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Stability and Change in Patterns of Concerns Related to Eating, Weight, and Shape in Young Adult Women: A Latent Transition Analysis

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Abstract

Although college women are known to be at high risk for eating-related problems, relatively little is known about how various aspects of concerns related to eating, weight, and shape are patterned syndromally in this population. Moreover, the extent to which various patterns represent stable conditions or transitory states during this dynamic period of development is unclear. The current study used latent class and latent transition analysis (LCA/LTA) to derive syndromes of concerns related to eating, weight, and shape and movement across these syndromes in a sample of 1,498 women ascertained as first-time freshmen and studied over four years. LCA identified five classes characterized by: (1) no obvious pathological eating-related concerns (prevalence: 28 to 34%); (2) a high likelihood of limiting attempts (prevalence: 29 to 34%); (3) a high likelihood of overeating (prevalence: 14 to 18%); (4) a high likelihood of limiting attempts and overeating or binge eating (prevalence: 14 to 17%); and (5) pervasive bulimic-like concerns (prevalence: 6 to 7%). Membership in each latent class tended to be stable over time. When movement occurred, it tended to be to a less severe class. These findings indicate that there are distinct, prevalent, and relatively stable forms of eating-related concerns in college women.

Keywords

disordered eating; latent class analysis; latent transition analysis; empirically derived classification; college

Concerns related to eating, weight, and shape (CREWS) are prevalent in young adult women. Research indicates that throughout college many women negatively judge their weight and shape and have difficulty regulating their dietary intake. For example, 72% of college women from six regionally dispersed U.S. campuses reported that “their thighs were too fat,” while only 34% reported that they were happy with their weight (Rozin, Bauer, & Catanese, 2003). Recent prevalence estimates of eating-related behaviors based on college women's self-report suggest that 26% engage in dietary restraint, 21 to 32% binge eat, 9% self-induce vomiting, 6 to 9% misuse laxatives, and 7% misuse diuretics (Celio et al., 2006; Luce, Crowther, & Pole, 2008). The occurrence of CREWS suggests that eating disorders may be prevalent among

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college-aged women. However, research indicates that most college women (e.g., 90%) do not meet current diagnostic thresholds for eating disorders (Cohen & Petrie, 2005), raising questions about how to best conceptualize CREWS in this population. Moreover, the extent to which various patterns represent stable conditions or transitory states during this dynamic period of development is unclear. The current study utilizes prospective longitudinal data to delineate patterns of CREWS over the course of four years in a sample of college-aged women. The major goals of the study are to determine (1) the syndromes that occur among young adult women during the traditional college years and (2) the prevalence and course of these syndromes.

The college years represent a period of high levels for most CREWS, including negative body image, problematic eating attitudes, dietary restraint, and bulimic-like behaviors (Celio et al., 2006; Luce et al., 2008; Rozin et al., 2003). These concerns tend to onset before or during college; thereafter during the college years, they generally persist or increase rather than decrease or remit (Allison & Park, 2004; Cooley & Toray, 2001; Cooley, Toray, Valdez, & Tee, 2007; Delinsky & Wilson, 2008; Graham & Jones, 2002; Klesges, Klem, Epkins, and Klesges, 1991; Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999; Vohs, Heatherton, & Herrin, 2001). However, the existing literature tends to be based on relatively small samples by epidemiologic standards, varied durations of observation, and differing assessment methods, as well as some convenience sampling (e.g., introductory psychology students). It is not surprising then that findings are inconsistent despite some general support for persistent and high levels of concerns. For example, levels of body dissatisfaction remained stable from the freshman year to the junior year in Allison and Park's (2004) sample but increased among the relatively larger samples of freshmen followed by Vohs and colleagues (Vohs et al., 1999; Vohs et al., 2001). Similarly, within the same sample, Striegel-Moore and colleagues (1989) found elevated rates of both stability and onset for dieting, binge eating, and purging. Although many studies have been reported, to our knowledge, none have followed a large, systematically ascertained cohort at frequent intervals over the college years in order to characterize the nature and course of CREWS in a comprehensive and systematic way.

Given the research evidence that most college women (e.g., 90%) do not meet current diagnostic thresholds for eating disorders but many are symptomatic (e.g., 39%, Cohen & Petrie, 2005), how to best conceptualize their CREWS is a critical but open question. Based on current nosology, most CREWS would largely be diagnosed as eating disorder not otherwise specified (EDNOS, American Psychiatric Association, 2000). This grouping is problematic, given the inherent heterogeneity and limited treatment utility of this designation (Fairburn & Bohn, 2005).

Alternatives to current diagnostic systems include empirically derived typologies from cluster analysis, latent class analysis (LCA; for a description of LCA, see Results, page 14), and latent profile analysis (a latent categorical variable technique that is similar to LCA but with continuous indicator variables). Three categories have been repeatedly replicated across these analytic techniques (for other possibilities see Wonderlich, Joiner, Keel, Williamson, & Crosby, 2007). The first categorizes individuals who engage in restriction with varying levels of weight/shape concern but not other disordered eating behavior (referred to as pure restriction hereafter; Bulik, Sullivan, & Kendler, 2000; Clinton, Button, Norring, & Palmer, 2004; Duncan et al., 2007; Kansi, Wichstrom, & Bergman, 2005; Lindeman & Stark, 2001; Mitchell et al., 2007; Sloan, Mizes, & Epstein, 2005; Williamson, Gleaves, & Savin, 1992). A second category specifies individuals who engage in binge eating, at times with weight/shape concern (referred to as binge eating hereafter; Bulik et al., 2000; Clinton et al., 2004; Eddy et al., 2008; Mitchell et al., 2007; Pinheiro, Bulik, Sullivan, & Machado, 2008; Sloan et al., 2005; Striegel-Moore et al., 2005; Sullivan, Bulik, & Kendler, 1998; Williamson et al., 1992). A third category delineates individuals with pervasive bulimic-like concerns, such as restrictive behavior with

binge eating and diverse purging behaviors (e.g., self-induced vomiting, laxative/diuretic abuse, excessive/compulsive exercise; Clinton et al., 2004; Eddy et al., 2008; Keel et al., 2004; Hay, Fairburn, & Doll, 1996; Pinheiro et al., 2008; Striegel-Moore et al., 2005; Turner & Bryant-Waugh, 2004). These categories roughly correspond to the diagnoses of restricting anorexia nervosa (AN), binge eating disorder (BED), and bulimia nervosa (BN) described in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association, 2000), and the International Classification of Diseases, 10th edition (ICD-10; World Health Organization, 1992).

Correspondence between conventional diagnostic categories and empirically-derived typologies is less than perfect because traditional diagnoses often involve behavior frequency and duration requirements (e.g. requiring that purging occurs on average twice a week for three months) and limits on body mass index; in contrast, empirically derived categories often do not impose such thresholds. However, it is not clear from existing evidence that such requirements result in more valid classification. Moreover, empirical approaches potentially identify categories that contain symptomatic individuals who might be viewed as not having an eating disorder using traditional diagnostic systems but yet have clinical validity in the sense that traditional validating criteria (e.g., distress, comorbidity) are associated with the category.

