longitudinal period that were greater than what would be expected by chance. Future studies should examine other risk factors that are associated with increases in eating disorder symptoms for this vulnerable population in addition to evaluating possible resilience factors that are associated with decreases in eating disorder symptoms.

Keywords: disordered eating, neuroticism, self-esteem, sorority status

Risk Factors of Disordered Eating Symptoms:

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Imagine you are getting ready to attend a dinner party with your closest friends. You should be looking forward to visiting with everyone, but instead there is something preventing you from being excited. An overwhelming number of questions begin to push and shove their way into your thoughts: What food will people bring? Will they have food that I can eat without gaining weight? How much can I eat without over-indulging? How will I be able to burn off all the calories I consume? Although these thoughts might seem extreme and obsessive, they are unfortunately not uncommon. We live in an appearance obsessed culture where how one looks often not only dictates how one feels about oneself, but also can control one's entire life. The importance our society places on appearance has ultimately created a culture, commonly known as the *diet culture*, in which people constantly obsesses over what types of food they eat, how much they eat, and how much they weigh. In American society, we are surrounded with advertisements promoting the next hot new fad diet, commercials on television that tell people just how happy they will be when they finally shed those "extra" ten pounds, as well as images of perfectly airbrushed thin female models and fit muscular male models plastered on billboards, posted on social media, and found in magazines everywhere. We are constantly being inundated with these types of images, which make us believe that appearances are truly everything. These images send us the message that our self-worth is defined not by our internal qualities and successes, but rather by our outward appearance. Thus, it should not come as a surprise that living in this diet culture and appearance driven world has taken a toll on people's self-image and overall mental health.

The negative consequences on people's self-esteem that are associated with living in America's appearance-obsessed culture are widespread. A common way of dealing with body image dissatisfaction is to restrict calories consumed in an effort to lose weight. At any given time, 70% of women and 35% of men are restricting their caloric intake (Brennan, Lalonde, & Bain, 2010). Approximately about 50% of boys and girls aged 8-11 years are concerned about being overweight and about half of both boys and girls engage in strategies to lose weight (McCabe & Ricciardelli, 2003). These statistics demonstrate the powerful influence that diet culture has in our society. Even adolescents as young as 8 years old believe that they need to diet in order to lose weight and fear being too big. Although these statistics about body image and self-esteem include both men and women, diet culture tends to cater primarily to women, and thus body image and self-esteem issues show up more frequently in women. The essentially impossible standards of beauty in modern American society as well as the overall importance of appearances that are placed on women can contribute to insecurities and self-esteem issues regarding physical appearance.

The excessive societal pressure to be thin, to engage in excessive dieting, and to be hyper aware of one's body image unfortunately impact a striking number of American women. The results of a representative national survey in the United States found that nearly one-half of the women reported globally negative evaluations of their appearance and a concern with being or becoming overweight (Cash & Henry, 1995). Furthermore, for a far fewer number of women this body dissatisfaction can result in an eating disorder. Eating disorders, including anorexia nervosa and bulimia nervosa, are mental health disorders having to do with the consumption of food. Whereas anorexia nervosa and bulimia nervosa are united by a distinctive core psychopathology, an obsession or preoccupation with the importance of shape or weight, people use different

methods of shape/weight control depending on their specific diagnosis. In anorexia nervosa there is a sustained and determined pursuit of weight loss via a restriction of calories and an increase in total energy expenditure, while in bulimia nervosa, attempts to restrict food intake are permeated by repeated episodes of binge eating, or episodes of eating during which there is an aversive sense of loss of control and an unusually large amount of food is consumed (Arcelus, Mitchell, Wales, & Nielsen, 2011; Fairburn & Harrison, 2003). Eating disorders are serious mental health problems that can affect any age, race, ethnicity, socioeconomic group, sex, or gender, although higher prevalence rates are seen in adolescent/young adult females (Frank, 2016). A prospective risk factor study that followed a sample of 496 female adolescents over an 8-year period found that by age 20, 13.1% of young adults had experienced at least one eating disorder (Stice, Marti, & Rohde, 2013). Although researchers are still working on understanding exactly what causes eating disorders, they are thought to develop through a combination of biological, psychological, and social factors.

