LONGITUDINAL PREVALENCE OF DISORDERED EATING AND WEIGHT CONTROL BEHAVIORS IN FEMALE COLLEGIATE ATHLETES

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Female collegiate athletes have been established as a high-risk group for the development of eating disorders due to the high prevalence rates of clinical and subclinical eating disorders, which have ranged from 1.9% to 16.6% and 4.0% to 26.1%, respectively. Collegiate athletes appear to meet criteria for ED-NOS more often than anorexia or bulimia nervosa, and frequently engage in pathogenic weight control behaviors (e.g., dieting, excessive exercise). To date, only a few studies have examined the long-term stability of eating disorders in collegiate female athletes. The current study investigated the prevalence of eating disorders (i.e., eating disordered, symptomatic, and asymptomatic) and pathogenic weight control behaviors (e.g., binging, vomiting, laxative use) in 325 NCAA-DI female collegiate gymnasts and swimmers/divers across two time points – the beginning of their competitive seasons (Time 1) and during the final two weeks of their competitive seasons (Time 2). By Time 2, 90% of the athletes classified as eating disordered at Time 1 (n = 20) maintained clinical or subclinical eating disturbances. Of the 83 athletes originally symptomatic, 37.3% remained so and 10.8% became eating disordered. Significantly more athletes became satisfied with their bodies over the course of the season than became dissatisfied. The athletes reported using exercise and dieting/fasting as the most frequent forms of weight control behaviors, each of which were used less frequently at Time 2 than at Time 1. The results support overall stability of eating disorder behaviors and classification over the course of a competitive season. Limitations and implications are discussed.
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CHAPTER 1
INTRODUCTION

Eating disorders are pathological disturbances in eating behavior that typically include acute misperceptions and concern about body shape and weight, and are divided into four categories: Anorexia Nervosa (AN), Bulimia Nervosa (BN), Binge-Eating Disorder (BED), and Other Specified/Unspecified Eating Disorder (*Diagnostic and Statistical Manual of Mental Disorders-V, DSM-V;* American Psychiatric Association [APA], 2013). These disorders warrant particular concern due to their association with a variety of co-morbidities, both psychological and physiological in nature (Treasure, Claudino, & Zucker, 2010), their high prevalence among girls and women (Hudson, Hiripi, Pope Jr., & Kessler, 2007), their high rate of mortality among psychiatric disorders (Smink, van Hoeken, & Hoek, 2012), and the extensive psychological care associated with their treatment (Treasure et al., 2010).

Among women, collegiate athletes are a sub-population that have been identified as particularly at-risk for the development of these disorders because of the unique pressures they experience in the sport environment regarding weight, appearance, body size/shape, and performance (Petrie & Greenleaf, 2012). Initial prevalence research has supported this assertion (Anderson & Petrie, 2012; Beals & Manore, 2002; Carter & Rudd, 2005; Greenleaf, Petrie, Carter, & Reel, 2009; Petrie, 1993; Petrie, Greenleaf, Reel, & Carter, 2009b; Sanford-Martens, Davidson, Yakushko, Martens, Hinton, & Beck, 2005). For example, among aesthetic and lean sport female athletes (e.g., gymnastics) competing at the NCAA D-I level, rates have ranged from 5.6% to 5.9% for an eating disorder; rates have been 3.5% to 5.9% for endurance and non-lean sport athletes (e.g., soccer) competing at the same level (Beals & Manore, 2002; Sanford-Martens et al., 2005). In a mixed-sport sample of NCAA D-I female athletes, 2.0% were
classified as eating disordered, though all diagnoses fell within the ED-NOS category (Greenleaf et al., 2009). Variability in prevalence rates likely results from including athletes from different sports within single samples. Thus, Hausenblas and Carron (1999) argued that researchers should examine single sport samples (or sports that fall within defined groupings, such as being “weight sensitive;” Martinsen & Sundgot-Borgen, 2013) in any future eating disorder studies.

Athletes generally endorse symptoms of eating disorders at rates much higher than those associated with full diagnostic criteria (e.g., Carter & Rudd, 2005; Greenleaf et al., 2009; Sundgot-Borgen & Torstveit, 2004). Among female collegiate athletes, for example, rates of subclinical eating disorders (i.e., symptomatic classification) have ranged from 14.5% to 25.5% (Beals & Manore, 2002; Carter & Rudd, 2005; Greenleaf et al., 2009; Sanford-Martens et al., 2005). The use of some pathogenic weight control measures (e.g., extreme dieting, excessive exercising) also tends to exceed rates associated with clinical eating disorders (Anderson & Petrie, 2012; Beals & Manore, 2002; Carter & Rudd, 2005; Greenleaf et al., 2009). For example, female collegiate athletes have reported the use of strict dieting at least twice in the last year (15.7%), binge eating at least once per week (18.6%), exercising at least 2 hours per day to burn calories (25.5%), vomiting at least 2 to 3 times per month (2.9%), and using diuretics 2 to 3 times per month (1.5%) or laxatives 1 to 2 times per week (1.0%; Greenleaf et al., 2009). Other general weight control strategies that female athletes have reported using include limiting what’s eaten to specific foods (67%), restricting how much is eaten (42%), binge eating (6%), fasting (11%), maintaining low-calorie diets (15%), using laxatives (4%), using diet pills (2.3 to 8.0%), vomiting (7%), binging (6.2 to 7.1%), and purging (e.g., fasting, self-induced vomiting; 1.7 to 2.8%; Beals & Manore, 2002; Carter & Rudd, 2005). Female athletes who participate in weight-sensitive sports (e.g., swimming, gymnastics) generally report the highest use of pathogenic
weight control behaviors (e.g., low calorie diets, vomiting; Beals & Manore, 2002; Carter & Rudd, 2005).

These prevalence studies (e.g., Anderson & Petrie, 2012; Beals & Manore, 2002; Greenleaf et al., 2009) provide a useful snapshot of the frequency with which female collegiate athletes engage in disordered eating behaviors and can be classified as either symptomatic or suffering from a clinical disorder. However, because of their cross-sectional methodologies, these studies cannot address the issue of how stable eating disorder classifications and disordered eating behaviors are over time. Longitudinal designs, however, would allow researchers to examine the progression of pathological eating, and may provide an understanding of how eating disorders develop, abate, and/or intensify over time, such as in response to the stress of a competitive season.

Although not a traditional longitudinal design in which the same sample was examined over time, Sungot-Borgen and Torstveit (2010) reported on the prevalence of eating disorders from 1990 to 2002. Using data from comparable samples of female elite athletes that they had collected and reported previously (Sundgot-Borgen, 1993; Sundgot-Borgen & Torstveit, 2004; Torstveit, Rosenvinge, & Sundgot-Borgen, 2008), Sundgot-Borgen and Torstveit (2010) found that the prevalence rates of those athletes considered at-risk for an eating disorder (i.e., based on cutoff scores on subtests of the Eating Disorder Inventory, positive responses to 2 or more questions assessing DSM-IV (2000) symptoms of eating disorders, and/or self-report of having an eating disorder) progressed from 22.4% in 1990-1991, to 21.2% in 1997-1998, to 60.1% 2001-2002; rates for those who met criteria for an eating disorder (i.e., per DSM-IV) increased from 20.0% to 21.5% to 28.1% across the three time points. Although these data suggest an increase in the prevalence of elite female athletes who were at-risk as well as those who were
eating disordered, because a single sample was not followed over the 12-year period, no definitive conclusions can yet be reached regarding change in risk and prevalence among female athletes.

Longitudinal research with female nonathletes, however, has examined changes in the prevalence of eating disorders over time and offers support for employing this approach within sport. Stice, Marti, Shaw, and Jaconis (2009) reported that, over the eight-year period of the study, 12.0% of the adolescent girls (who ranged in age from 12 years old at the beginning of the study to 23 years at the end) experienced some form of an eating disorder. Specific lifetime prevalence rates were: 0.6% (subthreshold anorexia), 0.6% (anorexia), 6.1% (subthreshold bulimia), 1.6% (bulimia nervosa [BN]), 4.6% (subthreshold binge eating disorder), 1.0% (binge eating disorder [BED]), and 4.4% (purging disorder). In terms of changes over the eight years, 26.7% of the participants who initially were classified as subclinical developed a clinical disorder (e.g., subthreshold BN to BN), and 4.0% of the women crossed over from one clinical ED classification to another (e.g., from BN to BED). For the majority of the women who had a subthreshold or clinical ED (91% to 96% depending on diagnosis), recovery occurred within a year of their diagnosis (that is, when they were classified as asymptomatic or normal in their eating behaviors). Stice et al.’s study demonstrates that ED classifications do change over time and recovery may occur within a relatively short timeframe, even without treatment.