Thus far, studies using empirical approaches to classification (as summarized in the previous paragraph) have primarily focused on samples with eating disorder diagnoses or symptoms (exceptions are provided by Duncan et al., 2007; Kansi et al., 2005; Kristeller & Rodin, 1989; Lindeman & Stark, 2001; Wade, Crosby, & Martin, 2006). Using clinical and disordered samples limits the ability to detect the spectrum of CREWS, including non-restrictive eating and self-judgment not heavily influenced by weight and shape. In addition, clinically ascertained samples are known to have higher rates of comorbidity than population-based samples, biasing the nature and course of most conditions in the direction of greater impairment and more severe courses (e.g., Cohen & Cohen, 1984). Thus, studies utilizing nonclinical samples permit characterization of a broader spectrum of CREWS. For example, Kristeller and Rodin's (1989) identified several unique syndromes, including uninhibited eaters with oversnacking (28%), uninterested eaters (22%), low self-monitors with oversnacking (11%), and high self-monitors (9%) in a nonclinical sample of 186 college students. Such groups have not been identified in clinical samples. In summary, although studies of clinical samples are important for identifying correlates that are likely of great concern for providers in clinical settings and the clients who are treated there, their ability is limited when it comes to characterizing and charting the natural history of variations in CREWS more generally, including instances of non-conformity to existing clinical prototypes.

It is noteworthy that there has been little research on the course of CREWS syndromes identified through empirical means. Such research is necessary to both describe the natural history of these syndromes and provide validating information in its own right. That is, a Kraepelinian approach to diagnosis emphasizes both careful syndromal description and characterization of its longitudinal course (Sher & Trull, 1996) a tradition also embraced by neoKraepelinians (Spitzer, 1983). Existing data indicate that DSM-IV eating disorder diagnoses show differing levels of stability. For example, Eddy and colleagues (2008) found that over seven years more than 50% of individuals with AN transitioned between the restricting and binge eating/purging subtypes and 33% transitioned to BN, but only 14% of individuals with BN crossed over to AN (Eddy et al., 2008). In the only longitudinal study of empirically derived subtypes we were able to identify, Kansi and colleagues (2005) used cluster analysis across seven years and three follow-ups with a representative sample of 623 Norwegian girls (13 to 14 years old at baseline). They identified eight clusters. These clusters appeared to be replicable over time. Of note, they found stability over seven years for patterns of dieting, restrictive symptoms, and mild bulimic symptoms with dieting. In contrast, three

of the identified patterns showed low levels of stability (mild bulimic symptoms, pronounced bulimic symptoms and dieting, and mixed symptoms). In this case, the examination of course information suggests that some categories may better capture stable aspects of eating-related difficulties more than others—an observation that cannot be made in the absence of longitudinal observation and that bears on the clinical relevance of empirically derived groups. Such unstable “diagnoses” could suggest that the derivation of groups has generated clusters that may be too narrow (e.g., should be part of a larger cluster) or reflect more transitory pathology. Thus, examining stability and change of eating-related syndromes provides an opportunity to gauge the chronicity of these conditions (an important validity consideration) and, relatedly, the potential need for intervention.

The Current Study

The current study addresses critical gaps in the literature on CREWS during the college years and the literature on empirically derived classifications of CREWS. Specifically, the study addresses limitations of prior studies by employing a large, unselected sample of college freshmen, surveying them annually over the college years, and using an analytic approach that integrates the study of latent group structure and stability and change in group members. This strategy provides a comprehensive portrait of the prevalence of specific CREWS in the college years, prevalence estimates of empirically-derived syndromes (i.e., latent classes), and estimates of stability and change among these classes. Based on prior research, most women are expected to report relatively stable weight/shape self-judgment and some eating-related concerns. In terms of syndromes, it is hypothesized that the categories that have emerged with some consistency in previous empirically derived classifications will be among the syndromes identified—namely, pure restriction (Limiting), binge eating, and pervasive bulimic-like concerns. A category characterized by no obvious pathological eating-related concerns (NOPE) is also predicted, given the nonclinical nature of the sample. It was also predicted that syndromes associated with eating-related concerns would show higher levels of problem behaviors (e.g., substance use and problems) and personality deviations associated with psychopathology than a group characterized by the absence of such concerns (Trull & Sher, 1994). Finally, based on previous research, it was expected that the empirically derived syndromes of CREWS would show considerable stability over the college years.

Method

Participants

Participants for this study were drawn from a larger study of freshmen at a large Midwestern university. Eighty-eight percent ($N = 3,720$) of all incoming, first-time freshmen for the 2002 fall semester were ascertained at baseline during the summer preceding their matriculation (M age at baseline = 18.0, $SD = 0.37$). Reported sample diversity was limited (89% non-Hispanic white at baseline; 90% at each follow-up) but representative of the university population (University of Missouri-Columbia, 2002). Further details of the broad study sample have been previously reported (Sher & Rutledge, 2006). Fifty-four percent ($n = 1,993$) of the baseline sample were women. The current sample consisted of 1,498 (75% of baseline) women who completed at least two of four follow-up surveys assessing CREWS. For the four follow-up time points, 1,430 women (95% of the study sample; 72% of baseline), 1,409 women (94% of the study sample; 71% of baseline), 1,348 women (90% of the study sample; 68% of baseline), and 1,238 women (83% of the study sample; 62% of baseline) participated, respectively.

Procedure

Participants were recruited prior to matriculating during on-campus summer freshman orientation. Incoming freshmen who did not attend on-campus orientation were also invited to

participate through mailings. All incoming freshmen were invited to participate. Following informed consent (assent and parental consent if under age 18), participants reported on their CREWS online near the end of the fall semester of the first year following university enrollment (approximately mid-November, with the fall semester ending mid-December) and near the end of the spring semester of the second, third, and fourth year following university enrollment (approximately mid-April, with spring semester ending mid-May).

In general, the reporting of health-related behaviors appears to be highly similar across paper-and-pencil and electronic (PC and PDA) formats (Gwaltney, Shields, & Shiffman, 2008). With respect to CREWS items in particular, electronic versions of a variety of measures have demonstrated strong psychometrics, paralleling their paper-and-pencil versions (Ferrer-Garvia & Gutierrez-Maldonado, 2008). In fact, some research suggests that computerized administration may improve their psychometrics (Gomez-Peresmitre, Granados, Jauregui, Pineda Garcia, & Tafoya Ramos, 2000). Differences may be more likely to arise when the electronic administration occurs in the context of ecological momentary assessment. This format has been compared with the “gold standard” Eating Disorder Examination interview; findings indicate that electronic assessment may yield lower (but potentially more accurate) estimates of CREWS (Stein & Corte, 2003).

Institutional Review Board approval and informed consent (participant assent and parental consent if under age 18) were obtained prior to each follow-up. Participants were compensated at each measurement occasion (from \$10 to \$25) with chances to win additional compensation through a lottery.