The biopsychosocial model of the development of psychopathology posits that each of the three elements, the individual's biology, psychology, and their social environment, interact in a unique way to influence the development of a mental disorder. The biopsychosocial model for eating disorders is especially complex. The literature discusses the importance of an individual's hormone secretion and levels of neurotransmitters, namely dopamine and serotonin, and proposes how unregulated levels of these chemicals appear to be risk factors associated with the development of an eating disorder (Frank, 2016). Unfortunately, relatively little is known about the specific biological risk factors that contribute to developing an eating disorder. There is, however, richer and more specific literature on the psychological and social risk factors of eating disorders. Psychological factors such as body dissatisfaction, low self-esteem, depression or

general negative affect, as well as certain personality traits like neuroticism and perfectionism, have been linked to the development of eating disorders (Stice, 2002). Eating pathology has also been heavily associated with the internalization of the societal appearance-ideal, which relies on extreme diet and exercise as well as alteration of pictures and plastic surgery. Thus, the appearance-ideal is essentially impossible to achieve and the quest for attainment often leaves people feeling dissatisfied with their bodies and unhappy with their shape or weight. In addition to being female, populations at higher risk for developing disordered eating patterns tend to be those experiencing environmental stress, including interpersonal, work related, and academic stressors (Berg, Frazier, & Sherr, 2009). The present study examined a particular population of women who have a uniquely stressful experience: the transition to college.

Many mental disorders, including eating disorders, are commonly diagnosed in the period of emerging adulthood, between the ages of 18 and 25 (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008). Neurobiologically, young adulthood is a key time for hormone secretion and overall brain development. Young adulthood is also filled with novel thoughts, new experiences, and social changes. The extreme importance given to a woman's appearance coupled with the fact that the college environment provides a breadth of unique social and academic stressors during the already high-risk developmental period of young adulthood, may put women at an increased risk for disordered eating during their college years. Indeed, excessive dieting and compensatory actions like over-exercise and calorie restriction as well as other eating disorder related behaviors are unfortunately very prevalent on college campuses across America (Heatherton, Nichols, Mahamedi, & Keel, 1995; Kurth, Krahn, Nairn, & Drewnowski, 1995; Nelson et al., 2008).

Using a diathesis-stress model of eating problems, the present study was conducted to assess the interaction between two risk factors – self-esteem and neuroticism – and two unique environmental experiences – pledging a sorority and the general transition to college – that first-semester freshman college women encounter and how each of these risk factors may work together to contribute to the development of eating pathology in a non-clinical sample.

Neuroticism is a personality trait denoted by an individual's emotional reactivity, tendency to worry, and susceptibility to negative mood (Claridge & Davis, 2001). Neuroticism has been proposed as a characteristic that may increase an individual's vulnerability to developing disordered eating habits. In female college students specifically, there are correlations between high levels of neuroticism and eating disorder symptoms (MacLaren & Best, 2009; Miller, Schmidt, Vaillancourt, McDougall, & Laliberte, 2006). For example, one study based on a non-clinical female college sample found correlations between disordered eating symptoms and higher levels of neuroticism as well as lower levels of extraversion (MacLaren & Best, 2009). Although personality traits other than neuroticism (i.e., extraversion) were not examined in the present study, it is important to note that previous research has found that neuroticism in college women can serve as a moderator of the association between other personality traits and eating problems. For example, one study found that lower extraversion was related to disordered eating patterns, but only for those women who scored higher on neuroticism (Miller et al., 2006).

Although prior studies have found that neuroticism is associated with eating problems, there are some limitations with these studies. For example, in MacLaren and Best's (2009) study, although participants were all female undergraduate psychology students, the researchers did not adequately consider potential age differences in their findings. Specifically, the age range of the

subjects varied greatly (17-41 years). Not controlling for age makes the findings of this study difficult to generalize to the typical female college undergraduate population. Furthermore, differences among participants that stem from the wide range of ages represented in this study sample may confound the study's overall results. Another limitation of MacLaren and Best's (2009) study was that aside from personality traits, the researchers did not consider other factors that may contribute to disordered eating habits (like environmental stressors). The present study examined neuroticism as a risk factor for eating pathology, and additionally sought to examine how neuroticism interacts with other recognized risk factors.