Thus, the purpose of the current study was to investigate the prevalence of ED classification (i.e., eating disordered, symptomatic, and asymptomatic) and pathogenic weight control behaviors (i.e., binging, vomiting, laxative use, diuretic use, fasting, and excessive exercise) in female collegiate gymnasts and swimmers/divers over a five month timeframe – at the beginning of their competitive seasons (Time 1) and during the final two weeks of their
competitive seasons (Time 2). Because data on Time 1 prevalence has been presented elsewhere (Anderson & Petrie, 2012), this study will focus on data from Time 2, though will use Time 1 data as the comparison. Specifically, from Time 1 to Time 2, I examined (1) prevalence rates of ED classifications, (2) prevalence rates for pathogenic weight control behaviors, (3) progression or reduction of symptoms (i.e., movement between asymptomatic, symptomatic, and eating disordered categories), and (4) change or crossover within the clinical eating disorder type (i.e., change from one eating disorder type to another). I hypothesized that across the five-month time span (1) prevalence rates for the disordered eating groups (i.e., eating disordered and symptomatic) would remain stable, (2) prevalence rates of pathogenic weight control behaviors (i.e., binging, vomiting, laxatives, diuretics, fasting, excessive exercise) would remain stable, (3) and the progression of symptomatology will primarily be from eating disordered category to the symptomatic category and symptomatic to asymptomatic, rather than from asymptomatic to the disordered eating categories.
CHAPTER 2

METHOD

Participants

Participants will be 219 female gymnasts and 106 female swimmers and divers who were drawn from 26 different NCAA Division I athletic programs; mean age was 19.24 years ($SD = 1.14$). There were 103 (31.7%) freshman, 97 (29.8%) sophomores, 75 (23.1%) juniors, and 50 (15.4%) seniors. In terms of racial/ethnic group status, 276 (84.9%) were White/Non-Hispanic, 14 (4.3%) Latina/Mexican, 13 (4.0%) Black/Non-Hispanic, 1 (0.3%) American Indian, and 14 (4.3%) Asian-American/Pacific Islander; 7 (2.2%) self-identified as “Other.” Two hundred fourteen (64.8%) had received an athletic scholarship; athletes had participated in their sport between 1 and 20 years ($M = 13.32, SD = 3.31$).

Athletes’ mean body mass index (BMI) was 22.55 kg/m$^2$ ($SD = 2.04$; Time 1) and 22.64 kg/m$^2$ ($SD = 2.04$; Time 2). Based on their BMI’s (Centers for Disease Control and Prevention [CDC; n.d.]) the athletes were: underweight (BMI < 18.5: Time 1, n = 6, 1.8% and Time 2, n = 4, 1.2%), normal weight (BMI 18.5-24.99: Time 1, n = 279, 85.8% and Time 2, n = 283, 87.1%), or overweight (BMI > 25: Time 1, n = 40, 12.3% and Time 2, n = 38, 11.7%).

Instruments

Demographics. The athletes provided information about age, race/ethnicity, year in school, height, weight, satisfaction with weight (i.e., ‘no’, ‘yes’), and scholarship status.

Disordered eating. The Questionnaire for Eating Disorder Diagnoses (QEDD; Mintz, O’ Halloran, Mulholland, & Schneider, 1997) is a 50-item self-report measure whose responses were used to classify the athletes based on criteria from the Diagnostic and Statistical Manual 4th Edition (DSM-IV-TR; APA, 2000) as: (1) eating disordered [i.e., anorexia nervosa, bulimia
nervosa, or eating disorder not otherwise specified (EDNOS), which includes menstruating
anorexia, subthreshold bulimia, nonbingeing bulimia, and binge-eating disorder], (2)
symptomatic of an eating disorder (i.e., demonstrates symptoms of disordered eating but do not
meet criteria for a diagnosis), and (3) asymptomatic. To more accurately assess the use of
exercise in the sporting environment, one question was adjusted for the current study, (i.e.,
“Indicate the amount of time you spent exercising in addition to your normal sport practice to
lose weight.”). Research has shown the QEDD is a reliable and valid tool that accurately
asses women who are asymptomatic, symptomatic, or who meet criteria for an eating disorder
in both clinical and community populations (Mintz et al.). Further, studies have demonstrated its
utility in classifying female athletes as eating disordered, symptomatic, and asymptomatic
(Carter & Rudd, 2005; Greenleaf et al., 2009).

**Weight control behaviors.** Seven items from the 36-item Bulimia Test-Revised (BULIT-
R; Thelen, Mintz, & Vander Wal, 1996) were used to assess the frequency and duration in which
the athletes have participated in binge eating, and the frequency with which they have used each
of the following weight control methods: laxatives, exercising to lose weight, vomiting,
dieting/fasting, and diuretics. For each item, such as, “I exercise in order to burn calories,”
athletes responded on a 5 point scale that ranged from 1, least frequent use, to 5, most frequent
use (the scale indicating the frequency of each behavior varied slightly). These items have been
used in previous research with female collegiate athletes to assess frequency of weight control
behaviors (e.g., Greenleaf et al., 2009).

**Procedures**

The university’s institutional review board approved this study, and all participants
signed informed consent forms prior to completing the surveys. The current data were collected
as part of a larger study funded by the NCAA, whose purpose was to examine the physical and psychological well-being of female collegiate athletes. The head coaches of 60 Division I gymnastics and swimming/diving programs from universities across the United States were contacted to solicit the participation of their athletes. The coaches were first informed of the study by email; follow-up communications were carried out by phone and email. Coaches were informed of the NCAA grant and the purpose of the study, and requirements of participation were explained. At each participating university, coaches had to identify a contact person (e.g. athletic trainer) who would administer the surveys at their schools. Of the 26 programs who agreed to participate, athletic trainers, team managers, assistant coaches, and head coaches served in this role and were paid $150.00 for their assistance.

Several weeks prior to data collection, team contacts were emailed to schedule survey administration dates with the athletes. Subsequently, team contacts were mailed the exact number of surveys necessary for each given team, standardized instructions, and the researcher’s contact information; follow-up phone calls were made to answer any questions. Time 1 data collection occurred during the last 2 weeks of September, at which each athlete received an unsealed envelope containing the consent form and survey questionnaire. Team contacts first read the instructions, and then the athletes signed consent forms. Participation was voluntary, though no athlete refused to complete the questionnaires. Survey packets were completed anonymously (i.e., athletes did not put their names on the questionnaires), though each one was coded by number so it could be matched to the questionnaires completed at Time 2; team contacts left the area so the athletes could respond in private. The same procedure was followed for the Time 2 data collection, which occurred during the 2 weeks prior to the teams’ conference championship tournaments at the end of their seasons.
Data Analysis

Although 414 athletes participated at Time 1 and provided complete data, 89 did not participate at Time 2 due to either not being on their teams anymore or not being available for the second data collection. Thus, analyses in this study are based on the 325 athletes who provided data at both collection times.

Change in eating disorder classification, based on QEDD responses, will be examined through cross-tabulations and chisquare analyses. Further, all athletes’ classifications from Time 1 will be examined in relation to their Time 2 classification to determine the extent to which movement occurred between eating disorder groups.

Change in specific pathogenic weight control behaviors, based on the 7 items from the BULIT-R, also will be examined through cross-tabulations and chisquare analyses. Again, all athletes’ responses from Time 1 will be examined in relation to their Time 2 responses to establish if pathogenic weight control behaviors changed over time and, if so, in what direction.

Finally, changes in weight satisfaction from Time 1 to Time 2 will be investigated through cross-tabulations and chisquare analyses. Athletes’ reported satisfaction from Time 1 will be compared to their Time 2 responses to determine if it changed over the course of the season and, if so, in what direction (i.e., stay the same, become satisfied, become dissatisfied).
CHAPTER 3

RESULTS

Change in Eating Disorder Prevalence Over Time

The prevalence of Eating Disorder Classification for each of the two time points, in addition to the season-long prevalence (i.e., the total number of athletes classified in a specific category at either of the two time points), are reported in Table 1. At Time 2, the athletes were classified as eating disordered (n = 24; 7.4%), symptomatic (n = 51; 15.7%), and asymptomatic (n = 250; 76.9%); of those meeting the criteria for an eating disorder diagnosis, 16 had sub-threshold bulimia, five non-binge bulimia, two binge eating, and one bulimia. The season-long prevalence included 76.9% (n = 250) who were classified as asymptomatic, 31.7% (n = 103) as symptomatic, and 9.5% (n = 31) as eating disordered.

Crossovers between pairs of ED classifications (e.g., asymptomatic to symptomatic or to eating disordered) are presented in Figure 1. Of the 20 athletes who were eating disordered at Time 1, at Time 2 two (10%) became asymptomatic, five (25%) became symptomatic, and 13 (65%) remained eating disordered (sub-threshold bulimia = 12; non-binge bulimia = 1). Overall, 90% (n = 18) of the participants who met criteria for an eating disorder at Time 1 continued to exhibit subclinical or clinical levels of eating disturbance at Time 2.

Of the 83 athletes who were symptomatic at Time 1, at Time 2 43 (51.8%) became asymptomatic, 31 (37.3%) remained symptomatic, and nine (10.8%) were classified with an ED (i.e., non-binge bulimia = 3; sub-threshold bulimia = 3; binge eating = 2; bulimia = 1). Of the 222 athletes who were asymptomatic at Time 1, at Time 2 92.3% (n = 205) remained so at the end of their season; 6.8% (n = 15) became symptomatic and 0.9% (n = 2) reported the symptoms of a clinical ED (i.e., non-binge = 1; sub-bulimia = 1).
The Time by Classification was significant, $\chi^2 [4, N = 325] = 166.4, p < .0001$, though two of the six cells (e.g., Asymptomatic at Time 1 X Eating Disordered at Time 2) had counts less than five. Overall, for those athletes who were asymptomatic at Time 1, significantly more remained asymptomatic than became symptomatic or eating disordered. Of the women who were symptomatic at Time 1, significantly more became asymptomatic than remained symptomatic or became eating disordered. And finally, of the women who reported symptoms of a clinical eating disorder at Time 1, significantly more stayed eating disordered or became symptomatic than became asymptomatic.

