

EATING DISORDER SPECIFIC HEALTH-RELATED QUALITY OF LIFE AND  
EXERCISE: FURTHER TESTING OF A CONCEPTUAL MODEL

By

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Dedicated to my grandfather, Larry Hebert.

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Abstract of Dissertation Presented to the Graduate School  
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EATING DISORDER SPECIFIC HEALTH-RELATED QUALITY OF LIFE AND  
EXERCISE: FURTHER TESTING OF A CONCEPTUAL MODEL

By

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Eating disorders are serious psychiatric illnesses associated with high mortality rates, functional impairment, emotional distress, psychiatric comorbidity, chronic course, expensive treatment, added healthcare burden, and impaired health-related quality of life. Researchers are continually finding that eating disorders results in reduced quality of life in both clinical (i.e., eating disordered) and nonclinical populations. Thus, theoretical models are needed to help ameliorate the detrimental effects of eating disorders through the continuum of there development. A recent model called the Exercise and Eating Disorder Model posits that in the absence of pathological psychological factors such as exercise dependence, the quality of life benefits conveyed by regular exercise may counteract the intervene on the development and maintenance of eating disorders.

The purpose of my dissertation was to closely examine the relationships proposed in the Exercise and Eating Disorder Model. Specifically, my primary purpose was to examine the relationships proposed in the Exercise and Eating Disorders Model with an eating disorder specific measure of quality of life. I hypothesized that exercise will be associated with positive changes in malleable risk factors such as physical well-being

and psychological well-being, while also associated with improvements in malleable protective factors such as social well-being and quality of life. These enhancements are also hypothesized to be associated with reduced eating disordered outcomes. My secondary purpose was to further delineate exercise amount versus exercise compulsion by more closely examining the path of exercise dependence as a mediator of exercise to eating disorders as identified in the Exercise and Eating Disorder Model. I hypothesized that the psychological criteria of exercise dependence will act as mediators in this relationship.

The results of my dissertation indicated that the hypothesis of my primary purpose was partially supported. Specifically, I found support for the beneficial association of psychological well-being on eating disorders as well as the detrimental association of exercise dependence on eating disorders. My results also indicated that my secondary purpose was partially supported. That is, the psychological criteria of exercise dependence showed a mediation relationship on exercise and eating disorders. However, the physical criteria also showed a mediation relationship.

Future research is needed to further develop the Exercise and Eating Disorder Model. Based on the results of my dissertation, I proposed two modifications to the Exercise and Eating Disorder Model. Future research is needed to continue to examine all relationships proposed in the Exercise and ED Model with longitudinal and experimental designs.

## CHAPTER 1 INTRODUCTION

Eating disorders (ED) are serious psychiatric illnesses associated with high mortality rates, functional impairment, emotional distress, psychiatric comorbidity, chronic course, expensive treatment, added healthcare burden, and impaired health-related quality of life (QOL; Crow & Nyman, 2004; Harris & Baraclough, 1998; Hay & Mond, 2005; Mitchell, Myers, Crosby, O'Neill, Carlisle, & Gerlach, 2009; Smolak & Striegel-Moore, 2004; Stice, Marti, Shaw, & Jaconis, 2009). Two main variants of ED are specified as Anorexia Nervosa and Bulimia Nervosa. Anorexia is categorized as a refusal to maintain at least 85% of expected body weight (APA, 2000). Bulimia is categorized as recurrent episodes of bingeing (i.e., consuming many more calories than what is considered normal under similar circumstances) and purging (i.e., engaging in one or more of several compensatory behaviors in an attempt to counteract the weight gain effects of increased caloric consumption; APA, 2000).

Recently, the continuum model of ED has proposed that anorexia and bulimia can be categorized as a single transdiagnostic continuum of ED (Fairburn & Bohn, 2005; Fairburn, Cooper, & Shafran, 2003; Hay & Fairburn, 1998). The continuum model of ED states that the behaviors and attitudes, such as body dissatisfaction, over concern about weight and shape, and calorie-restrictive dieting, observed in full threshold ED individuals begin with less severity and progress linearly, culminating in either anorexia or bulimia. Levine and Smolak's (2006) literature review presents the possibility that the research may support a continuum model culminating in bulimia, with a continuum of all ED potentially existing. Some recent studies, however, have not supported the continuum model of ED, resulting in researchers concluding that anorexia and bulimia

should be considered two distinct and separate ED (Birmingham, Touz, & Harbottle, 2009). In short, considerable debate exists concerning the transdiagnostic nature of ED. Thus, the forthcoming fifth edition of the Diagnostic and Statistical Manual (DSM-V) scheduled for publication in 2012 has been charged with examining possible changes to the diagnostic criteria for all ED (Walsh, 2009).