Another risk factor commonly associated with disordered eating patterns is self-esteem. Self-esteem, or people's attitudes toward themselves, is a key component in how individuals see their own value. Self-esteem has been negatively correlated with eating disorder symptoms (Berg et al., 2009; Ghaderi, 2003; Noordenbos, Aliakbari, & Campbell, 2014). In a study of college age women, low self-esteem was frequently combined with high body concern and excessive body image awareness in women who scored higher for disordered eating patterns (Ghaderi, 2003). It appears that women who want to have a certain shape and desire to achieve the thin-ideal body type and weight have a highly critical style of self-evaluation (Noordenbos et al., 2014).

Whereas past research points to higher neuroticism and lower perceived self-esteem as potential risk factors for developing eating pathology, most research fails to look at both risk factors simultaneously. In comparison, a more comprehensive understanding of the role of these risk factors for understanding eating problems may include consideration of how these risk factors interact with one another and with environmental stressors, specifically the unique transitional changes experienced by women during their first semester of college.

The normative transition of a late adolescent graduating from high school and moving to attend college in an unfamiliar place is a transition period that includes not only leaving behind the comfort of friends and family, but also involves an adjustment to the new college environment. This environment requires the late adolescent to deal with novel academic and social pressures (Compas, Wagner, Slavin, & Vannatta, 1986). Compas et al. (1986) completed a prospective study of stressful life transitions and their impact on psychological symptoms. The researchers recruited high school graduates who were about to begin their first semester of college and had chosen to reside in the university's residence halls. These researchers suggested that the unique social and academic stressors of college combined with the vulnerable transition period first-year students face, put them at an increased risk for developing disordered psychological symptoms (Compas et al., 1986). Results from their study suggested that stressful events and psychological problems may mutually influence one another at certain times. Symptoms assessed at the beginning of college were the only significant predictor of symptom levels assessed at the end of the semester 3 months later; thus, it appears that students experience an initial period of psychological vulnerability at the start of college (Compas et al., 1986). In a more recent study specific to eating disorder symptoms, researchers found that although eating disorder behaviors tend to remain stable over time for undergraduate college women, a large portion of these women (nearly 50%) reported engaging in binge eating and/or nonpurging compensatory behaviors like excessive exercise or calorie restriction (Berg et al., 2009). It appears that these dangerous behaviors are very common among undergraduate women.

Within the female college community, many different subgroups exist that each experience their own unique stressors. One particular subgroup that has been associated with a preoccupation with shape, weight, appearance, and body image and thus appears to be uniquely

at risk for developing disordered eating habits is sorority women (Rolnik, Engeln-Maddox, & Miller, 2010; Schulken, Pinciario, Sawyer, Jensen, & Hoban, 1997). Although research on this group is limited, one study that surveyed 627 sorority women found that sorority women scored significantly higher on the drive for thinness and body dissatisfaction concerns compared to other college women in previous studies (Schulken et al., 1997). These findings suggest that the sorority women in this study were more preoccupied with the thin appearance ideal and may have had a greater fear of weight gain. These types of thoughts have been associated with the development of disordered eating behavior (Stice, 2002). Although these results are important, this study is not without limitations. Schulken et al. chose to perform a comparative study and compared their sorority women sample with previous studies done with other college females. It is unclear whether the previous samples of other college women used during comparative analysis were involved with a sorority; Schulken's et al. results would have been stronger had they done an intracampus comparison of sorority and non-sorority women.