Measures

The Eating Disorder Diagnostic Scale (EDDS; Stice, Telch, & Rizvi, 2000) provided the basis for the CREWS items. Multiple studies support the EDDS's validity and reliability (e.g., content validity, criterion validity, convergent validity, internal consistency, predictive validity, test-retest reliability; Stice et al., 2000; Stice, Fisher, & Martinez, 2004). Similar single-item indicators are used in diagnostic algorithms. Specific items were selected as the most critical to include to examine CREWS within a large etiological study.

Alpha coefficients for a seven-item composite scale using the EDDS items in this study ranged from .67 to .73 across the four waves. These alpha coefficients reflect similar mean inter-item correlations that would lead to alpha coefficients reported by Stice and colleagues for their 20-item scale (.86 to .93). For example, assuming the same inter-item correlation for the 7-item composite and a 20-item composite, our data imply alphas ranging from .85 to .93—almost exactly those reported by Stice et al. (2000; 2004). In addition, the CREWS classes produced based on the EDDS items demonstrated evidence of validity, with graded association to measures of distress and personality, such as neuroticism. This is similar to Stice and colleagues' (2004) validity analyses linking EDDS-identified bulimia nervosa to greater elevations in depressive symptoms and temperamental emotionality relative to EDDS-identified non-cases. Together, these findings bolster our confidence in the psychometric properties of these items when administered online rather than via paper and pencil.

Weight/shape self-judgment—The influence of weight and shape on self-judgment (“Judgment”) was assessed by asking “Over the last 3 months, has your weight or shape influenced how you think about (judge) yourself as a person?” This item combined the EDDS items “Has your weight influenced how you think about (judge) yourself as a person?” and “Has your shape influenced how you think about (judge) yourself as a person?” Participants responded on a six-point Likert-type scale, from “Not at all” to “Extremely.” Participants could also endorse the response “I choose not to answer.” Responses were dichotomized using a median split (0-3 vs. 4-6).¹

Limiting attempts—Attempts to limit intake (“limiting attempts”) were measured by asking “Over the last 3 months, to what extent have you been deliberately trying to limit the amount or type of food or calories you eat to influence your weight or shape?” This behavior is not measured on the EDDS but was included to provide a measure of limiting attempts (a behavior typically included in empirically derived eating-related classifications) in a single-item format similar to the items based on the EDDS. Participants responded on a six-point Likert-type scale, from “Not at all” to “Extremely.” Participants could also endorse the response “I choose not to answer.” Responses were dichotomized using a median split (0-3 vs. 4-6).

Fasting, overeating, binge eating, self-induced vomiting, and laxative and diuretic abuse—These behaviors were measured by asking participants to “think about the past 3 months” and report “on average, how many times per week” they “fasted (not eaten any food at all, meals or snacks, for at least 8 waking hours) to prevent weight gain or to counteract the effects of eating,”² “eaten what other people would regard as an unusually large amount of food,” “experienced a loss of control (with respect to eating) while eating a large amount of food,” made themselves “vomit to prevent weight gain or to counteract the effects of eating,” and “used laxatives or diuretics to prevent weight gain or to counteract the effects of eating,” respectively. Response options were “0 times,” “1 time,” “2 times,” “3 times,” “4 times,” “5 times,” “6 times,” “7 times,” “8 times,” “9 times,” “10 times,” “11 times,” “12 times,” “13 times,” “14+ times,” and “I choose not to answer.” Responses were dichotomized using a median split (0 vs. 1-14+).

Validation measures—Based on validation analyses from previous empirical typology studies (e.g., Keel et al., 2004; Duncan et al., 2007), several additional variables assessed at the first-year fall semester were examined to evaluate evidence for the construct validity of the derived classes. These variables included self-reported ethnicity and body mass index (BMI) calculated from self-reported height and weight. General level of distress, on average over the past week, was measured using the Brief Symptom Inventory-18 (BSI-18; Derogatis, 2001, omitting the suicidality item; Cronbach's coefficient alpha = 0.92). General self-efficacy and internal locus of control were measured using an overall score from the Personal Mastery Scale (Pearlin & Schooler, 1978; Cronbach's coefficient alpha = 0.80). Past-week positive affectivity was measured by the sum of 10 positive affect items (interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, active; Cronbach's coefficient alpha = 0.93) from the Positive and Negative Affect Scale (PANAS; Watson & Clark, 1988). Four substance-related indices were used: past-month frequency of smoking, past-month frequency of consuming five or more drinks in a sitting, number of alcohol-related consequences in the past year (out of 37 possible; Cronbach's coefficient alpha = 0.86), and number of drug-related consequences in the past year (out of 37 possible; Cronbach's coefficient alpha = 0.88). Personality traits consisted of Neuroticism, Extroversion, Openness, Conscientiousness, and Agreeableness from the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1989;

¹There was concern that participants may have misinterpreted the phrasing of at least some of the items. This concern was raised by endorsements of “14+ times” for average weekly fasting (not eaten any food at all, meals or snacks, for at least 8 waking hours). This level of fasting would have required participants to have followed a very rigorous pattern (e.g., eaten upon waking, then fasted for eight waking hours, then eaten, then fasted for another eight waking hours) for seven days in a row for three months. Although this is possible, an alternative explanation of the endorsements is that participants were reporting the average number of times they fasted over the entire previous three months rather than the average number of times they fasted on a weekly basis over the previous three months. In case the latter was the cause of the endorsements and the scale participants were using for reporting differed (i.e., average times per week for the past three months vs. average times for the past three months), the decision was made to dichotomize according to a median split. The decision to dichotomize was further informed by the skewed nature of the data. As described by Bauer and Curran (2003), such distributions could produce spurious classes if analyzed continuously (e.g., using latent profile analysis).

²This contrasts with the definition of fasting on the EDDS. The EDDS defines fasting as skipping at least two meals in a row. This and other small phrasing changes were based on consultation with eating disorder experts. The fasting item in particular was changed to be consistent with the definition used on the Eating Disorder Examination—the gold standard in the field for the assessment of eating disorder symptoms (based on the recommendation of Anna Bardone-Cone).

Cronbach's coefficient alpha = 0.86, 0.80, 0.72, 0.84, and 0.77 respectively) and novelty seeking (Cronbach's coefficient alpha = 0.71) from Sher and colleagues' (1995) shortened version of the Tridimensional Personality Questionnaire (Novelty Seeking; STPQ; Cloninger, 1987).

Results

Attrition

Attrition analyses were conducted on ten potentially relevant variables assessed at baseline, prior to matriculation. Specifically, the 1,498 participants included in the current study were compared to the 495 women who were part of the larger study at baseline but did not complete at least two follow-up assessments containing the CREWS items. On seven of the eleven variables examined (age, ethnicity, overall health, frequency of eating healthy, frequency of exercising, and past-year frequency of amphetamine use and cocaine use) there were no differences between those who attrited and those who did not ($ps > .05$). However, on four items—frequency of alcohol use (Cohen's $d = 0.30$), frequency of heavy alcohol use (Cohen's $d = 0.31$), frequency of smoking cigarettes (Cohen's $d = 0.32$), and frequency of marijuana use (Cohen's $d = 0.16$)—attrition was linked to more substance involvement ($ps < .05$). This pattern of attrition indicates that those women with heaviest substance involvement showed a modest tendency to not participate in the follow-up surveys. However, given the overall lack of strong attrition effects, we do not believe attrition likely biased our findings to a great degree.