Despite discrepancies in classification, researchers are continually finding that ED results in reduced QOL. In recent years, increased research attention has been given to the effects of ED symptoms on health-related QOL for both clinical (i.e., eating disordered) and nonclinical populations. QOL is a broad term that includes physical, psychological, and social aspects related to an individual's overall well-being (Hennessy et al, 1994; WHOQOL group, 1998). Compared to overweight individuals (i.e., a group with well-documented health impairments), nonclinical people engaging in ED behaviors experience more health impairments in the QOL constructs of psychosocial and physical health functioning (Mond, Hay, Rodgers, & Owen, 2009). Attention has focused on QOL in ED individuals for at least four reasons. First, both clinical and subclinical ED individuals have lower levels of QOL than normal controls. Second, the impairment is comparable to other serious illnesses and disorders. Third, health impairments extend to family members caring for ED individuals. Fourth, treatment improves QOL in ED individuals (Engel, Adair, Las Hayas, Abraham, 2009). Because of the negative effects of ED symptoms on QOL, there has been an increased interest in examining the effects of ED symptoms on QOL in both clinical and nonclinical ED populations (Engel et al., 2009; Hay & Mond, 2005).

Several behaviors affect QOL. Of importance to my dissertation, the physical and psychological benefits of exercise may positively influence QOL constructs (Brown, Brown, Heath, Balluz, Giles, et al., 2004; Martin, Church, Thompson, Earnest, & Blair, 2009; Fox, 1999, USDHHS, 2008). Several of these health benefits may also positively impact know risk and maintaining factors as well as health consequences of ED (Hausenblas et al., 2008). Specifically, regular exercise is associated with improvements in several physical (e.g., cardiovascular, metabolic benefits, decreased adiposity, and increases in bone density), psychological (e.g., improved body image, depression, anxiety, stress reactivity, and self-esteem), and social benefits (Campbell & Hausenblas, 2009; Fox, 1999; Haskell, 1994; Hausenblas & Fallon, 2006; Mehler & Krantz, 2003; Paluska & Schwenk, 2000; Taylor, 2003). For example, the physical benefits such as decreased adiposity positively affect sociocultural pressures to be thin thus, contributing to a leaner, fit, and culturally ideal body type (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). Cardiovascular benefits such as increased cardiac mass, increased stroke volume and cardiac output at rest and during exercise, lower resting heart rate and blood pressure, and a decreased tendency for blood clotting are pertinent to ED research because cardiac damage can occur during ED development (Haskell, 1994; Mehlenbeck, 2002; Pearson et al., 2002; Sobel, 2004). Similarly, exercise has the ability to impart positive improvements on the psychological ED risk factors of anxiety (Landers & Arent, 2001; Taylor, 2003), body dissatisfaction (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006), depression (Craft & Landers, 1998; Landers & Arent, 2001), stress reactivity (Crews & Landers, 1987; Taylor, 2003), and self-esteem in nonEd populations (Landers & Arent, 2001; Taylor, 2003).

Current exercise guidelines identify the minimum amount of exercise needed to experience the aforementioned health benefits of regular physical activity, and also recommend that increases in exercise are associated with additional health benefits (USDHHS, 2008). However, no guideline/threshold exists for the maximum amount of physical activity. That is, although increases above the minimum physical activity guidelines are encouraged to receive additional health benefits, no cut-off exists for “how much is too much”. Simply stated, no upper limit of exercise amount exists; thus it is unknown if there is a point at which increased exercise may become detrimental to one’s health.

Although increased amounts of exercise can lead to negative consequences such as exercise dependence (Hausenblas & Symons Downs, 2002a), the amount of exercise required for exercise dependence has not been established. Correlational research also associates increased amounts of exercise with the development and maintenance of ED (Davis, Katzman, & Kirsh, 1999; Holm-Denoma, Scaringi, Gordon, Van Orden, & Joiner, 2009; Levitt, 2008). It appears to be contradictory that increased exercise leads to health benefits (USDHHS, 2008), yet also has the potential to result in negative consequences such as exercise dependence (Hausenblas & Symons Downs, 2002a) and ED symptoms (Davis, Katzman, & Kirsh, 1999; Holm-Denoma, Scaringi, Gordon, Van Orden, & Joiner, 2009; Levitt, 2008). Therefore, examining psychological motivations rather than exercise amount may help explain these relationships (Cook & Hausenblas, 2008; Hausenblas & Symons Downs, 2002a). Simply stated, there is confusion concerning the relationship of exercise amount and ED and a need exists to further our understanding of the relationship between exercise, ED, and exercise

dependence (Meyer, Taranis, & Touyz, 2008). Thus, the mechanisms of how exercise can lead to detrimental consequences for some as well as health benefits for others must be determined.