Rolnik et al. (2010) were interested more specifically in the process of first year college women going through sorority rush, or the process of "trying out" for sororities on one's campus. The rush process typically spans several days or even a week, with new potential members meeting and talking with current sorority members. During these brief interpersonal interactions, women are judged by many things including their physical appearance; and women often experience anxiety as to if they will be offered a bid, a formal offer to join a specific sorority, from their top choice house (Atlas & Morier, 1994). By surveying first year college women at 4 different time points (before, during, bid/selection day, and one month following rush) during the uniquely stressful and anxiety inducing experience of sorority rush, it was found that women who chose to rush scored higher on eating disordered behavior and attitudes at baseline than

those who did not rush (Rolnik et al., 2010). It is important to note that perhaps women who choose to rush already have a preoccupation with their body image and an increased interest in achieving the cultural thin appearance ideal. This suggests that if sororities place an emphasis on appearance and the thin ideal, they may be attracting like-minded potential new members. Furthermore, rushees' BMIs significantly predicted if they would complete the rush process; those with higher BMIs dropped out of rush at significantly larger rates than those with lower BMIs (Rolnik et al., 2010). These findings suggest that the stressful experience of sorority rush stems from not only the rushees' ultimate goal of being chosen by a sorority, but also from their desire to meet the cultural thin ideal standards of beauty.

The present study sought to address the degree to which changes in eating problems for females in their first semester of college was predicted by specific risk factors (neuroticism and self-esteem) and certain environmental experiences (the general transition to college and pledging a sorority/sorority status). Examining disordered eating behavior through the lens of the diathesis-stress model, this study investigated the above risk factors using a short-term longitudinal design with baseline assessment occurring at the start of the fall semester and follow-up assessment occurring approximately halfway through the semester. It was predicted that lower self-esteem and higher neuroticism would each individually be associated with eating problems in cross-sectional analyses. It was also predicted that rushing or pledging a sorority would moderate the cross-sectional associations between those risk factors and eating problems such that the associations between these risk factors and eating problems would be greater for women who rushed relative to women who did not rush. With respect to longitudinal associations, it was hypothesized that lower self-esteem and higher neuroticism would be associated with greater increases in eating problems. Furthermore, it was predicted that sorority

status would moderate the association between these risk factors and increases in eating problems, such that the associations between these risk factors and changes in eating problems would be greater for women who rushed a sorority relative to those women who did not rush.

Methods

Participants

Participants consisted of female college freshman enrolled in their first semester at the University of Colorado Boulder. Participants were recruited from an introductory psychology course, and they participated in the study for course credit. To be included in this study, the women had to be between the ages of 18-22 years, fluent in English, and enrolled in their first year of undergraduate study at the university. They also had to have a body mass index (BMI) above the underweight category ($BMI > 18.5$). Students in their second year or higher at the university, who were pregnant, who were enrolled in a weight loss program at baseline assessment, or who had a history of an eating disorder were excluded from participation in this study.

Data were collected using an online survey. The study was a two-wave longitudinal study with the baseline assessment occurring toward the beginning of the semester and follow-up assessment occurring approximately halfway through the semester. Baseline assessment generally occurred within the third week of the semester, with a small portion of participants completing the baseline survey during week four of the semester due to timing and logistical reasons. In total, 95 first semester college women ($M = 18.1$ years, $SD = 0.64$ years) completed the baseline assessment survey. A majority of the participants were Caucasian (86.3%), followed by Biracial (5.3%), Asian (3.2%), Other (3.2%), and Black (2.1%); 14.7% of participants were Latina. Between 35 and 43 days after completing the baseline questionnaire, participants

completed the follow-up survey either during week seven or eight of their semester. In total, 60 women completed both the baseline assessment and the follow-up assessment.

Measures

Demographic characteristics. Age, race/ethnicity, sex, gender, height, and weight, were assessed using standard demographic questions. At baseline, participants were asked if they had gone through sorority rush and if they had indeed selected a sorority, whereas at the follow-up assessment, participants were asked if they were currently a member of a sorority.

Neuroticism. Neuroticism was measured using the 12-item NEO Five Factor Inventory Neuroticism Scale (Costa & McCrae, 1992). This questionnaire includes a variety of statements about the self, both positive and negative, and asks the individual to respond using a 5-point Likert scale format ranging from “strongly disagree” to “strongly agree.” Examples of positive statements include, “I rarely feel lonely or blue” as well as “I am seldom sad or depressed.” Examples of more negative statements on this scale include “I often feel inferior to others” and “When I’m under a great deal of stress, sometimes I feel like I’m going to pieces.” Because four of these items are worded in a positive direction and eight in a negative direction, positive items were reverse-scored and the items were averaged. The measure demonstrated good internal consistency in this study ($\alpha = .83$).