Prevalence Estimates of Concerns Related to Eating, Weight, and Shape

Table 1 reports the prevalence estimates of specific CREWS. To examine item prevalence across years, generalized estimating equation models were used. Consistent with prediction, most women reported some CREWS. Judgment and limiting attempts were most prevalent, followed by overeating, binge eating, fasting, and purging. Statistically significant change across waves was found for overeating (quadratic: $\beta = -.06$, $p < .01$), binge eating (linear: $\beta = .44$, $p < .01$; quadratic: $\beta = -.14$, $p < .01$), fasting (linear: $\beta = -.14$, $p < .01$), and laxative/diuretic abuse (linear: $\beta = .40$, $p < .05$; quadratic: $\beta = -.10$, $p < .05$), but not for judgment, limiting attempts, or purging ($ps > .05$).

Syndromes of Concerns Related to Eating, Weight, and Shape

Latent class analysis, using MPlus version 5.1 (Muthén & Muthén, 1998-2007) was used to estimate latent class structure. LCA aims to characterize the number and composition of unobserved latent classes underlying the observed data. LCA generates class membership probabilities (i.e., the likelihood of being in a given class) and item endorsement probabilities for each class in a model. Each latent class represents a distinct profile of item endorsement probabilities (i.e., the likelihood of endorsing an item given membership in a class) that is the same for all members of the class, although individuals within a class may actually differ in probability of item endorsement (e.g., because of measurement error; McCutcheon, 1987).

To determine the number of latent classes that best account for variation in the patterning of concerns related to eating, weight, and shape the Bayesian Information Criterion (BIC; Schwarz, 1978) was used as a measure of goodness of fit. The BIC is the most commonly used fit index in the context of mixture models (see Dasgupta & Raftery, 1998; Fraley & Raftery, 1998; Law, Figueirdo, & Jain, 2004; Martinez & Martinez, 2005; McLachlan & Peel, 2000; Raftery & Dean, 2006) and is often used as the primary measure of fit in latent structure studies of CREWS (e.g., Myers et al., 2006; Striegel-Moore et al., 2005; Wonderlich et al., 2005).

Analyses in MPlus were based on all participants who completed at least two of the four waves of data collection and therefore include some missing data. MPlus uses full information

maximum likelihood estimation and assumes that items are missing at random. In addition, MPlus requires a minimum proportion of non-missing data for variables and pairs of variables to ensure adequate coverage for convergence of the models. We conducted ancillary analyses using listwise deletion. These analyses yielded the same pattern of results as when all data were used. Consequently, LTA data from all participants using full information maximum likelihood estimation are reported here.

BIC indicated that the best fitting model consisted of five classes (see Table 2 for a summary of the BIC statistic). Each of the predicted classes emerged: a class with no obvious pathological eating-related concerns (NOPE), a pure restriction class, a class characterized by a high likelihood of binge eating, and a pervasive bulimic-like concerns class (see Table 3 for item endorsement probabilities). The pure restriction class (Limiting) was characterized by a high likelihood of limiting attempts. The class with a high likelihood of binge eating (Overeating/Binge Eating) had an even higher likelihood of overeating. In other words, this class combined the behavior of overeating without loss of control and overeating with loss of control (binge eating). A fifth class (Limiting with Overeating/Binge Eating; LOBE) combined a high likelihood of overeating or binge eating with a high likelihood of limiting attempts.

To examine whether classification changed when including BMI, the analyses were also conducted with BMI included as a dichotomous indicator variable ($0 = \leq 17.5$; $1 = >17.5$, consistent with the ICD-10 thresholds for anorexia nervosa). Including BMI reduced the clarity of the solutions, with two years supporting a four-class solution and two years supporting a five-class solution. The four-class solution replicated four of the classes produced when BMI was not included (NOPE, Limiting, LOBE, and Pervasive Bulimic-Like Concerns). The meaningfulness of the fifth class was questionable (with high likelihoods of all eating-related concerns except limiting and a low likelihood of weight/shape self-judgment). The more clearly interpretable results for the analyses without BMI are, therefore, presented.

Table 3 reports the latent class prevalence estimates at each year. Although there was statistically significant variation over time for four of five classes, overall, the prevalence of each class tended to remain similar over time. Specifically, the prevalence of the NOPE class ranged from 28 to 34% (linear: $\beta = .08$, $p < .01$). Similarly, the prevalence for Limiting was 29 to 34% (linear: $\beta = -.21$, $p < .01$; quadratic: $\beta = .06$, $p < .01$). For Overeating/Binge Eating, the prevalence ranged from 13 to 17% (linear: $\beta = .24$, $p < .01$; quadratic: $\beta = -.10$, $p < .01$). Likewise, the prevalence of LOBE was 14 to 17% (quadratic: $\beta = -.04$, $p < .05$). Pervasive Bulimic-Like Concerns was the least prevalent and most stable class (6 to 7%; *n.s.*).

Validation Analyses of the Syndromes of Concerns Related to Eating, Weight, and Shape

In order to examine differences among baseline (year 1) latent classes on variables associated with problem behaviors and personality variation (Table 4), one-way analyses of variance (ANOVAs) were conducted on 14 relevant variables that were available in the data set. Post hoc comparisons between classes were evaluated using the Ryan-Einot-Gabriel-Welsch multiple range test (Milligan & Cooper, 1988). Overall, classes characterized by CREWS were associated with greater substance involvement, impulsivity, and negative affectivity and lower positive affectivity and feelings of competence compared to the NOPE class. Classes with the most extreme CREWS (e.g., Pervasive Bulimic-Like Concerns; LOBE) demonstrated extremes for substance involvement and personality deviation compared to classes with less severe CREWS. Classes with different configurations of concerns but similar numbers of concerns (specifically, the Overeating/Binge Eating class and the Limiting class) showed similar associations with the external validators. All of the classes were statistically indistinguishable on extraversion and openness. These findings suggest that although the latent classes vary in their configuration of CREWS, they can be linked to severity according to the

number of concerns they are characterized by (from NOPE to both the Overeating/Binge Eating class and the Limiting class to LOBE to Pervasive).

Ethnicity prevalence was differentially associated with class ($X^2(16, N = 1498) = 36.34, p = .003$; see Table 5). Specifically, participants who identified as non-Hispanic Black were overrepresented in the NOPE class and underrepresented in the LOBE and Pervasive classes compared to other ethnicities.

Movement among Syndromes of Concerns Related to Eating, Weight, and Shape

In order to characterize the transitions across latent classes over time, latent transition analyses (LTA) were conducted. LTA is a technique for estimating the transition probabilities of moving or staying in a given latent class across measurement occasions. As with LCA, LTA divides a population into mutually exclusive and exhaustive latent classes. Utilizing the latent class structure identified in the LCA, LTA provides an overarching data analytic framework that can utilize information from all observation periods to estimate a single class structure and the likelihood of moving from one latent class to another across temporally adjacent measurements. In this way, the probabilities of transitioning between latent classes can be estimated—specifically for this study, transitions from the first-year fall semester to the second-year spring semester, the second-year spring semester to the third-year spring semester, and the third-year spring semester to the fourth-year spring semester were estimated. That is, at each time point, LTA estimates the proportion in each class and the probability of being in a particular latent status at Time T, conditional on latent status membership at Time T-1 (Collins et al., 1994; Collins & Wugalter, 1992).