Change in Weight Satisfaction Over Time

Season-long, Time 1, and Time 2 prevalence of the athletes’ satisfaction with their weight is reported in Table 2; crossover in weight satisfaction is presented in Figure 2 (one athlete did not report her weight satisfaction at Time 2) and the Time by weight satisfaction interaction was significant, $\chi^2 [2, N = 323] = 79.5, p < .0001$. Across Time 1 and Time 2, respectively, 130 (40.3%) and 126 (38.8%) of the athletes reported being dissatisfied with their current weight. Of the athletes who were dissatisfied with their current weight at Time 1, significantly more ($n = 89, 68.5$) remained dissatisfied than became satisfied ($n = 41, 31.5$) at Time 2. Of the 193 athletes who said they were satisfied with their weight at Time 1, significantly more remained so ($n= 155, 80.3$) then became dissatisfied ($n = 37, 19.2$) at Time 2. The season-long prevalence of weight dissatisfaction was 51.4% ($n = 167$) and of weight satisfaction was 72.0% ($n = 234$).

Changes in Pathogenic Weight Control Behavior Prevalence Over Time

*Exercising for weight loss.* The Time by classification interaction was significant, $\chi^2 [16, N = 325] = 174.7, p < .01$. At Time 1, 138 athletes indicated exercising 2 or more hours per day
specifically to burn calories; at Time 2, significantly more of these athletes (n = 82, 59.4%) had maintained this frequency then had decreased to less than 2 hours per day (n = 56, 40.6%). Of the 187 athletes who reported exercising less than 2 hours per day to burn calories at Time 1, significantly more had stayed at this level of exercise frequency (n = 154, 82.4%) then had increased to 2 or more hours per day (n = 33, 17.6%) at Time 2. The season-long prevalence of exercising 2 or more hours a day was 52.6% (n = 171), and for exercising less than 2 hours per day was 74.8% (n = 243). See Table 3 and Figure 4.

Fasting or strict dieting. The Time by classification interaction was significant, $\chi^2_{[16, N = 325]} = 178.7, p < .01$. At Time 1, of the 40 athletes who reported fasting or going on strict diets 4 times or more in the past year, significantly more had reduced their frequency to 3 times per year or less (n = 23, 57.5%) then remained at 4 times or more per year (n = 17, 42.5%). Of the 285 athletes who were fasting 3 times per year or less at Time 1, significantly more maintained this frequency at Time 2 (n = 272, 95.4%) then increased their fasting/dieting behavior to 4 times or more (n = 13, 4.6%). The season-long prevalence for fasting 4 or more times a year was 16.3% (n = 53) whereas the rate for 2 times per year or less was 94.8% (n = 308). See Table 3 and Figure 6.

Vomiting. At Time 1, 11 athletes reported vomiting 2 or more times per week to control their weight; three of these athletes remained doing so at Time 2. Of the 314 athletes (96.6%) who were vomiting once or less per month at Time 1, only four increased their use of vomiting to 2 or more times per week. Thus, at Time 2, a total of seven athletes (2.2%) reported vomiting 2 or more times per week to control their weight. The season-long prevalence for vomiting 2 or more times per week was 4.6% (n = 15), while the rate for once or less per month was 99.1% (n = 322). See Table 3 and Figure 5.
**Laxative/suppository use.** At Time 1, four athletes (1.2%) endorsed using laxatives/suppositories 3 or more times per week; only one of these athletes maintained this frequency of laxative/suppository use at Time 2. Of the 320 athletes (98.5%) who used a laxative/suppository 1-2 times or less per week at Time 1, all but one continued to use at this level at Time 2. Thus, at Time 2, a total of two athletes (0.6%) reported using laxatives/suppositories 3 or more times per week. The season-long prevalence for using laxatives 3 or more times per week was 1.5% (n = 5), whereas the rate for using 2 times or less per week was 99.4% (n = 323). See Table 3 and Figure 3.

**Diuretic use.** At Time 1, five athletes (1.5%) reported using diuretics 3 or more times per week; one sustained this frequency at Time 2. Of the 319 athletes who were using diuretics 3 or fewer times per month at Time 1, three athletes had increased their use to 3 or more times per week. Thus, at Time 2, a total of four athletes (1.2%) reported diuretic use 3 or more times per week. The season-long prevalence of using diuretics 3 or more times per week was 2.5% (n = 8), and the rate for 3 or fewer times per month was 99.4% (n = 323). See Table 3 and Figure 8.

**Binge eating.** The Time by classification interaction was significant, $\chi^2 [1, N = 325] = 69.8, p < .0001$. At Time 1, of the 18 athletes who reported binge eating 2 or more times per week, significantly more continued to do so at Time 2 (n = 11, 61.1%) then decreased to once or less per week (n = 7, 38.9%). Of the 307 athletes (94.5%) who were binge eating once or less per week at Time 1, significantly more remained at this frequency at Time 2 (n = 291, 94.8%) than increased their binge eating behavior to 2 or more times per week (n = 16, 5.2%). Thus, at Time 2, a total of 27 athletes (8.3%) were binge eating 2 times or more per week. The season-long prevalence of binge eating 2 or more times per week was 10.5% (n = 34), whereas the rate for binge eating once or less per week was 96.6% (n = 314). See Table 3 and Figure 7.
CHAPTER 4
DISCUSSION

The number of athletes classified as ED increased over the competitive season from 20 (6.2%) at Time 1 to 24 (7.4%) at Time 2. At Time 1, all ED athletes were categorized as ED-NOS, whereas at Time 2, 23 of the 24 also were ED-NOS; at both times the diagnostic classifications were primarily a form of bulimia or binge eating. Overall, the season-long prevalence of athletes classified as ED was 31 (9.5%). The fact that the majority of the athletes with a clinical disorder met criteria for ED-NOS rather than AN or BN is consistent with past research (e.g., Greenleaf et al., 2009; Stice et al., 2009). For example, Stice et al. (2009) separated the ED-NOS category into threshold and subthreshold groups (e.g., subthreshold anorexia and threshold anorexia), and found that over an eight-year span, the majority of the female adolescents in their study met criteria for subthreshold EDs, particularly bulimia, binge eating, and purging disorders. Women diagnosed with ED-NOS typically either exhibit some, but not all, of the required criteria for AN or BN, or do not reach the required severity of criteria for AN or BN. For example, an athlete who was bingeing and purging, but doing so less frequently than the required twice per week for a 3-month period, would be diagnosed as subthreshold bulimic, an ED-NOS classification. Given the physical and psychological demands associated with training and competing full-time, as the athletes in this study were, it is not surprising that their diagnoses would fall into the less severe ED-NOS category. Athletes with full-blown BN or AN might have a particularly difficult time maintaining their energy, physical conditioning, and mental stamina during an athletic season and thus would likely be identified by sports medicine personnel (e.g., athletic trainers) and referred for treatment.
Overall, 90% of the athletes who were originally classified as eating disordered maintained some level of disturbance at Time 2 (i.e., remained eating disordered or became symptomatic); the majority of the women (92.3%) who were originally classified as asymptomatic remained in this category as well. Thus, consistent with past research (Doughty & Hausenblaus, 2005; Krentz & Warschburger, 2013), the athletes demonstrated relative stability in both their clinical eating disorder symptomatology as well as their normal eating over time. Stice et al. (2009) found that the average subthreshold and threshold ED episode duration ranged from 3.9-4.7 months, whereas Krentz and Warschburger (2013) reported a high stability of disordered eating behaviors in female athletes lasting up to a year; the timeframe for athletes in the current study was five months. Athletes’ eating disturbances may be longer lasting than non-athletes because of the pressures surrounding weight and body shape that exist in the sport environment (and athletes continual presence in this environment). Thus, athletes with clinical eating disorders may not improve spontaneously and may require purposeful intervention.

The largest change in classification occurred with the athletes who were symptomatic at Time 1; over half became asymptomatic at Time 2, 37.3% remained symptomatic, and 10.8% became eating disordered. Consistent with Stice et al. (2009), few of the female athletes progressed from subclinical to clinical eating disorders. However, the fact that almost half of the athletes continued to report problematic eating behaviors at the end of their competitive seasons is concerning because both clinical and symptomatic levels of eating disorders have been associated with psychological disturbances (e.g., sadness, anxiety, stress; Petrie, Greenleaf, Reel, & Carter, 2009a) and physical health concerns (e.g., electrolyte imbalance, bone mineral density loss, dehydration; Beals, 2000; Treasure et al., 2010). It is encouraging, though, that over 50% of the women reported normal eating at the end of their competitive season.
Like the asymptomatic and clinical eating disorder classifications, the overall percentage of athletes who were dissatisfied with their body weight was consistent across the two time points as were those who remained satisfied (80.3%) or dissatisfied (68.5%) across the season. These findings suggest a relative stability in the athletes’ satisfaction with their weight, which is consistent with Doughty and Hausenblas (2005) who reported stability in female collegiate athletes’ body satisfaction across a competitive season. In my study, though, significantly more athletes became satisfied over the course of the season (31.5%) than became dissatisfied (19.2%) with their weight. The athletes’ satisfaction with their weight may have increased over the course of the season as a result of improvements in physical fitness and conditioning and a focus on performance (and being instrumental with their bodies) at the end of the season. During the summer months prior to returning to a collegiate season, some athletes take time off from training (or train at a load lower than they do when in season). Thus, when they begin their fall seasons, as did the swimmers/divers and gymnasts in my study, their physical strength, conditioning and fitness may have been low, which likely contributed to feeling dissatisfied with their bodies, including their weight.