Self-esteem. Self-esteem was measured using the Rosenberg Self-Esteem Scale (Rosenberg, 1965). This 10-item survey uses a 4-point Likert scale format to measure the individual’s global self-worth using both positive (“I feel that I have a number of good qualities”) and negative (“At times I think I am no good at all”) self-statements. Because five of these items are worded in a positive direction and five in a negative, negative items were reverse

scored and the items were averaged. The measure demonstrated good internal consistency in this study ($\alpha = .91$).

Disordered eating. Participants' disordered eating patterns/behaviors were assessed using the 28-item Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). The questions on the EDE-Q ask only about the individual's eating patterns over the past four weeks (28 days). The EDE-Q covers many aspects of disordered eating behaviors, including restriction, fasting, purging (excessive exercise, vomiting, laxatives), and binge eating. The EDE-Q also assesses disordered eating attitudes, including fear of gaining weight, desire to be thin, and dissatisfaction with shape or weight. A total score was computed by taking the mean of the items, with higher scores indicating greater severity of disordered eating. The EDE-Q had good internal consistency at baseline ($\alpha = .95$) and follow-up ($\alpha = .96$).

Results

Baseline Findings

Descriptive statistics of baseline measures are presented in Table 1. The mean EDE-Q scores were comparative to normative data on the measure reported by Luce, Crowther, and Pole (2008).

Pearson correlations among study variables at baseline are presented in Table 1. As can be seen in this table, neuroticism was significantly and positively correlated with the EDE-Q, and self-esteem was significantly and negatively correlated with the EDE-Q. In addition, neuroticism was significantly and negatively correlated with self-esteem.

Due to the findings that neuroticism and self-esteem were highly associated with scores on the EDE-Q, and that neuroticism and self-esteem were highly associated with one another, we evaluated the unique and combined variance in EDE-Q scores associated with neuroticism and

self-esteem. A multiple regression analysis was conducted in which EDE-Q scores were regressed on neuroticism and self-esteem. Results suggested that the combination of neuroticism and self-esteem accounted for 23% of the variance in EDE-Q scores, $F(2, 92) = 13.33, p < .001$. In addition, it was found that after accounting for neuroticism, self-esteem was uniquely associated with EDE-Q scores ($B = -16.61, SE = 7.56, p = .031$). In comparison, after adjusting for self-esteem, neuroticism was not uniquely associated with EDE-Q scores ($B = 4.95, SE = 6.03, p = .414$).

At baseline, 39% of participants rushed a sorority and 61.1% of participants did not rush a sorority. A *t*-test indicated that EDE-Q scores for the women who rushed a sorority ($M = 1.70, SD = 1.04$) were significantly higher than the scores of the women who did not rush ($M = 1.20, SD = 1.09$), $t(93) = -2.19, p = .031$. To test whether sorority rush status moderated the association between risk factors and EDE-Q scores, we created a Neuroticism \times Rush and a Self-Esteem \times Rush cross-product interaction term and entered these into the regression equation, controlling for the component terms; neuroticism and self-esteem were mean deviated (i.e., centered) prior to creating the interaction terms. Results from these analyses are presented in Table 2 and Table 3. As can be seen in these tables, after controlling for the component terms, the interaction terms were not significantly related to EDE-Q scores, suggesting that rush status did not moderate the cross-sectional association between neuroticism and EDE-Q scores or between self-esteem and EDE-Q scores.

Follow-Up Findings

At follow-up, 60 participants completed the questionnaire, with 63.3% of women not members of a sorority and with 36.7% sorority members. *T*-tests for continuous variables and chi-squared tests for categorical variables were used to test for differences in the participant

demographics and the three study measures between the 60 participants who returned to follow-up relative to the 35 participants who did not complete the follow-up. No significant differences were found between groups, with all p values greater than .08.