With five classes and four time points, 625 (5^4) transition patterns based on most likely class membership were possible. 143 of these 625 patterns were observed. Twenty-four of these patterns were followed by 10 or more participants and characterized 80% of participants.

Stability was quite high (see the diagonals of Table 6 for the probability of maintaining a latent status). In total, 54% of participants maintained their original class each of the four years. When individuals transitioned to a different class, they typically transitioned only once. When this occurred, transitions tended to reflect a change in only one behavior (e.g., the loss of elevated limiting attempts in the transition from LOBE to Overeating/Binge Eating; the addition of limiting attempts in the opposite direction). Furthermore, when movement occurred, it tended to be to a less severe class (e.g., from Limiting to NOPE; from LOBE to Limiting; see Table 6). The more infrequently observed transitions to more severe classes primarily involved movement from NOPE to Limiting and movement from Limiting or Overeating/Binge Eating to LOBE.

Because the LTA studied patterns of change from one year to the next, we conducted an additional analysis that involved the two waves most temporally distant, the fall of the first year and the spring of the fourth year, to see if this longer interval yielded less stability and more change. In general, the patterns observed over 3.5 years were highly similar to those observed over one. 64% remained in the same class and when movement occurred, it usually involved change in only one behavior (e.g., LOBE to Overeating/Binge Eating).

Discussion

Although there has been increasing attention to empirical approaches to classify clinically relevant concerns related to eating, weight, and shape (CREWS), existing data are based primarily upon clinical samples, restricting the lower end of problems likely to be observed. Moreover, the overwhelming majority of this research is based on cross-sectional snapshots of CREWS and fails to establish the degree to which these groups or syndromes represent

stable or transitory phenomena. Using a large cohort of undergraduate women followed over the college years, the current study recovered a latent class structure of CREWS that replicated, in many key respects, structures found in diverse patient and nonpatient samples. These individual classes that were found demonstrated associations with etiologically and clinically relevant covariates and relatively high stability over four measurement occasions over four years.

The Prevalence of Individual Concerns over the College Years

Examining the timing of trends for specific behaviors in relation to each other suggests potential insights about etiology, such as differential periods of vulnerability for different syndromes. For the current sample, patterns in prevalence trends for binge eating and purging are of particular interest, given that emerging adulthood has been identified as the period of most likely onset for bulimia nervosa (BN) and binge eating disorder (BED; Mussell et al., 1995; Wade et al., 2006). The patterns observed indicate that when binge eating increased in prevalence (slightly during the second and third years), purging did not increase to the same degree in tandem. This suggests that during the traditional college years, variants of BED (which does not include purging) may be more likely to emerge than variants of BN (which combines binge eating and compensatory behavior, such as purging). This parallels previous prevalence patterns (e.g., Hudson, Hiripi, Pope, & Kessler, 2007) and is in line with research indicating that purging may more strongly drive binge eating rather than vice versa (Byrne & McLean, 2002).

Consistent with previous research (e.g., Ackard, Croll, & Kearney-Cooke, 2002; Ackard, Fulkerson, & Neumark-Sztainer, 2007; Aibel, 2003), weight/shape self-judgment and limiting attempts were consistently the norm in our collegiate sample although fasting was less common in these women. Furthermore, compared to limiting attempts, prevalence estimates for fasting decreased to a greater degree over the college years. Although sample dissimilarity tempers the potential comparability of findings from the literature, the current results parallel research indicating that strict dieting and fasting are less common (e.g., 1.6% in a large Australian community sample; Hay, 1998) than dietary restraint coupled with disinhibition (e.g., 20.7% overall for a large Floridian sample; 18.9% for college students in this sample; 21.5% for same-age non-college students; Rand & Kulda, 1991). Longitudinal work by Heatherton, Keel, and colleagues (Heatherton, Mahamedi, Striepe, Field, & Keel, 1997; Keel, Baxter, Heatherton, & Joiner, 2007) suggests that the decreasing trend will continue post-graduation, with fasting prevalence estimates for women of only 6.5% at 10-year follow-up and 6% at 20-year follow-up (compared to 20% at baseline (freshman year for half the sample; senior year for the other half)).

Syndromes of CREWS: Implication for a Nosology of Eating-Related Concerns and Issues

While patterns in individual concerns are of public health and clinical importance in their own right, there are a number of ways that distinct CREWS could be combined, and simply charting individual symptoms' courses provides limited insight into symptom configurations likely to be observed. These combinations or "mixtures" were identified through latent class analysis (LCA). LCA grouped CREWS into five classes: a small class with no obvious pathological eating-related concerns (NOPE), a pure restriction class (Limiting, characterized by a high likelihood of limiting attempts), a binge eating class (Overeating/Binge Eating), a class resembling bulimia nervosa (termed Pervasive Bulimic-Like Concerns), and a class characterized by both limiting attempts and overeating or binge eating (LOBE).

It is noteworthy that, from a latent class perspective, lack of CREWS was relatively uncommon and the NOPE group represented a minority of the sample. In other words, latent classes characterized by one or more CREWS were the norm. Given what we know about the low

prevalence of DSM eating disorders in college samples (Cohen & Petrie, 2005), it is likely that most of our participants who were classified as belonging to one of the four latent classes characterized by CREWS would not have been diagnosed with a DSM-IV eating disorder. Given that membership in these classes tended to be stable and associated with clinically relevant covariates, it is reasonable to propose that current diagnostic convention fails to resolve some forms of milder eating-related problems.

Consistent with the pattern found for individual concerns, weight/shape self-judgment and limiting attempts were consistently the norm in the classes characterized by CREWS. For example, the combined prevalence estimates for the latent Limiting and LOBE class ranged from 46 to 49% annually. In contrast, fasting was less likely in the classes that were observed and a class primarily characterized by a high likelihood of fasting was not recovered. This is consistent with the finding that, despite widespread dieting, few women (e.g., 0.78%, Wade, Bergin, Tiggemann, Bulik, & Fairburn, 2006) are diagnosable with restricting AN or restrictive EDNOS (i.e., disorders with extreme limiting behavior).

Overeating/binge eating was often linked to limiting attempts (in the LOBE class) and was relatively common. This may reflect a cycle between limiting attempts and overeating or binge eating as described by theories of BN (Fairburn, Cooper, & Shafran, 2003) and moderately supported by research on BED (e.g., Kinzl, Traweger, Trefalt, Mangweth, & Biebl, 1999). The likelihood of endorsing binge eating was less than the likelihood of endorsing overeating in the LOBE class. This suggests that the class combined both binge eaters and overeaters. This likely explains the prevalence estimates of the class, which are higher than those that have been reported for BED (e.g., 4% for lifetime sub-threshold or full-threshold, Hudson et al., 2007).