A recent model, titled the Exercise and ED Model, suggests that regular exercise improves QOL, which in turn decreases the risk of developing an ED (Cook, Hausenblas, Tuccito, & Giacobbi, under review; Hausenblas, Cook, & Chittester, 2008). Simply stated, the Exercise and ED Model posits that in the absence of pathological psychological factors such as exercise dependence, the benefits conveyed by regular exercise (e.g., decreases in depression and anxiety, increases in stress reactivity and self-esteem, and positive physiological changes) may counteract the risk factors for ED (e.g., body dissatisfaction, depression, anxiety, increased body mass). The initial test of this model using structural equation modeling suggest support for a partially mediated model where the mental health benefits of exercise positively influence ED development and exercise dependence negatively influence ED development (Cook et al., under review).

Although Cook and colleague's study (under review) showed initial support for the associations between constructs presented in the Exercise and ED Model, future research must further elucidate their findings for three reasons. First, the sample was healthy and physically active college students recruited from health oriented undergraduate classes. This was evident by the students reporting good psychological and physical well-being scores, regular physical activity, and nonsymptomatic ED risk. Thus, because of the small range in the aforementioned constructs, the variance of this sample was small. Such a homogenous sample limits the ability to detect large

differences and generalize the findings to other populations. Furthermore, because the sample was active it is expected that they will receive the established psychological health benefits associated with prolonged exercise (Fox, 1999).

Second, the SF-36 (Ware & Gandek, 1998; Ware & Sherbourne, 1992), which is a well-validated generic measure of QOL, was used to measure key QOL constructs in the model. While it is common to use generic QOL measures in ED populations (Hay & Mond, 2005), and it is preferable to use a validated rather than an unvalidated QOL measure (Fairclough, 2002), the negative health consequences experienced along the continuum of ED may not be captured by generic QOL measures (Abraham et al., 2006; Adair et al., 2007; Engel et al., 2006; Las Hayas et al., 2006).

Finally, structural equation modeling relies heavily on existent theory and knowledge (Schumacker & Lomax, 2004). Research examining the mediational path of exercise dependence (i.e., a key component in the model; Hausenblas et al., 2008) revealed only small amounts of variance explained (Cook & Hausenblas, 2008). Future testing of the Exercise and ED Model with structural equation modeling may therefore be improved if the mediation relationship of exercise dependence is further elucidated. That is, the minimal amount of a priori knowledge regarding this path may have been a limitation of Cook's et al. (under review) study. In summary, a need exists to recruit more diverse samples in terms of exercise and health behaviors, test this model with ED specific QOL measures, and provide more empirical research that will further clarify the relationship between model constructs.

In summary, closer examination of the associations presented in the Exercise and ED Model is needed to provide a rationale for future prospective and experimental

studies. Therefore, the primary purpose of my dissertation was to further examine the relationships proposed in the Exercise and ED Model (Cook et al., under review; Hausenblas et al., 2008) with a more diverse health sample and an ED specific QOL measure. Specifically, the Eating Disorders Quality of Life instrument, which is a psychometrically-sound measure of ED specific QOL (Engel et al., 2006), was used to assess the physical well-being and psychological well-being QOL constructs in a more diverse college sample. I hypothesized that exercise will be associated with positive changes in malleable risk factors such as physical well-being and psychological well-being, while also associated with improvements in malleable protective factors such as social well-being and quality of life. These enhancements are also hypothesized to be associated with reduced ED outcomes (APA, 2007; Haines & Neumark-Sztainer, 2006; Hausenblas et al., 2008).