We first examined changes in mean levels of eating problems from baseline to follow-up. Results from a paired samples t -test indicated that EDE-Q scores at follow-up ($M = 1.36$, $SD = 1.21$) were not significantly different from EDE-Q scores at baseline, $t(59) = 1.12$, $p = .269$. Furthermore, scores on baseline and follow-up were highly correlated ($r = .84$, $p < .001$). Despite the fact that no systematic mean differences were found in the baseline and follow-up EDE-Q scores and that the scores at the two assessments were highly correlated, we were interested in examining the degree to which EDE-Q scores changed for individuals. Using the formula provided by Jacobson and Truax (1991) for calculating reliable change (i.e., change greater than would be expected by chance), 9 participants (15.0% of the sample) reported decreases in eating disorder symptoms and 5 participants (8.3% of the sample) reported increases in eating disorder symptoms greater than would be expected by chance.

To evaluate the hypothesis that neuroticism and self-esteem would predict changes in eating disorder symptoms, follow-up EDE-Q scores were regressed on baseline EDE-Q scores and either neuroticism or self-esteem assessed at baseline. Changes in EDE-Q scores from baseline to follow-up were not predicted by neuroticism, $B = .073$, $SE = .138$, $p = .597$, or self-esteem, $B = -.203$, $SE = .184$, $p = .275$. Changes in EDE-Q scores were not greater for women in a sorority relative to women who were not in a sorority, $B = .073$, $SE = .138$, $p = .691$. Multiple regression analyses were used to evaluate whether the associations between neuroticism and self-esteem and changes in eating disorder symptoms were moderated by sorority status. We created a Neuroticism \times Sorority and a Self-Esteem \times Sorority cross-product interaction term and entered

these into the regression equation predicting follow-up EDE-Q scores, controlling for baseline EDE-Q scores and the component terms; neuroticism and self-esteem were mean deviated (i.e., centered) prior to creating the interaction terms. Results from these analyses are presented in Table 4 and Table 5. As can be seen in these tables, after controlling for the component terms, the interaction terms were not significantly related to follow-up EDE-Q scores, suggesting that sorority status did not moderate the associations between neuroticism and self-esteem and changes in eating disorder symptoms.

Discussion

The present study was conducted to examine the cross-sectional and longitudinal association between neuroticism, self-esteem, and eating disorder symptoms in women during the transition to college. We predicted that at baseline, neuroticism would be positively associated with eating problems and self-esteem would be negatively associated with eating problems. We also hypothesized that sorority rush status would moderate the association between those risk factors and eating problems, such that the association would be stronger for women who rushed a sorority relative to women who did not rush a sorority. With respect to longitudinal associations, we predicted that higher neuroticism and lower self-esteem would be associated with greater increases in eating problems, and that sorority status would moderate the association between these risk factors and eating problems, such that the risk factors would be more strongly associated with changes in eating problems for women who did versus those who did not join a sorority.

Results provided partial support for the study hypotheses. As hypothesized, higher neuroticism and lower self-esteem were associated with higher eating disorder problems in cross-sectional analyses. However, neither neuroticism nor self-esteem predicted changes in eating

problems. Furthermore, rushing a sorority was not found to moderate the association between neuroticism and self-esteem and disordered eating in either the cross-sectional or longitudinal analyses. Interestingly, despite the findings that there was no significant change in mean scores on the EDE-Q from baseline to follow-up, there were reliable changes in scores among some individual participants. Specifically, 8% of the women demonstrated a reliable increase in eating disorder symptoms and 15% demonstrated a reliable decrease in symptoms. These results underscore the importance of examining change at the level of the individual, as well as mean change for the overall group.