Construct validation analyses that examined the clinical and personality correlates of class membership suggested a continuum of severity among the classes, from NOPE to the Overeating/Binge Eating class and the Limiting class, then LOBE, and finally, Pervasive Bulimic-Like Concerns. This ordering was supported by graded associations to both substance involvement and personality. This pattern is consistent with the general trends in previous studies using LCA (e.g., Duncan et al., 2007; Keel et al., 2004). For example, Duncan and colleagues' (2007) classes (from Unaffected to Low Weight to Weight Concerned and Dieting to Eating Disorder) evidenced graded associations with substance involvement, suicidality, and depression. Similarly, for personality, Keel and colleagues' (2004) most pervasively pathological disordered eating class (characterized by restriction, binge eating, and multiple purging methods) also had the greatest level of harm avoidance and neuroticism and the lowest level of self-directedness (the tendency to not view the self as autonomous), while their more moderate class resembling BN (with purging limited to self-induced vomiting) had comparatively moderate personality elevations.

Findings related to ethnicity add to the limited research on this topic in empirical syndromes of CREWS. While the current study found that participants who identified as non-Hispanic Black were overrepresented in the NOPE class, African American participants in Duncan and colleagues' (2007) LCA were more likely to be assigned to Low Weight Gain, Weight Concerned, and Dieter classes than Unaffected and Eating Disorder classes. Another discrepancy with previous literature emerged related to binge eating. That is, in the current study, participants identifying as non-Hispanic Black were underrepresented in the LOBE class (characterized by overeating or binge eating and limiting). In contrast, Striegel-Moore and colleagues' (2005) LCA assigned more African American women than white women to their binger class. Given that our own sample is drawn from a Midwestern university campus where close to 90% of the students are of European descent, it is admittedly not an optimal one for studying ethnic correlates of eating related concerns and further research is thus warranted to clarify prevalence differences related to ethnicity.

Stability

Although there have been a number of studies of empirically derived eating syndromes, there has been relatively little work that has systematically examined the course (i.e., stability and change) of these syndromes even though, in the Kraepelinian tradition, course information is considered central in establishing “diagnostic” classes (i.e., “prognosis is diagnosis”). Of note, membership in the classes observed was highly stable over time. These findings suggest that CREWS do not typically resolve or remit during the traditional college years. However, when movement occurred, it tended to be toward a less severe class (e.g., LOBE to Limiting or Binge Eating/Overeating; Limiting to NOPE). This finding is somewhat in conflict with previous findings that eating concerns are more likely to emerge than to abate over the freshman year (Striegel-Moore et al., 1989) but is more in line with decreasing trends from extensive follow-up (e.g., 10 to 20 years; Heatherton et al., 1997; Keel et al., 2007).

When movement from the ostensibly least affected, NOPE class occurred, it tended to be to Limiting. This is consistent with previous research indicating that during college dieting onset is much more prevalent than the onset of binge eating or purging. For example, in Striegel-Moore and colleagues' (1989) sample, the prevalence estimate for dieting onset by the end of the freshman year was 64% for women, compared to 25% for binge eating and 4.5% for purging.

Strengths and Limitations

The current study has a number of significant strengths. In particular, its comprehensive sampling during the college years provides unique information on empirically derived syndromes of CREWS for this nonclinical but potentially high-risk population of women. However, this study has a number of limitations worth noting. First, the current study is limited by its reliance on individual self-report items. Future work could benefit from multi-item measures and measures that do not rely solely on self-report, particularly given the recent debate on whether self-report measures assess actual dieting (see Stice, Fisher, & Lowe, 2004; Stice, Presenell, Lowe, & Burton, 2006; van Strien, Engels, van Staveren, & Herman, 2006). In general, using multiple methods is recommended for establishing validity (Campbell & Fiske, 1959; Dumenci, 2000), corroborating findings, and revealing inconsistencies (e.g., with self-report vs. reports from informants; Sher & Trull, 1996). Research with community samples and clinical samples indicates that estimates may be lower if they were based on interview, namely, the Eating Disorder Examination (EDE, e.g., Grilo, Masheb, & Wilson, 2001a; 2001b; Wilfley, Schwartz, Spurrell, & Fairburn, 1997), in particular for binge eating (Binford, le Grange, & Jellar, 2005; Fairburn & Beglin, 1994). Replication with more formal assessment of eating disorder symptoms is thus warranted (e.g., using the EDE), along with more thorough, formal assessment of clinical impairment and Axis I and II comorbidity (e.g., using the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, First, Spitzer, Gibbon, & Williams, 2002; and Structured Interview for DSM-IV Personality, Pfohl, Blum, & Zimmerman, 1997). Another potential limitation is bias from attrition, with 25% of the current sample not participating in the final assessment for the current study. However, attrition analyses suggest that bias was minimal and predominantly related to substance use/abuse, not CREWS.

Clinical Implications and Future Directions

Although the ultimate clinical relevance of the findings reported here awaits future data on the association of our classes with various correlates not assessed in the current study (including DSM syndromal diagnoses of eating and other disorders, assessed via formal means), there are several clear clinical implications of our findings. Perhaps most critically, the high stability of class membership suggests that intervention may be indicated to alter women's CREWS during the college years. This conclusion is tentative, given that treatment-seeking was not assessed

and it is not clear if existing treatments would be especially helpful for the conditions identified. Also, intervention may not be necessary if individuals are not significantly negatively impacted emotionally, physically, or functionally by their CREWS or if they are benefiting more than they are experiencing harm. For example, limiting has at times been shown to help reduce binge eating (e.g., de Zwaan et al., 2005) and so it may be difficult to anticipate possible “unintended consequences” of ostensibly “successful” treatments.

Perhaps the most important implications concern relevance for revision to the DSM. One of the primary areas receiving attention for revision is the category of EDNOS (deAngelis, 2009; Fairburn & Cooper, 2007; Wilfley, Bishop, Wilson, & Agras, 2007). This heterogeneous diagnosis currently includes BED. This study's Binge Eating/Overeating and LOBE classes bolster support for a syndrome predominantly characterized by binge eating. In addition, it suggests possible subtypes. Specifically, the grouping of binge eating with overeating (in Binge Eating/Overeating and LOBE) and limiting (in LOBE) suggests a syndrome of Overeating with subtypes distinguished by loss of control and limiting: Overeating only, Overeating with Limiting, Overeating with Loss of Control (Binge Eating only), and Overeating with Loss of Control (Binge Eating) and Limiting. This possibility is tentative, given the mounting empirical support for BED being distinct from overeating (Striegel-Moore & Franko, 2008). However, there is some evidence that, for some, overeating may resemble binge eating in terms of subjective experience (Telch, Pratt, & Niego, 1998) and clinical covariates (Antonuccio, Tasca, & Bissada, 2003) or be a stage in the syndrome (Eldredge & Agras, 1996).