Consistent with past research (e.g., Greenleaf et al., 2009), the most commonly employed weight control behaviors were exercise and dieting/fasting. Fewer athletes reported that they exercised to burn calories for 2 or more hours per day at Time 2 (35.4%) than at Time 1 (42.5%), as did those who indicated fasting or dieting 4 or more times per month (Time 1 = 12.3%; Time 2 = 9.2%). Over the course of the season, excessive exercise and dieting/fasting were employed with much greater frequency (52.6% and 16.3%, respectively) than other weight control methods (i.e., laxative/suppository use - 1.5%; vomiting - 4.6%; diuretic use - 2.5%; binge eating - 10.5%). For female athletes, exercise and dieting/fasting may be preferred weight control
methods as opposed to more “extreme” measures (e.g., laxative use, vomiting) because these behaviors may be viewed as potentially more helpful, than detrimental, to their performances. Further, athletes may perceive supplemental exercise and dietary restriction as weight-loss strategies that are approved of or even reinforced by some coaches (Kerr, Berman, & De Souza, 2006; Thompson & Sherman, 1999).

There are several explanations for why the athletes reported lower frequencies of use for the weight control behaviors at the end of the season relative to the beginning of the season. First, because of commitments, such as traveling, increased NCAA time allotment for practices, and competitions, the athletes simply may have had less “free” time to engage in additional exercise. Second, the increased training loads that corresponded with a return to practicing with their teams likely resulted in greater demands on their energy, leaving the athletes more physically fatigued and less motivated or able to engage in supplemental exercise or dietary restriction. Third, the rigid, structured training regimens of a competitive season (which likely include increases in physical conditioning) may have led some athletes to rely less on their own weight control behaviors because their weight was instead being managed through energy spent during practices and competitions. Thus, it is not surprising to find that the athletes reported lower use of a variety of pathogenic weight control behaviors.

Although the use of a longitudinal design represented a significant improvement over past prevalence studies (Beals & Manore, 2002; Carter & Rudd, 2005; Greenleaf et al., 2009), limitations still existed that warrant discussion. First, all data were collected through self-report measures, which can be influenced by social desirability bias. Because the geographic diversity of the sample precluded the use of one-on-one structured interviews to determine diagnosis, which we recognize as the gold standard (Sundgot-Borgen & Torstveit, 2004), we used a
measure of eating disorders that has demonstrated a high accuracy rate (98%), low false-negative (.03) and false-positive (.02) rates, high sensitivity (.97), specificity (.98), positive predictive power (.94), and negative predictive power (.99; Mintz, O’Halloran, Mulholland, & Schneider, 1997). Further, athletes did not provide any identifying information on the questionnaires themselves and coaches were blind to the data provided by the athletes. Second, although geographically diverse, our sample was based on two “weight-sensitive” sports (Martinsen & Sundgot-Borgen, 2013) drawn from U.S. universities, thus limiting the generalizability of our findings. We did, however, follow Hausenblas and Carron’s (2002) recommendations to examine sports that represent specific categories to establish clear and consistent prevalence data. Future studies might incorporate our longitudinal methodology to study other subsets of athletes. Third, although longitudinal, our data collection occurred solely across a five-month competitive season. Thus, we cannot comment on how prevalence might change when athletes’ competitive seasons end and they move to a less rigorous off-season (i.e., summer) training schedule. Future studies might extend data collection over a longer period of time and across competitive and noncompetitive seasons to examine the stability of disordered eating behaviors when team training environments lessen during an off season (as occurs within collegiate sport environments).

In terms of clinical implications, rates of clinical eating diagnoses remained relatively stable, suggesting that athletes who demonstrate eating problems at the beginning of a competitive season are likely to continue to experience severe symptoms without purposeful intervention by sports medicine personnel. Thus, early detection becomes imperative so athletes may receive needed treatment and not have to suffer with their eating disorder throughout a physically grueling and psychologically demanding sport season (Thompson & Sherman, 2010).
Because athletes tend to demonstrate subclinical problems and engage in weight control behaviors that may be reinforced in the sport environment (e.g., supplemental exercise), these problems may not be easily identified. Thus, it is important that coaches, athletes, parents, medical personnel, college counselors, and sport psychologists be educated about risk factors and indicators of athletes who may be engaging in problematic eating behaviors. Further, the creation of a “body-healthy” environment has been recommended (Petrie & Greenleaf, 2012), in which the athletes’ physical and psychological well-being is a primary concern in the development of training requirements and decision-making processes. Petrie and Greenleaf suggested de-emphasizing the linear association between leanness or weight loss and performance, restructuring the process of weigh-ins (e.g., only conducting them for medical purposes, completing them with medical personnel rather than coaches, informing athletes of their purpose, completing them in private), shifting the body-focused cultural norms to performance-enhancement strategies (e.g., strength training, speed and conditioning, mental skills training, nutrition), and educating the coaches about ED recognition, prevention, and the effects of ED symptomatology on performance. Given that the majority of athletes with eating problems were symptomatic of an ED, and, from a season-long perspective some also developed clinical EDs, a “body-healthy” environment is likely to help those athletes who are symptomatic to become asymptomatic and ultimately more satisfied with their weight.

Our findings suggest that female collegiate gymnasts and swimmers/divers experience clinical levels of eating pathology at rates slightly higher than found among athletes from less weight-sensitive sports (Carter & Rudd, 2005; Hausenblas & McNally, 2004), and their eating disorders remain stable over the course of an athletic season. A slight majority of symptomatic athletes, however, appear to resolve their concerns and report being asymptomatic at the end of
the season. Further, the majority of the athletes who were asymptomatic at Time 1 remained so at
the end of the season, casting some doubt on the theorized negative effects of training and
competing in potentially weight conscious environments. More longitudinal research is needed
to examine these issues by following athletes over the course of multiple years and seasons.
Table 1

*Prevalence of Eating Disorder Classification in a Sample of 325 Collegiate Female Athletes Followed Over a Competitive Season*

<table>
<thead>
<tr>
<th>Eating Disorder Classification</th>
<th>Season-Long Prevalence</th>
<th>Time 1 (%)</th>
<th>Time 2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>250 (76.9)</td>
<td>222 (68.3)</td>
<td>250 (76.9)</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>103 (31.7)</td>
<td>83 (25.5)</td>
<td>51 (15.7)</td>
</tr>
<tr>
<td>Eating Disordered</td>
<td>31 (9.5)</td>
<td>20 (6.2)</td>
<td>24 (7.4)</td>
</tr>
<tr>
<td>Anorexia</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Bulimia</td>
<td>1 (0.3)</td>
<td>0 (0.0)</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>ED-NOS</td>
<td>30 (9.2)</td>
<td>20 (6.2)</td>
<td>23 (7.1)</td>
</tr>
<tr>
<td>Sub-bulimia</td>
<td>19 (5.8)</td>
<td>15 (4.6)</td>
<td>16 (4.9)</td>
</tr>
<tr>
<td>Non-binge bulimia</td>
<td>7 (2.2)</td>
<td>2 (0.6)</td>
<td>5 (1.5)</td>
</tr>
<tr>
<td>Binge eating</td>
<td>5 (1.5)</td>
<td>3 (0.9)</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Weight Satisfaction</td>
<td>Season-Long Prevalence</td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Satisfied</td>
<td>234 (72.4)</td>
<td>193 (59.8)</td>
<td>196 (60.9)</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>167 (51.71)</td>
<td>130 (40.2)</td>
<td>126 (39.1)</td>
</tr>
</tbody>
</table>
Table 3  