Some of the results obtained in the current study are consistent with findings from previous studies. First, the finding that neuroticism was significantly and positively correlated with disordered eating patterns is consistent with findings from previous studies (MacLaren & Best, 2009; Miller et al., 2006). Like this study, previous research has found that the personality trait of neuroticism is associated with more disordered eating thoughts and behaviors. Second, the current finding that self-esteem was significantly and negatively correlated with eating disorder symptoms is consistent with findings from previous studies (Berg et al., 2009; Ghaderi, 2003; Noordenbos et al., 2014). Results from the current study are consistent with findings from prior research in finding that lower self-esteem is associated with higher disordered eating symptoms. The present study also found that neuroticism was significantly and negatively associated with self-esteem (i.e., scoring higher in neuroticism was associated with scoring lower in self-esteem). Because neuroticism and self-esteem were highly associated with eating disorder symptoms and with each other, the unique and combined variance in eating disorder symptoms accounted for by these two risk factors was examined. Combined, neuroticism and self-esteem accounted for 23% of variance in eating disorder symptoms. Furthermore, whereas neuroticism

was not uniquely associated with eating disorder symptoms when adjusting for self-esteem, self-esteem was uniquely and significantly associated with eating disorder symptoms when adjusting for neuroticism. Thus, it was the shared variance between the two risk factors that was primarily associated with eating disorder symptoms. Perhaps it is the negative self-evaluation that is common to neuroticism and low self-esteem that is associated with eating problems. These findings underscore why it is important to look at multiple risk factors in a single study. Including both neuroticism and self-esteem in this study provided an opportunity to evaluate the *specificity* of the association between each risk factor and eating problems. The multivariate perspective of the present study allowed us to look at both the unique and shared variance in disordered eating patterns associated with neuroticism and self-esteem.

The finding that women who rushed had significantly higher scores on the EDE-Q at baseline relative to women who did not rush is consistent with results from previous research (Rolnik et al., 2010). This finding suggests that freshman women who choose to rush a sorority at the beginning of the semester may have higher levels of disordered eating habits even before they decide to rush. The finding that the relationship between neuroticism and eating disorder symptoms as well as the relationship between self-esteem and eating disorder symptoms was not moderated by rush status suggests that the associations between these individual variables and eating problems did not differ as a function of differences between women who did versus those who did not rush a sorority. These findings are consistent with the perspective that perhaps women who choose to rush a sorority already have a preoccupation with their body image and an increased interest in achieving the cultural thin appearance ideal. Therefore, if sororities place an emphasis on appearance and the thin ideal, they may be attracting like-minded potential new members. At the University of Colorado Boulder, women tend to rush a sorority at the beginning

of their first semester of their freshman year; commonly, however, the new members do not live in the sorority house until the first semester of their sophomore year. Living in the sorority house is the time when the new members are able to truly integrate themselves into their sorority community. Spending time every day, including sharing meals, with their fellow sorority members perhaps creates more of an impact on the women living in the house, and may be especially influential in regards to their eating habits. Examining eating habits before and after women have lived in the sorority house may provide a stronger test of the impact of sorority involvement on disordered eating behavior.

Longitudinally, there were no systemic differences in level of eating problems at time 1 and time 2. It is noteworthy, however, that the results indicate that there was still variability in the change in eating problems from baseline to follow-up. Using the reliable change index (Jacobson & Truax, 1991) we found that approximately 1 out of 4 women reported change in eating symptoms during this short longitudinal period greater than would be expected by chance, with 9 participants (15.0% of the sample) reporting decreases in eating disorder symptoms and 5 participants (8.3% of the sample) reporting increases in eating disorder symptoms. These findings suggest that although not all women are experiencing changes in eating problems some of them are, which leaves room for examining other risk factors that may leave certain women more vulnerable to the development of disordered eating. Furthermore, 15% of women saw a meaningful decrease in their disordered eating scores which perhaps indicates the effect of some resilience factor. Researchers have tended to focus on predicting increases in eating problems during this developmental period, but the results from the current study suggest it may also be useful to identify characteristics associated with decreasing problems as well. Messages from parents about their daughter's weight or shape may serve as a protective factor of problematic

eating problems in undergraduate college women (Cordero & Israel, 2009) as well as overall high family support (Snapp, Hensley-Choate, & Ryu, 2012). In addition, low levels of perceived importance of achieving the thin-appearance ideal and a positive self-concept have been found to be protective factors for a positive body image among first-year college women (Snapp et al., 2012).