The identification of the Pervasive Bulimic-Like Concerns class, consistent with previous empirically derived nomenclature (Clinton et al., 2004; Eddy et al., 2008; Keel et al., 2004; Hay et al., 1996; Pinheiro et al., 2008; Striegel-Moore et al., 2005; Turner & Bryant-Waugh, 2004), raises the possibility that differentiating between BN with purging only through self-induced vomiting and BN characterized by multiple purging methods may be warranted. This specific distinction has been found by multiple research groups (Eddy et al., 2008; Keel et al., 2004) and the more severe syndrome has been linked to particularly high distress and comorbidity by Keel and colleagues (2004). Likewise, current results point to higher elevations of substance involvement and personality deviation with multiple CREWS. This suggests that a diagnostic subtype characterized by multiple purging methods would carry clinical value, an important criterion when considering diagnostic revisions (Walsh, 2007). Furthermore, conceptualizing this potential subtype as multi-impulsive (i.e., with impulsivity beyond CREWS, e.g., severe alcohol abuse or dependence, other drug abuse, sexual promiscuity, stealing, self mutilation, and suicidal gestures) may be most valuable (Myers et al., 2006).

More broadly, the current findings support recommendations by some researchers to use behaviors as the primary basis for grouping rather than frequency, duration, and weight (Anderson, Bowers, & Watson, 2001; Williamson, Gleaves, & Stewart, 2005). According to Anderson and colleagues (2001), grouping together individuals based on anorexic vs. bulimic symptoms, without imposing severity restrictions, would substantially reduce the number of cases relegated to the category of EDNOS. For example, in their sample, only 18% of the original EDNOS group remained after reclassifying individuals using this approach.

The current findings lay the groundwork for several future directions, including examining predictors of transition (e.g., sorority involvement, BMI/weight change, drinking behavior) and conducting longer, post-graduation follow-up. It would also be interesting to include affect and emotion in the models to see whether they further distinguish women with certain eating-related concerns as done by cluster analyses (e.g., emotional dieters vs. non-emotional dieters, Lindeman & Stark, 2001), particularly with negative affect/depressed mood and dieting in the context of BN (Chen & le Grange, 2007; Grilo, Masheb, & Berman, 2001; Grilo, Masheb, &

Wilson, 2001c; Stice & Agras, 1999) and BED (e.g., Grilo et al., 2001c; Stice, Agras, Halmi, Mitchell, & Wilson, 2001).

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Table 1
Prevalence Estimates of Weight, Shape, and Eating-Related Concerns across the Four Traditional College Years

Concern	Fall 1 st Year <i>N</i> = 1,423-1,429	Spring 2 nd Year <i>N</i> = 1,403-1,408	Spring 3 rd Year <i>N</i> = 1,339-1,346	Spring 4 th Year <i>N</i> = 1,217-1,234
	% (<i>SE</i>)			
Weight/Shape Self-Judgment	54.5 (1.32)	52.3 (1.33)	52.4 (1.36)	53.7 (1.42)
Limiting Attempts	53.3 (1.32)	52.7 (1.33)	50.2 (1.36)	50.6 (1.42)
Overeating	52.1 (1.32)	51.6 (1.33)	50.9 (1.37)	43.7 (1.42)
Binge Eating	21.4 (1.09)	28.8 (1.21)	26.0 (1.20)	22.6 (1.20)
Fasting	18.2 (1.02)	17.5 (1.01)	14.5 (0.96)	12.3 (0.94)
Self-Induced Vomiting	7.0 (0.68)	7.9 (0.72)	8.1 (0.75)	7.3 (0.74)
Laxative/Diuretic Abuse	4.3 (0.54)	5.3 (0.60)	5.8 (0.64)	5.2 (0.64)

Table 2
Summary of the Bayesian Information Criterion Fit Statistic for Two- to Seven-Class Solutions at Each of the Four College Years

	2-Class	3-Class	4-Class	5-Class	6-Class	7-Class
Fall 1 st Year	10,615.535	10,452.731	10,405.292	10,401.677	10,430.119	10,461.304
Spring 2 nd Year	9657.915	9426.178	9330.584	9316.307	9334.342	9375.065
Spring 3 rd Year	9153.779	8942.152	8856.194	8862.594	8884.252	8908.094
Spring 4 th Year	8180.031	7976.767	7911.88	7900.682	7917.600	7958.917

Table 3
Item Endorsement Probabilities According to Class Membership and Prevalence Estimates of the Classes

Class	Item						Time Point				
	Judging	Limiting	Overeating	Binge Eating	Fasting	Vomiting	Laxatives/Diuretics	Fall 1 st Yr	Spring 2 nd Yr	Spring 3 rd Yr	Spring 4 th Yr
	IEP	IEP	IEP	IEP	IEP	IEP	IEP	IEP	Prevalence (SE)		
NOPE	.110	.115	.163	.007	.020	.002	.000	.28 (1.16)	.29 (1.18)	.30 (1.18)	.34 (1.22)
Limiting	.847	.847	.291	.077	.172	.040	.032	.34 (1.22)	.29 (1.17)	.31 (1.19)	.32 (1.20)
Overeating/Binge Eating	.252	.203	.886	.289	.041	.015	.010	.17 (0.97)	.18 (0.99)	.18 (0.98)	.13 (0.86)
LOBE	.930	.874	.974	.772	.239	.068	.032	.15 (0.93)	.17 (0.96)	.15 (0.92)	.14 (0.89)
Pervasive Concerns	.827	.842	.809	.767	.800	.714	.507	.6 (0.62)	.7 (0.67)	.7 (0.66)	.7 (0.67)

Note. Judging = weight/shape self-judgment. Limiting = limiting attempts. Vomiting = self-induced vomiting. Laxatives/Diuretics = laxative/diuretics abuse. IEP = item endorsement probability. NOPE = No Obvious Pathological Eating-related concerns. LOBE = Limiting with Overeating/Binge Eating.

Table 4
Reported Ethnicity Percentages Within Latent Classes for the First-Year Fall Semester (N = 1,498)

	NOPE (28%, n = 421)	Limiting (34%, n = 504)	Overeating/Binge Eating (17%, n = 252)	LOBE (15%, n = 230)	Pervasive (6%, n = 91)
	Row % (n)				
White, non-Hispanic (88.5%, n = 1,326)	27.2 (361)	33.3 (442)	17.0 (225)	15.8 (209)	6.7 (89)
Black, non-Hispanic (5.8%, n = 87)	44.8 (39)	39.1 (34)	11.5 (10)	4.6 (4)	0.0 (0)
Hispanic (1.5%, n = 23)	17.4 (4)	39.1 (9)	17.4 (4)	21.7 (5)	4.4 (1)
Asian (3.5%, n = 53)	22.6 (12)	34.0 (18)	22.6 (12)	20.8 (11)	0.0 (0)
American Indian (0.6%, n = 9)	55.6 (5)	11.1 (1)	11.1 (1)	11.1 (1)	11.1 (1)

Note. Bolded percentages indicate that the cell chi-square was greater than 4, indicating higher/lower than expected n's.