*Prevalence of Pathogenic Eating and Weight Control Behaviors*

<table>
<thead>
<tr>
<th>Pathogenic Weight Control Behavior</th>
<th>Season-Long Prevalence</th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise to Burn Calories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 hours or more/day</td>
<td>171 (52.6)</td>
<td>138 (42.5)</td>
<td>115 (35.4)</td>
</tr>
<tr>
<td>Less than 2 hours/day</td>
<td>243 (74.8)</td>
<td>187 (57.5)</td>
<td>210 (64.6)</td>
</tr>
<tr>
<td>Fasting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-5x or more/month</td>
<td>53 (16.3)</td>
<td>40 (12.3)</td>
<td>30 (9.2)</td>
</tr>
<tr>
<td>2-3x or less/year</td>
<td>308 (94.8)</td>
<td>285 (87.7)</td>
<td>295 (90.8)</td>
</tr>
<tr>
<td>Intentionally Vomit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3x or more/week</td>
<td>15 (4.6)</td>
<td>11 (3.4)</td>
<td>7 (2.2)</td>
</tr>
<tr>
<td>1x/month or never</td>
<td>322 (99.1)</td>
<td>314 (96.6)</td>
<td>318 (97.8)</td>
</tr>
<tr>
<td>Laxative/Suppository Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3x or more/week</td>
<td>5 (1.5)</td>
<td>4 (1.2)</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>2x or less/week</td>
<td>323 (99.4)</td>
<td>320 (98.5)</td>
<td>322 (99.1)</td>
</tr>
<tr>
<td>Diuretic Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3x or more/week</td>
<td>8 (2.5)</td>
<td>5 (1.5)</td>
<td>4 (1.2)</td>
</tr>
<tr>
<td>2-3 times/month or less</td>
<td>323 (99.4)</td>
<td>319 (98.2)</td>
<td>320 (98.5)</td>
</tr>
<tr>
<td>Frequency of Binge Eating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x or more /week</td>
<td>34 (10.5)</td>
<td>18 (5.5)</td>
<td>27 (8.3)</td>
</tr>
<tr>
<td>1x or less/week</td>
<td>314 (96.6)</td>
<td>307 (94.5)</td>
<td>298 (91.7)</td>
</tr>
</tbody>
</table>
Figure 1. Eating disorder classification from Time 1 to Time 2
Figure 2. Change in weight satisfaction from Time 1 to Time 2
**Figure 3.** Change in laxative/suppository use from Time 1 to Time 2

<table>
<thead>
<tr>
<th>TIME 1</th>
<th>TIME 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3x or more/week</td>
<td>Remained 3x or more/week</td>
</tr>
<tr>
<td>$n = 4$</td>
<td>$n = 1$ (25.0%)</td>
</tr>
<tr>
<td>2x or less/week</td>
<td>Became 3x or more/week</td>
</tr>
<tr>
<td>$n = 320$</td>
<td>$n = 1$ (0.3%)</td>
</tr>
<tr>
<td></td>
<td>Became 2x or less/week</td>
</tr>
<tr>
<td></td>
<td>$n = 3$ (0.9%)</td>
</tr>
<tr>
<td></td>
<td>Remained 2x or less/week</td>
</tr>
<tr>
<td></td>
<td>$n = 319$ (99.7%)</td>
</tr>
</tbody>
</table>
Figure 4. Change in excessive exercise from Time 1 to Time 2
Figure 5. Change in vomiting from Time 1 to Time 2

- **TIME 1**
  - 2 or more times/week
    - \( n = 11 \)
  - Once/month or never
    - \( n = 314 \)

- **TIME 2**
  - Remained 2 or more times/week
    - \( n = 3 (27.3\%) \)
  - Became 2 or more times/week
    - \( n = 4 (1.3\%) \)
  - Became once/month or never
    - \( n = 8 (72.7\%) \)
  - Remained once/month or never
    - \( n = 310 (98.7\%) \)
Figure 6. Change in fasting frequency from Time 1 to Time 2
Figure 7. Change in binge eating frequency from Time 1 to Time 2

TIME 1

- 2x or more/week
  - \( n = 18 \)

- 1x/week or less
  - \( n = 307 \)

TIME 2

- Remained 2x or more/week
  - \( n = 11 \) (61.1%)

- Became 2x or more/week
  - \( n = 16 \) (5.2%)

- Became 1x or less/week
  - \( n = 7 \) (38.9%)

- Remained 1x or less/week
  - \( n = 291 \) (94.8%)
Figure 8. Change in diuretic use from Time 1 to Time 2
APPENDIX

THESIS PROPOSAL
Longitudinal Prevalence of Disordered Eating and Weight Control Behaviors in Female Collegiate Athletes

Elite and collegiate female athletes are a sub-population that have been identified as a high-risk group for the development of eating disorders (Beals, 2000; Pearson & Rivers, 2006; Smolak, Murnen, & Ruble, 2000; Sundgot-Borgen, 1993), particularly because of the unique pressures in the sport environment about weight, eating, body size/shape, and appearance that emanate from coaches, teammates, and other sport personnel. These pressures can include things like weight limits, judging criteria that reinforce certain body shapes, publically conducted weigh-ins, stereotypical performance ideals (e.g., thin physique for long-distance runners), revealing uniforms, pressures from coaches and teammates to attain a certain physique, and a competition environment inundated with competitive personalities (Thompson & Sherman, 2010). Athletes also have to cope with the pressures of performing in front of audiences, experiencing training loads that vary throughout the year (i.e., in-season vs. off-season), and balancing the workloads of being a student and athlete. The culmination of these stressors may be decreases in psychological well-being and the development of disordered eating behaviors.

The unique nature of the collegiate sport environment, and the pressures associated with it, has prompted researchers to examine the prevalence of disordered eating behaviors in female athletes. Although prevalence studies have been conducted with samples of female collegiate athletes (e.g., Anderson & Petrie, 2012; Beals & Manore, 2002; Greenleaf, Petrie, Carter, & Reel, 2009), this line of research has been limited by the use of cross-sectional designs. These methodologies provide useful information about disordered eating behaviors but at only a single point in time, what has been referred to as “point” prevalence (e.g., Beals & Manore, 2002; Petrie, 1993; Petrie, Greenleaf, Reel, & Carter, 2009a). Thus, these methodologies cannot
address the stability of eating disorder classifications and disordered eating behaviors over different periods of time, such as across an athletic season. Employing longitudinal designs, however, will allow researchers to examine the progression of pathological eating, and may provide an understanding of how eating disorders develop, abate, and/or intensify over time, such as in response to the stress of a competitive season.

Definitions of Eating Disorders

Eating disorders are pathological disturbances in eating behavior that typically include acute misperceptions and concern about body shape and weight. They often involve extreme weight control behaviors, such as strict fasting, self-induced vomiting, excessive exercise, or laxative misuse (Diagnostic and Statistical Manual of Mental Disorders-V, DSM-V; American Psychiatric Association [APA], 2013). Currently, there are four categories of eating disorders: (a) Anorexia Nervosa (AN), (b) Bulimia Nervosa (BN), (c) Binge-Eating Disorder (BED), and (d) Other Specified/Unspecified Eating Disorder (APA, 2013). Other Specified/Unspecified Eating Disorder replaced Eating Disorder Not Otherwise Specified (ED-NOS) as a diagnostic category for those individuals who demonstrate clinically significant disturbances in eating behavior, but do not meet full criteria for AN, BN, or BED. Eating disorders as a general psychological disorder warrant particular concern due to their association with a variety of comorbidities, both psychological and physiological in nature (Treasure, Claudino, & Zucker, 2009). Furthermore, eating disorders have a high risk of mortality, with rates ranging from 1.93 to 9.6 times higher than mortality rates expected in the U.S. population as a whole (Smink, van Hoeken, & Hoek, 2012).

Anorexia nervosa. AN is characterized by extreme restriction of calories and nutrients that leads to significantly low body weight, and is often associated with fear of gaining weight
and misperception about one’s body weight and shape (APA, 2013). AN has been associated with developmental disorders (i.e., autism spectrum, attention-deficit hyperactivity disorder; Treasure et al., 2009), anxiety disorders, both obsessive compulsive disorder and personality traits, major depressive disorder, and substance misuse (Hudson, Hiripi, Pope Jr., & Kessler, 2007). In addition to psychological distress, a variety of physiological effects can result from extreme dieting, some of which occur secondarily to nutritional deficits (Winston, 2004).

Common physical complications associated with women with AN may include gastrointestinal disturbances (e.g., delayed gastric emptying), dental erosion, cardiovascular irregularities (e.g., low blood pressure, arrhythmias), electrolyte imbalances, bone mineral density loss, amenorrhea, dry skin, and sensitivity to cold.

*Bulimia nervosa.* BN includes self-evaluation based on body weight and shape, but is accompanied by recurrent episodes of binging and purging behaviors (APA, 2013). Binging is defined as eating an amount of food that is significantly larger than one would typically eat in a given time period, and normally is accompanied by an inability to control or stop oneself. Within BN, binges are followed by an episode of purging or compensatory behaviors, such as vomiting, laxative or diuretic misuse, fasting, or excessive exercise. Associated psychological co-morbidities may include affective disorders (e.g., depression, bipolar disorder), anxiety disorders (e.g., specific phobia, social phobia, post-traumatic stress), impulse control disorders (e.g., attention-deficit hyperactivity, oppositional defiance), and substance misuse (Hudson et al., 2007; Treasure et al., 2010). Physiological disturbances typically result from purging behaviors (i.e., vomiting, laxative misuse, fasting, excessive exercise) rather than binging, and can include dehydration, electrolyte imbalances, acute renal failure, nutritional deficiencies, dental erosion, menstrual dysfunction, and inflammation of esophageal lining (Winston, 2004).
**Binge-eating disorder.** BED was previously categorized as ED-NOS, but now represents its own category in the *DSM-V* (APA, 2013). BED consists of episodes of binge eating, similar to BN, but without the use of pathogenic weight control behaviors. Psychological co-morbidities that have been related to BED may include anxiety disorders (e.g., specific phobia, social phobia), mood disorders (e.g., depression), impulse control disorders (e.g., attention-deficit hyperactivity, oppositional defiance), personality disorders (e.g., avoidant, borderline), and substance misuse (Hudson et al., 2007). Physical complications can include obesity, fibromyalgia, irritable bowel syndrome, insomnia, and physical inactivity (Javaras et al., 2008).