Strengths of this study include the use of well-validated study measures as well as the use of a longitudinal design. The present study also delved more deeply into the contributions of the risk factors, neuroticism and self-esteem, by looking at the unique and shared variance in the associations between these risk factors and participants' disordered eating behaviors. Another strength of the present study was the use of reliable change scores in addition to a comparison of means to examine changes in eating disorder symptoms over time. Limitations of this study pertain to sample characteristics, high participant drop-out rate, and short length of time between baseline and follow-up data collection. Although the sample size of the study was adequate for testing the study hypotheses at baseline ($n = 95$), it may have been underpowered to evaluate predictors of changes in eating problems from baseline to follow-up. Specifically, despite best efforts to maintain maximum participation in this study, 35 participants did not return for follow-up assessment, resulting in a sample of only 60 women at follow-up. Although there were no significant differences between women who did versus those who did not participate in the follow-up, suggesting that there wasn't differential attrition based on sample characteristics, a sample size of 60 people may not have had adequate power for predicting changes in behavior over time. The high attrition may have been because the participants fulfilled their research requirements for their introductory psychology course prior to the follow-up time scheduled for this study, or even just general schedule conflicts the first semester freshman women experienced

as they settled into their new college experience. In addition, most of the sample (86.3%) was White, and it would be important to examine whether the associations between risk factors, sorority involvement, and eating disorder symptoms differ for women who are White relative to those who are members of race or ethnic minority groups. Furthermore, the length of time between baseline and follow-up assessment was only six weeks at its longest point, which may not have been extensive enough for changes in eating behaviors to have occurred. Ideally, assessing participants' eating behaviors over the entire first semester or perhaps even their whole freshman year would have provided time for larger changes in eating problems. Finally, the use of self-report questionnaires to assess each of the study constructs may inflate the associations among variables due to shared method variance.

By obtaining a random sample of college women, we did not recruit very many participants on the extreme ends of the disordered eating risk spectrum. It may be useful for researchers in the future to pre-screen a large group of participants, and select those women that are at the higher end of the risk spectrum as well as those at the lower end of the risk spectrum, and follow those groups over time. The use of a behavioral high risk paradigm such as this may provide a stronger test of the cross-sectional and longitudinal association between risk factors and disordered eating attitudes and behaviors. Future research should also look at multiple risk factors in a longer study, ideally examining changes in eating behaviors across the participant's entire undergraduate career, to more accurately assess the impact of risk factors across the general transition to college, as well as examine how sorority involvement influences disordered eating behavior.

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Table 1

Descriptive Information and Inter-correlations of Study Measures at Baseline

Variables	Mean	SD	2	3
1. Neuroticism	2.85	0.68	-0.83**	0.43**
2. Self-Esteem	3.05	0.54	—	-0.47*
3. EDE-Q	1.39	1.09	—	—

Note: EDE-Q = Eating Disorder Examination Questionnaire

* $p < .05$. ** $p < .01$.

Table 2

*Cross-sectional Association between Sorority Rush Status, Neuroticism, and Eating Disorder**Symptoms*

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Rush	9.53	4.78	2.00	.049
Neuroticism	15.98	4.07	3.93	.001
Rush × Neuroticism	-2.51	7.67	-0.33	.744

Table 3

Association between Sorority Rush Status, Self-Esteem, and Eating Disorder Symptoms

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Rush	9.40	4.65	2.02	.046
Self-Esteem	-19.59	4.85	-4.04	.000
Rush × Self-Esteem	-6.06	9.79	-0.62	.538

Table 4

Longitudinal Association between Sorority Status, Neuroticism, and Eating Disorder Symptoms

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Baseline EDE-Q	.929	.094	9.856	.000
Sorority	.071	.187	.379	.706
Neuroticism	.074	.162	.457	.649
Sorority × Neuroticism	-.008	.284	-.02	.977

Note: EDE-Q = Eating Disorder Examination Questionnaire.

Table 5

Longitudinal association between Sorority Status, Self-Esteem, and Eating Disorder Symptoms

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Baseline EDE-Q	.895	.098	9.168	.000
Sorority	.091	.184	.494	.624
Self-Esteem	-.130	.212	-.611	.544
Sorority × Self-Esteem	-.286	.351	-.815	.419

Note: EDE-Q = Eating Disorder Examination Questionnaire.