Table 5
Means (SD) of Validity Measures Within Latent Classes for the First-Year Fall Semester ($N = 1,498^f$)

	NOPE (28%) $n = 380$ -393	Limiting (34%) $n = 450$ -482	Overeating/Binge Eating (17%) $n = 222$ -243	LOBE (15%) $n = 199$ -219	Pervasive (6%) $n = 79$ -82	R ²
AFFECTIVITY						
BSI Global Severity Index	0.4 (0.4) _a	0.5 (0.6) _b	0.5 (0.5) _b	0.8 (0.7) _c	1.0 (0.8) _d	0.08*
PANAS Positive Affect	26.4 (7.2) _a	25.7 (7.8) _a	25.1 (8.0) _{ab}	24.7 (8.4) _{ab}	23.4 (9.2) _b	0.01*
PERSONALITY						
NEO-FFI Neuroticism	18.8 (7.2) _a	22.2 (8.1) _b	21.3 (7.1) _b	25.3 (7.7) _c	26.8 (8.0) _c	0.09*
NEO-FFI Extraversion	30.8 (6.4) _a	31.8 (5.9) _a	31.9 (5.7) _a	31.1 (6.4) _a	30.6 (6.4) _a	0.01*
NEO-FFI Openness	27.3 (6.1) _a	26.8 (6.1) _a	26.9 (5.6) _a	27.2 (5.7) _a	27.1 (6.2) _a	0.00
NEO-FFI Agreeableness	33.3 (5.9) _a	32.2 (6.1) _{ab}	32.5 (5.8) _{ab}	31.0 (6.1) _b	30.5 (5.7) _c	0.02*
NEO-FFI Conscientiousness	32.7 (6.4) _a	32.0 (6.4) _{ab}	30.8 (6.2) _b	29.7 (6.6) _c	30.0 (6.4) _c	0.03*
STPQ Novelty Seeking	4.1 (2.7) _a	5.0 (2.9) _b	4.9 (2.9) _b	5.9 (3.2) _c	6.3 (2.8) _c	0.05*
Personal Mastery Scale	14.9 (3.0) _a	14.1 (3.3) _b	14.0 (2.7) _b	13.3 (3.5) _b	12.7 (3.5) _c	0.03*
SUBSTANCE USE/PROBLEMS						
Frequency of Smoking ²	0.5 (1.5) _a	0.9 (1.7) _{ab}	1.0 (1.9) _{ab}	1.1 (1.9) _b	1.6 (2.1) _c	0.02*
Frequency of 5+ drinks ³	0.6 (1.1) _a	1.0 (1.3) _b	1.0 (1.3) _b	1.3 (1.4) _b	1.8 (1.5) _c	0.05*
No. Alcohol Consequences	2.6 (3.5) _a	4.4 (4.1) _b	4.3 (4.3) _b	5.8 (4.9) _c	7.4 (5.4) _d	0.09*
No. Drug Consequences	0.5 (2.1) _a	0.5 (1.5) _a	1.1 (3.1) _{ab}	1.2 (3.1) _b	1.7 (3.8) _c	0.02*
Body Mass Index	21.5 (3.0) _a	22.6 (3.5) _b	21.9 (3.0) _{ab}	23.4 (4.3) _c	22.1 (2.4) _{ab}	0.03*

Note. Classes that *share* subscript letters are *not* significantly different from one another based on the Ryan-Einot-Gabriel-Welch multiple range test. NOPE = No Obvious Pathological Eating-related concerns. LOBE = Limiting with Overeating/Binge Eating. Pervasive = Pervasive Bulimic-Like Concerns. BSI = Brief Symptom Inventory. PANAS = Positive and Negative Affect Scale. STPQ = Short Tridimensional Personality Questionnaire. NEO-FFI = NEO Five Factor Inventory.

* $p < .05$.

¹ n 's vary due to missing data. Thus the range of n is provided for each column.

² Frequency of smoking during the past month is ordinally scaled, where 0 = never in the past month, 1 = once or twice, 2 = a few days, 3 = a couple of days/week, 4 = three times/week, 5 = most days of the week, and 6 = daily or almost daily.

³ Frequency of drinking five or more drinks in one sitting is ordinally scaled, where 0 = never in the past 30 days, 1 = once, 2 = 2 to 3 times, 3 = once or twice/week, 4 = 3 to 4 times/week, 5 = 5 to 6 times/week, 6 = nearly every day, and 7 = every day.

Table 6
Conditional Latent Transition Probability Estimates (Estimated *n*)

	NOPE	Limiting	Overeating	LOBE	Pervasive
Fall 1 st Year Latent Status	Spring 2 nd Year Latent Status				
NOPE (<i>n</i> ≈ 401)	.78 (313)	.13 (52)	.05 (20)	.01 (4)	.03 (12)
Limiting (<i>n</i> ≈ 498)	.13 (64)	.63 (311)	.09 (44)	.10 (49)	.06 (30)
Overeating (<i>n</i> ≈ 286)	.15 (43)	.08 (23)	.61 (176)	.13 (38)	.02 (6)
LOBE (<i>n</i> ≈ 219)	.01 (2)	.09 (20)	.14 (31)	.73 (162)	.02 (4)
Pervasive (<i>n</i> ≈ 93)	.01 (1)	.13 (12)	.06 (6)	.09 (8)	.71 (66)
Estimated <i>n</i>	(423)	(418)	(277)	(261)	(118)
Spring 2 nd Year Latent Status	Spring 3 rd Year Latent Status				
NOPE (<i>n</i> ≈ 425)	.84 (357)	.11 (47)	.04 (17)	.00 (0)	.01 (4)
Limiting (<i>n</i> ≈ 419)	.12 (50)	.75 (315)	.02 (8)	.07 (29)	.04 (17)
Overeating (<i>n</i> ≈ 278)	.07 (19)	.04 (11)	.82 (228)	.06 (17)	.01 (3)
LOBE (<i>n</i> ≈ 264)	.03 (8)	.14 (37)	.07 (18)	.69 (180)	.08 (21)
Pervasive (<i>n</i> ≈ 114)	.10 (11)	.20 (23)	.04 (5)	.03 (3)	.64 (72)
Estimated <i>n</i>	(445)	(433)	(276)	(229)	(117)
Spring 3 rd Year Latent Status	Spring 4 th Year Latent Status				
NOPE (<i>n</i> ≈ 445)	.82 (365)	.13 (58)	.03 (13)	.00 (0)	.02 (9)
Limiting (<i>n</i> ≈ 434)	.18 (77)	.76 (327)	.01 (4)	.06 (26)	.00 (0)
Overeating (<i>n</i> ≈ 279)	.23 (64)	.15 (42)	.54 (151)	.03 (8)	.05 (14)
LOBE (<i>n</i> ≈ 230)	.00 (0)	.16 (37)	.14 (32)	.68 (156)	.02 (5)
Pervasive (<i>n</i> ≈ 113)	.07 (8)	.09 (10)	.08 (9)	.00 (0)	.76 (86)
Estimated <i>n</i>	(514)	(474)	(209)	(190)	(114)

Note. NOPE = No Obvious Pathological Eating-related concerns. Overeating = Overeating/Binge Eating. LOBE = Limiting with Overeating/Binge Eating. Pervasive = Pervasive Bulimic-Like Eating-Related Concerns. Latent transition probabilities that are > .10, i.e., the corresponding transition has a likelihood of at least 10% of occurring, are shown in bold.