**Other specified/unspecified eating disorders.** Other specified/unspecified eating disorders replaced ED-NOS as a diagnostic category and applies to those individuals who demonstrate clinically significant disturbances in eating behavior, but do not meet full criteria for any of the above three disorders (APA, 2013). Examples of specified eating disorders include atypical anorexia or bulimia nervosa, in which symptoms of AN or BN are present, but the weight requirement for AN or the frequency of binge/purge behaviors for BN is not met. Unspecified eating disorders typically represent a category of disorders in which there is clear psychological distress resulting from eating disturbances, but for which limited information is available to make a more discerning diagnosis. Psychological and physiological co-morbidities vary within this category and depend on the predominant symptomatology exhibited (i.e., symptoms of anorexia, bulimia, or BED).

**Subclinical disordered eating.** Subclinical (or symptomatic) eating disorders are not considered a diagnostic category within the *DSM-V* (APA, 2013), though they have been examined and classified by researchers. They are defined by the presence of eating disorder symptoms that do not meet full criteria or severity for one of the clinical disorders (e.g., Beals,
2000; Greenleaf, et. al, 2009; Williams, Sargent, & Durstine, 2003). Subclinical disorders may include pathological disturbances in eating behavior and misperceptions about body weight and shape, but can be distinguished from Other Specified/Unspecified Eating Disorders because they are less severe, in terms of frequency or intensity of symptoms, than clinical eating disorders. Similar to clinical eating disorders (e.g., AN, BN), subclinical disorders often involve negative self-evaluation based on body image and can include the use of pathogenic weight control behaviors, such as diet restriction, vomiting, excessive exercise, and laxative or diuretic misuse (Petrie & Greenleaf, 2012).

Prevalence of Disordered Eating in Women

*Anorexia nervosa.* Prevalence rates using *DSM-V* categories are not yet available; however, data based on *DSM-IV-TR* criteria suggest average lifetime prevalence rates range from approximately 0.5% to 0.9% (APA, 1994; Le Grange, Swanson, Crow, & Merikangas, 2012; Smink, van Hoeken, & Hoek, 2012; Treasure, Claudino, & Zucker, 2010). For example, using data collected from a 2001-2003 population-based survey, one study (Hudson et al. 2007), reported lifetime prevalence rates for women of 0.9%. Median age of onset ranged from 18-21 years, and no cases began after the mid-twenties. The average duration of this disorder was 1.7 years, which was significantly lower than the other eating disorders examined (i.e., BN, ED-NOS).

In a review of the epidemiology of eating disorders (Smink, van Hoeken, & Hoek, 2012), lifetime prevalence rates of AN were reported using both *DSM-IV-TR* and *DSM-V* criteria, for which the criterion of amenorrhea is dropped. The authors reviewed several population-based studies of women from Sweden, Australia, and Finland, and reported rates of 1.2%, 1.9%, and 2.2% using *DSM-IV-TR* criteria, and 2.4%, 4.3%, and 4.2% with *DSM-V* criteria, respectively.
These findings suggest that the exclusion of amenorrhea substantially increases the prevalence among women.

*Bulimia nervosa.* In contrast to rates of anorexia, average lifetime rates for BN generally are higher, ranging from 1.0% to 3.5% (APA, 1994; Le Grange et. al, 2012; Smink, van Hoeken, & Hoek, 2012; Treasure et al., 2010). Hudson et al. (2007) reported a lifetime prevalence rate of 1.5%. The age of onset ranged from 14 to 22 years with an average duration of 8.3 years for the disorder.

In their epidemiological review, Smink et al. (2012) reported lifetime prevalence rates for BN per both *DSM-IV-TR* criteria and *DSM-V* criteria, where symptom frequency is reduced to once per week. For Finnish female twins, they reported rates of 1.7% per *DSM-IV-TR* and 2.3% when using *DSM-V* criteria. Swedish female twins had rates of 1.2% (*DSM-IV-TR*) and 1.6% (*DSM-V*). Using only *DSM-IV-TR* criteria, they reported rates of BN ranging from 0.9% to 1.5% for U.S. and European women, 2.9% for Australian female twins between the ages of 28 to 39 years, and 1.3% to 1.6% for U.S. female adolescents.

*Binge eating disorder.* Though BED was only added to the most recent version of the *DSM*, researchers have included it as a sub-category of ED-NOS so prevalence data exist (e.g., Hudson et al., 2007; Le Grange et al., 2012; Smink et al., 2012; Treasure et al., 2010). Binge eating disorder was the most prevalent eating disorder in Hudson et al.’s study with a reported lifetime rate of 3.5% in women (2007). Age of onset ranged from 17 to 32 years, and the average duration of the disorder was 8.1 years.

In their review, Smink et al. (2012) cited one large population study of six European countries that reported lifetime prevalence rates of BED at 1.9% for women. In another study, higher rates for U.S. women (3.5%) were noted, but likely due to the use of less stringent criteria.
(i.e., duration of three months instead of standard six months for *DSM-IV* research criteria). The U.S.-based study also included estimates of BED using *DSM-V* criteria, which would then range from 0.1% to 3.6%. In a large sample of adult Swedish female twins, Smink et al. found that the average lifetime prevalence of BED was 0.17%, which increased to 0.35% using *DSM-V* criteria. The differences in prevalence rates across countries may be due to cultural differences related to food or meal portions between European countries and the United States. Despite the variability in prevalence, BED appears to be a more common eating disturbance than either AN or BN.

**Subclinical eating disorders.** Researchers have reported higher prevalence rates for subclinical eating disorders than for clinical eating disorders (Cohen & Petrie, 2005; Greenleaf, et al., 2009; Mintz & Betz; 1988; Peck & Lightsey, 2008). For example, in a sample of female undergraduates only 9.6% met full criteria for a clinical eating disorder, whereas 39% exhibited symptoms of an eating disorder and were classified as subclinical (Cohen & Petrie, 2005). Tylka and Subich (2002) surveyed 166 high school and college-aged women, finding 51.2% to be symptomatic of an eating disorder (i.e., subclinical), which was more than twice the number who met criteria for a clinical eating disorder (i.e., 21.7%). They also reported a high prevalence in the use of specific pathogenic weight control behaviors: 59.0% skipped meals, 36.7% ate fewer than 1200 calories per day, 30.1% eliminated fats, 27.7% exercised heavily, 26.5% eliminated carbohydrates, 25.9% fasted, 15.7% took appetite suppressants, and fewer than 15% either used powder supplements, diuretics, enemas, laxatives, or vomited after eating. Taken together, subclinical disordered eating is far more prevalent than clinical eating disorders and needs to be considered in all prevalence studies to fully understand the extent of these problems.
Prevalence of Disordered Eating in Female Athletes

**Clinical eating disorders.** Researchers have found the prevalence of eating disorders in female athlete populations to be equal to or greater than those reported for female nonathletes (e.g., Hausenblas & Carron, 1999; Petrie, Greenleaf, Reel, & Carter, 2009; Sanford-Martens, Davidson, Yakushko, Martens, Hinton, & Beck, 2005; Smolak, Murnen, & Ruble, 2000; Sundgot-Borgen & Torstveit, 2004). In their meta-analysis that included 92 studies and over ten thousand athletes (1999), Hausenblas and Carron found that female athletes reported more symptoms of anorexia ($ES = 0.12$) and bulimia ($ES = 0.16$) than nonathlete control groups. Similarly, in another meta-analysis, college student athletes demonstrated more problematic eating behavior than non-athletes ($d = 0.15$; Smolak et al., 2000). Although the effect sizes within the meta-analyses were small, all were significant and supported the contention that athletes were at a slightly greater risk than nonathletes across a variety of eating disorder indices.

**Elite athletes.** In a study that examined 572 female elite Norwegian athletes, 16.0% met criteria for an eating disorder, yet only 9.0% of female controls did (Sundgot-Borgen & Torstveit, 2004). Of the female athletes who met criteria for an eating disorder, 1.9% were categorized as anorexic, 6.3% as bulimic, and 7.8% as ED-NOS. Another study that examined 522 female elite Norwegian athletes categorized 20.0% as eating disordered (Sundgot-Borgen, 1993). In a third separate study of 669 female elite Norwegian athletes ranging in age (13 to 39 years) and sport type (e.g., technical, endurance, aesthetic, weight class), the authors found that 4.8%, 8.1%, and 19.9% met criteria for anorexia nervosa, bulimia nervosa, and ED-NOS, respectively (Torstveit, Rosenvinge, & Sundgot-Borgen, 2008).