With regard to my secondary purpose, preliminary studies report that exercise dependence may mediate the relationship between exercise and ED (Cook & Hausenblas, 2008, Cook et al., under review). What remains to be determined is which, if all, of the criteria of exercise dependence best explain this mediation relationship as presented conceptually in the Exercise and ED Model. The measurement of exercise dependence is based upon seven criteria identified from addiction research (APA, 2000; Hausenblas & Symons Downs, 2002a) and therefore includes physiological (i.e., time, tolerance, and withdrawal) and psychological criteria (i.e., reduction in other activities, lack of control, intention, and continuance). Thus, the physical criteria may not be of importance when examining the psychological aspect of pathologically excessive exercise (Bamber et al., 2000). For example, exercise dependence criteria such as

“time” (i.e., a great deal of time is spent in activities to obtain exercise), “tolerance” (i.e., a need to increase amounts of exercise to achieve the desired effect or diminished effect with continued use of the same amount of exercise), and “withdrawal effects” (i.e., withdrawal symptoms for exercise or when the same amount of exercise is engaged in to avoid withdrawal effects) may be an artifact of exercise behavior itself (ACSM, 2000; Hausenblas & Symons Downs, 2002b; USDHHS, 2008). Conversely, criteria such as “continuance” (i.e., exercise is continued despite knowledge of having persistent or recurring physical or psychological problems likely caused by or exacerbated by the exercise), “lack of control” (i.e., a persistent desire or unsuccessful effort to cut down or control exercise), “reduction in other activities” (i.e., social, occupational, or recreational activities are given up because of exercise), and “intention” (i.e., exercise is often taken in larger amounts or over longer periods of time than was intended) may more closely reflect the obsessional nature of exercise dependence (Blatt, 1995; Gulker et al., 2001; Hausenblas & Symons Downs, 2002b; Hollander, 1993). Therefore, the secondary purpose of my dissertation was to further delineate exercise amount versus exercise compulsion by more closely examining the path of exercise dependence symptoms as a mediator of exercise to ED as identified in the Exercise and ED Model (Cook & Hausenblas, 2008; Cook et al., under review). Specifically this was done by examining the variance explained by each of the seven criteria of exercise dependence (Hausenblas & Symons Downs, 2002b). I hypothesized that the continuance, lack of control, reduction in other activities, and intention criteria will act as mediators of the exercise and ED relationship (Blatt, 1995; Gulker et al., 2001; Hollander, 1993).

## CHAPTER 2 LITERATURE REVIEW

The purposes of this chapter are to present pertinent research and provide a general understanding of ED, exercise, and QOL as relevant to my dissertation. First, I will begin with a brief overview of ED followed by a review of the exercise and ED research. Then, I will review the ED specific QOL literature. Finally, I will review the current state and limitations of measuring QOL in ED populations. The research presented in this literature review will show the need to further examine the Exercise and ED Model (Cook et al., under review; Hausenblas et al., 2008) with improved measurement of QOL and model constructs.

### **Eating Disorders Overview**

The Diagnostic and Statistical Manual of Mental Illness (DSM; APA, 2000) defines ED as severe disturbances in eating behavior. Two variants (Anorexia Nervosa and Bulimia Nervosa) are specifically identified. The criteria for anorexia includes an intense and unrealistic fear of becoming fat, engaging in behaviors intended to produce distinct weight loss, and amenorrhea resulting from the refusal to maintain a healthy weight. The disturbance of self-evaluation and consequential denial of the brevity of one's low weight are defined as maintaining a weight that is less than 85% of what is considered an ideal body weight for the individual. This denial is physically evident by a physiological criterion of amenorrhea – when at least three consecutively absent menstrual cycles occur in women.

Two specific types of AN, restricting type and binge-eating/purging type, are based on how the extreme low weight is reached and maintained. The restricting type is defined as the absence of bingeing and purging behaviors. The binge-eating/purging type

states that during the current episode of AN, the individual also engages in binges (i.e., eating inappropriately massive amounts of food in one set period of time) or purging behavior (i.e., self-induced vomiting, misuse of laxatives, diuretics, or enemas).

The DSM criteria for bulimia are similar to that of anorexia in that it also outlines an intense fear of becoming fat, but differentiates itself by including the requirements of powerful urges to overeat and subsequent binges that are followed by engaging in some sort of purging or compensatory behavior in an attempt to avoid the fattening effects of excessive caloric intake. Similar to anorexia, the fear experienced by bulimia is in regards to self-evaluation, thus resulting in compensatory behaviors to evade weight gain. The paradox is the presence of the uncontrollable urges to overeat. These binges are defined as occurring within two hours and including an amount of food that is definitely larger than most people would consume in a similar time and setting and a sense of lack of control during the binge (APA, 2000). Similar to anorexia, compensatory behaviors are separated into purging type (i.e., self-induced vomiting, use of laxative, diuretics, enemas, or medication abuse.) and nonpurging type (i.e., other compensatory behaviors such as fasting or excessively exercising). Unlike anorexia, there is no criterion defining maintenance of body weight or presence of amenorrhea.