**Collegiate athletes.** Studies using female collegiate athlete samples have reported rates of clinical eating disorders that have ranged from 2.0% to 16.6% (Anderson & Petrie, 2012;
Carter & Rudd, 2005; Petrie, et. al, 2009a; Greenleaf et al., 2009; Sanford-Martens et al., 2005). For example, in a sample of 442 National Collegiate Athletic Association (NCAA) Division I female athletes representing 21 sports, 5.7% ($n = 25$) met criteria for an eating disorder, one of which was categorized as bulimia nervosa and the remaining 24 as ED-NOS (Petrie, et. al, 2009a). The majority (91.7%) of those within the ED-NOS classification exhibited bulimic symptomatology (i.e., 9 with subthreshold bulimia, 8 with nonbinging bulimia, and 5 with binge-eating disorder). The remaining 2 athletes were categorized as subthreshold anorexia, which would meet the most recent DSM criteria for anorexia (i.e., all criteria for anorexia met but maintain menstrual cycle). In a similar study of female collegiate athletes ($N = 158$) who were drawn from 18 NCAA Division I sports, Sanford-Martens et al. (2005) reported a prevalence rate of 5.1% for clinical eating disorders, though they did not provide a breakdown of the specific disorders in this category. In another mixed-sport sample of 425 NCAA Division I female athletes, 3.3% and 2.3% reported symptoms that met criteria for anorexia nervosa and bulimia nervosa, respectively (Beals & Manore, 2002). However, Greenleaf et al. (2009) found that only 2.0% of 204 NCAA-DI female athletes met criteria for an eating disorder, all of which were categorized as ED-NOS. Similarly, Carter and Rudd (2005) examined an entire NCAA-DI student-athlete body across two years and found a range of 2.0% to 2.5% of females who met criteria for an eating disorder across each year, all of which were ED-NOS. The variability of prevalence found across these studies may be due, in part, to the athletes who comprised the samples, being drawn from a wide range of sports.

In an effort to limit this variability in reported prevalence, Hausenblas and Carron (2002) recommended that a large group from a specific at-risk sport (e.g., gymnastics) be examined instead of combining numerous different sports. Another methodological approach to minimize
the variability has been to group sports that share similar qualities, such as combining sports that are “lean, or “non-lean” (e.g., Anderson & Petrie, 2012; Beals & Manore, 2002; Sanford-Martens et al., 2005; Torstveit, et. al, 2008). For example, Sanford-Martens et al. (2005) distinguished between lean (i.e., cross country, gymnastics, swimming/diving, and wrestling) and non-lean (i.e., volleyball, golf, softball, basketball, soccer, and tennis) sports and found 3.6% and 5.9% of NCAA-DI female athletes in these groups, respectively, met criteria for an eating disorder. Beals and Manore (2002) compared aesthetic (i.e., cheerleading, diving, and gymnastics) and endurance (i.e., basketball, cross country/track, field hockey, crew, soccer, swimming, and water polo) sports, identifying 5.6% and 3.5% of the athletes, respectively, who met criteria for an eating disorder. Anderson and Petrie (2012) sampled 414 NCAA Division I gymnasts, swimmers, and divers, and found that 6.3% overall met criteria for an eating disorder, all of which were labeled as ED-NOS. Separated by sport, 6.1% of gymnasts and 6.7% of swimmers and divers were categorized as eating disordered. Furthermore, in a sample of 215 NCAA-DI gymnasts, 16.6% were reported as being at-risk for bulimia (Petrie, 1993). Despite these attempts to group the sports into qualitatively similar categories, variability continues to exist in prevalence rates, though the incidence does appear to be higher in sports that are aesthetic and endurance focused.

Subclinical eating disorders. Researchers often find higher percentages of athletes who endorse symptoms of eating disorders than who meet full diagnostic criteria (e.g., Carter & Rudd, 2005; Greenleaf et al., 2009; Sundgot-Borgen & Torstveit, 2004). In a large sample of elite female Norwegian athletes, 4% met criteria for a subthreshold eating disorder, specifically anorexia athletica, which was defined by the researchers as an intense fear of gaining weight despite being underweight (i.e., 5% less than normal expected weight for given age and height)
due to dietary restriction or excessive exercise (Sundgot-Borgen & Torstveit, 2004). This classification system was more narrowed than those that have been applied in studies of female collegiate athletes. For example, in a mixed-sport sample of NCAA female athletes, including sports such as gymnastics, basketball, swimming, and golf, 15.2% demonstrated symptomatology (i.e., EAT-26 score greater than or equal to 20) such that they were deemed “at-risk” for an eating disorder (Beals & Manore, 2002). Within an entire NCAA-DI student-athlete population at a large university, 17.0% to 19.2% of the female athletes were classified as subclinical across two subsequent years (Carter & Rudd, 2005). Other studies with female collegiate athletes that have used broader criteria have reported prevalence rates of subclinical disorders that have ranged from 14.5% (Sanford-Martens et al., 2005) to 25.5% (Greenleaf et al., 2009). Among female collegiate swimmers and gymnasts, 26.1% of the athletes were classified as symptomatic (Anderson & Petrie, 2012). Consistent with what has been found using non-athlete samples, female athletes exhibit a greater frequency of subclinical eating problems than they do behaviors that warrant a clinical diagnosis.

Pathogenic weight control behaviors. Specific pathogenic weight control measures, such as dieting and excessive exercise, have been examined as well among female athletes. In the Greenleaf et al. (2009) study, female athletes reported employing a range of weight control behaviors including fasting or maintaining strict diets at least twice in the last year (15.7%), binge eating at least once per week (18.6%), exercising at least 2 hours per day to burn calories (25.5%), vomiting at least 2 to 3 times per month (2.9%), and using diuretics 2 to 3 times per month (1.5%) or laxatives 1 to 2 times per week (1.0%). Among female athletes from 15 different sports (e.g., diving, gymnastics, basketball, swimming, softball), 67% consciously limited food choices (e.g., eliminate red meat, severely restrict fat intake, reduce carbohydrate
intake), 42% purposely restricted food intake for the purpose of controlling weight, 6% engaged in binge eating, 11% fasted, 15% maintained low-calorie diets, 4% used laxatives, 8% used diet pills, and 7% vomited as a means of controlling weight (Beals & Manore, 2002). Furthermore, those female athletes who participated in aesthetic sports (e.g., cheerleading, diving, gymnastics) exhibited significantly more eating pathology and reported greater use of pathogenic weight control behaviors (e.g., low calorie diets, fasting, vomiting, laxative misuse) than those in endurance (e.g., basketball, cross country, field hockey, soccer, swimming) or team sports (e.g., track, golf, softball, tennis, volleyball). Over a two year period, the female athletes from a large NCAA-DI university (Carter & Rudd, 2005), which included the sports of gymnastics, swimming, and volleyball, to name a few, reported binge eating (6.2% to 7.1%), purging (e.g., fasting, self-induced vomiting; 1.7% to 2.8%), and using diet pills (2.3% to 4.6%) to control their weight. The authors also found that athletes who participated in sports emphasizing a lean physique (e.g., gymnastics, rowing, swimming, volleyball) reported higher rates of pathogenic weight control behaviors (e.g., chronic dieting) than those in non-lean sports (e.g., basketball, field hockey, golf, soccer, softball). Anderson and Petrie (2012) also sampled a group of female athletes from both lean (i.e., swimming) and aesthetic (i.e., gymnastics, diving) sports. The athletes reported employing weight control methods including fasting or maintaining strict diets at least once in the last year (gymnasts 18.6%; swimmers/divers 13.4%), binge eating at least once per week (gymnasts 6.1%; swimmers/divers 9.0%), exercising more than 2 hours per day to burn calories (gymnasts 39.3%; swimmers/divers 35.1%), vomiting at least twice per week (gymnasts 201%; swimmers/divers 1.5%), and using diuretics at least 3 times per week (gymnasts 1.1%; swimmers/divers 1.5%) or laxatives 2 to 3 times per month (gymnasts 1.8%; swimmers/divers 1.5%). Across all these behaviors there were no significant differences
between the gymnasts and swimmers except with respect to the frequency with which they exercised and dieted. Overall, athletes report greater use of dieting (and other food restricting practices) and exercise as means of controlling weight than more extreme behaviors (e.g., vomiting, laxative use). Further, athletes who participate in aesthetic sports or sports that emphasize a lean physique may use these pathogenic weight control behaviors at rates that are higher than athletes from other sport types.

Summary

In female athlete samples, the prevalence of clinical and subclinical eating disorders has ranged from 1.9% to 16.6% and 4.0% to 26.1%, respectively. Studies that included elite athletes have reported rates ranging from to 1.9% to 4.8% for those exhibiting symptoms of AN, 6.3% to 8.1% for BN, and 16.0% overall (i.e., including ED-NOS). Collegiate athletes appear to meet criteria for ED-NOS more often than either AN or BN, with the exception of one study that found 16.6% of gymnasts were at-risk for BN (Petrie, 1993). Rates of ED-NOS have ranged from 2.0% to 6.3%, depending on the athletes sampled. In addition to experiencing disordered eating, female athletes commonly engage in pathogenic weight control behaviors, tending toward the use of dieting and exercising as opposed to more extreme measures (e.g., vomiting, diuretic or laxative misuse). Collegiate female athletes, particularly those who participate in sports that emphasize a lean physique (e.g., gymnastics, swimming, cross country), may be at increased risk for the development of disordered eating behaviors and pathogenic weight control behaviors. Thus, it appears that female athletes are more likely to exhibit subclinical disordered eating or pathogenic weight control behaviors than the different categories of clinical eating disorders. When they do meet criteria for clinical eating disorders, they tend to exhibit bulimia-related behaviors and attitudes, and their use of pathogenic weight control behaviors seems to be less
extreme and more sustainable (i.e., dietary restraint and excessive exercise). It may be that these forms of pathogenic weight control can be “hidden” within the sport environment. For example, it may be easier for athletes to engage in restrictive diets or supplemental exercise without generating concern, whereas more extreme behaviors such as vomiting and diuretic or laxative misuse may be more difficult to conceal from others. Additionally, athletes may be hesitant to engage in more extreme weight control behaviors for fear of health detriments that may result.

Limitations of Past Research

Previous research has established that female collegiate athletes do experience eating disorders that range from the use of pathogenic weight control behaviors (e.g., dieting, vomiting), to subclinical (i.e., the presence of some symptoms of an eating disorder), to clinical (i.e., the presence of symptoms that meet diagnostic criteria; Anderson & Petrie, 2012; Greenleaf et al., 2009; Sundgot-Borgen & Torstveit, 2004; Williams et al., 2003). Although important, these studies have been limited in providing information about the prevalence of pathogenic or disordered eating behaviors at a single time point. And, depending on how the assessment of eating disorder symptoms was framed, the data provided information about either point-prevalence (i.e., the presence of eating disorder symptoms/behaviors at that specific point in time) or life-time prevalence (i.e., the presence of eating disorder symptoms/behaviors at any point within the individual’s lifetime). Employing methods that can elucidate the progression, maintenance, and/or reduction in disordered eating behaviors will help researchers understand the course of these disorders (and related symptoms/behaviors) among female athletes.

Although the use of a longitudinal research design has been recommended (Hausenblas & Carron, 1999; Petrie & Greenleaf, 2012), to date, only a few studies have incorporated this approach in studies with female athletes (Anderson, Petrie, & Neumann, 2012; Doughty &
Doughty and Hausenblas (2005) selected various subscales (i.e., Drive for Thinness, Body Dissatisfaction, Perfectionism) from the Eating Disorder Inventory-2 (EDI-2) and compared 72 NCAA-DI gymnasts’ responses at two different time points, once during the preseason and once during the competitive season. They found no significant within group differences on any measure across the two points in time, suggesting that the level of the pathological eating behaviors were relatively stable. They did not, however, examine prevalence of disordered eating using a diagnostic measure nor how specific weight control behaviors might change over the course of the season. Relatedly, Krentz and Warschburger (2013) sampled 38 elite aesthetic sport (e.g., gymnastics, figure skating, ballet) adolescent athletes on their degree of eating disorder symptomatology using the EAT-26 at two separate time points, approximately one year apart. The authors found the female athletes’ eating disorder scores on the EAT were relatively stable, with no significant differences between year 1 and year 2.

Anderson et al. (2012) surveyed 325 NCAA-DI female gymnasts, swimmers, and divers regarding their experience of sport pressures to achieve a certain body shape, body satisfaction, and their intent to diet or restrict food intake at two different time points – within the first two weeks of their competitive seasons (Time 1) and again in the final two weeks of their seasons just before their conference championships (Time 2). They found that sport pressures about body and weight that the athletes reported experiencing at Time 1 predicted decreases in their Time 2 body satisfaction, even after accounting for the athletes’ body satisfaction at Time 1. Further, within each disordered eating variable (i.e., sport pressures, body satisfaction, dietary restraint) the athletes’ Time 1 scores accounted for 25% to 64% of the variance in their Time 2 scores,
suggesting that these constructs remained relatively stable over the course of their athletic seasons, which is consistent with the findings of Doughty and Hausenblaus (2005).

Each of the above studies utilized indices of disordered eating (i.e., scores from an eating disorder measure) to estimate prevalence of eating pathology in female athletes as opposed to assessing specific pathogenic weight control behaviors or eating disorder diagnoses. Although these results do suggest some stability among disordered eating attitudes and behaviors (e.g., body satisfaction, dietary intent) across athletic seasons, they do not address the question of how specific behaviors and eating disorder prevalence may change over time. Thus, longitudinal research is needed to examine this issue among female collegiate athletes.

Although not a traditional longitudinal study in which the same sample was examined over time, Sungot-Borgen and Torstveit (2010) did report on the prevalence of eating disorders from 1990 to 2002, which provides the support for more research in this area. Using existing data from comparable samples of female elite athletes that they had collected and reported on during 1990-1991 (Sundgot-Borgen, 1993), 1997-1998 (Sundgot-Borgen & Torstveit, 2004), and 2001-2002 (Torstveit et al., 2008), they examined how the frequency of specific eating disorder diagnoses changed across the 10 year span. Prevalence rates of athletes considered at-risk for an eating disorder varied, ranging from 22.4% in 1990-1991, to 21.2% in 1997-1998, to 60.1% in 2001-2002. Female athletes who met criteria for an eating disorder also varied over the course of the three studies, ranging from 20.0% in 1990-1991, to 21.5% in 1997-1998, to 28.1% in 2001-2002. Although these data suggest an increase in the prevalence of elite female athletes who were at-risk as well as those who met the criteria for a clinical disorder over time, the authors acknowledged that the higher rates in the 2001-2002 sample also could be due to other factors, specifically (a) the inclusion of more criteria that would identify athletes as being at-risk,
or (b) increased individual and societal awareness of disordered eating behaviors among the athletes. As noted previously, a major limitation of this study was the lack of single sample of female athletes that was compared over time. Thus, as the authors’ acknowledged, the change in prevalence may not have reflected an actual increase in risk.

Research with nonathletes has used a longitudinal approach to examine changes in the prevalence of disordered eating behavior over time. Stice, Marti, Shaw, and Jaconis (2009) followed the same group of 496 adolescent girls over an eight year span. By the eighth year of the study, when the women were on average 20 years old, the authors determined a lifetime prevalence of 12% for the sample (subthreshold anorexia = 0.6%, anorexia = 0.6%, subthreshold bulimia = 6.1%, bulimia = 1.6%, subthreshold binge eating disorder = 4.6%, binge eating disorder = 1.0%, purging disorder = 4.4%). Of those diagnosed with subthreshold bulimia at some point in the study \( n = 30 \), five of the women progressed over time to be classified with Bulimia Nervosa. Additionally, three participants’ presentations of subthreshold binge eating disorder (BED) intensified to become clinically significant BED over the course of the study. Stice et al. (2009) also reported the crossover between eating disorder classifications, which occurred for 20 of the women. Specifically, six participants moved from bulimia to binge eating disorder, 10 from binge eating to bulimia, one from binge eating to purging, one from purging to bulimia, and two from purging to binge eating. Overall, 13% to 17% of the participants who were originally classified with subthreshold BN or BED later demonstrated symptomatology such that they met criteria for BN or BED at follow up and were thus classified as eating disordered. Additionally, crossover between disordered eating categories was most common for those presenting with BN- or BED-related behaviors. The authors also reported recovery rates, with which they found 91\% \( n = 29 \) of those with either subthreshold or clinical BN, 96\% \( n = \)
23) of those with threshold or clinical BED, and 95% (n = 21) of those with purging disorder recovered within 1 year of their diagnoses. Overall, this study’s findings indicate that eating disorder classification does change over an 8-year time period. Although important for understanding the potential progression of eating disorders, this study was limited by the fact that data collection occurred on a yearly basis, which may have missed other changes in eating behaviors that occurred over a shorter timeframe. Also, participants who met criteria for an eating disorder were given referrals and encouraged to seek treatment, which may have shortened the duration of eating pathology. Despite these limitations, applying Stice et al.’s methodology within a female athlete sample will be necessary to be able to examine change in prevalence rates over time, progression, reduction or maintenance of symptom classification, and transformation or crossover from one eating disorder category to another.

Purpose & Current Study

In the current study I will investigate the prevalence of eating disorders (i.e., eating disordered, symptomatic, and asymptomatic) and pathogenic weight control behaviors (i.e., binging, vomiting, laxative use, diuretic use, fasting, and excessive exercise) in female collegiate gymnasts and swimmers/divers across two time points – the beginning of their competitive seasons (Time 1) and during the final two weeks of their competitive seasons (Time 2). Data on Time 1 prevalence has been presented (Anderson & Petrie, 2012), so this study will focus on (1) comparing prevalence rates of clinical and subclinical eating disorders between Time 1 and Time 2, (2) comparing prevalence rates for the use of pathogenic weight control behaviors at Time 1 and Time 2, (3) examining progression or reduction of symptoms (i.e., movement between asymptomatic, symptomatic, and eating disordered categories) between Time 1 and Time 2, and (4) examining diagnostic change or crossover from one disorder to another between Time 1 and
Time 2. Given the lack of specific data examining changes in prevalence rates among female athletes over time, no specific hypotheses were made. It is hypothesized that (1) the prevalence rates for the disordered eating groups (i.e., eating disordered and symptomatic) will increase from Time 1 to Time 2, (2) the prevalence rates of pathogenic weight control behaviors (i.e., binging, vomiting, laxatives, diuretics, fasting, excessive exercise) will increase from Time 1 to Time 2, (3) there will be a general trend in the progression of symptomatology (i.e., movement from asymptomatic category to symptomatic, and from symptomatic to eating disordered) from Time 1 to Time 2, and (4) there will be movement or crossover between bulimic, binge eating, and purging categories from Time 1 to Time 2.
REFERENCES