Recent efforts to categorize anorexia and bulimia as a single transdiagnostic continuum of ED (Fairburn & Bohn, 2005; Fairburn, Cooper, & Shafran, 2003; Hay & Fairburn, 1998) have not been supported. Therefore, anorexia and bulimia are considered two distinct and separate types of ED (Birmingham, Touz, & Harbottle, 2009). Thus, the development, maintenance, and course of ED remains controversial.

This debate in identifying the specific nature of ED is based on the behaviors and attitudes that compose the disorders. Excessive exercise is one such behavior commonly observed in ED individuals (Shroff et al., 2006), and has also been the focus of much controversy in ED research (Mitchell, Cook-Myers, & Wonderlich, 2005; Sloan, Mizes, & Epstein, 2005; Williamson, Gleaves, & Steward, 2005). The focus of my dissertation will examine the relationship of excessive versus healthy amounts of regular exercise in regards to ED outcomes and overall health.

### **Exercise in Eating Disorders**

Despite that exercise is an effective intervention for many physical and psychological health issues and recent recommendations for research to reexamine exercise and ED (Meyer, Taranis, & Touyz, 2008), regular exercise is overlooked as a possible innovative, cost-effective, and easily disseminable adjunct to ED prevention for at least four reasons. First, the belief that exercise is associated with the development and maintenance of ED is based largely on cross-sectional, retrospective, and case study designs that fail to adequately assess and quantify “excessive exercise”. For example, there is a long standing clinical observation that most hospitalized inpatients receiving treatment for anorexia engage in excessive amounts of exercise during the development and/or maintenance of their ED (Katz, 1996). However, no definition is provided for what is considered “excessive exercise”. Similarly, recent studies have correlated participation in athletics (i.e., populations that engage in large amounts of physical activity) with deleterious eating attitudes related to ED (Holm-Denoma, Scaringi, Gordon, Van Orden, & Joiner, 2009; Levitt, 2009). Thus, researchers have focused on exercise amount contributing to the development and maintenance of ED. However, focusing on exercise amount may be misleading because much of the

research examining “excessive” exercise has relied on bias sampling methods using unvalidated self-report exercise measures that lack a clear, concise, and consistent definition of how much exercise is excessive (ACSM, 2000; Adkins & Peel, 2005; Hausenblas, Cook, Chittester, 2008; Penas~Lledo, Leal, & Waller, 2002; Solenberger, 2001). Furthermore, many of the operational definitions used for excessive exercise fail to meet the minimum amount of exercise needed to achieve the health-related benefits of physical activity (ACSM, 2000; USDHHS, 2008).

Second, the DSM’s (APA, 2000) diagnostic criteria for anorexia and bulimia are vague in describing the relationship between excessive exercise and ED. The definition of exercise reaching excessive when, “it significantly interferes with important activities, when it occurs at inappropriate times or in inappropriate settings, or when the individual continues to exercise despite injury or other medical complications” (APA, 2000; pp. 590-591) fails to quantify the amount needed to determine if exercise is excessive. Because excessive exercise and its negative health outcomes have been studied far less than the other diagnostic symptoms, more research is needed to better understand excessive exercise and ED (Lewisohn, Seeley, Moerk, & Streigel-Moore, 2004). In an attempt to provide clarity to the “excessive exercise” construct, researchers advocate for either revising the diagnostic criteria with regard to excessive exercise or eliminating excessive exercise as a diagnostic criterion because of a lack of empirical support (Hebebrand, Casper, Tressure, & Schweiger, 2004; Mond, Rodgers, Hay, Owens, & Beaumont, 2004). In short, considerable debate exists regarding ED classification in general (Mitchell, Cook-Myers, & Wonderlich, 2005; Sloan, Mizes, & Epstein, 2005; Williamson, Gleaves, & Steward, 2005), and in particular with excessive exercise,

regarding how best to define it (Walsh, 2004), or even whether to include excessive exercise as a compensatory behavior for bulimia (Herzog, & Delinsky, 2001).

Third, animal models suggest that strenuous exercise can suppress appetite (Epling & Pierce, 1996). Research examining anorexic effects of exercise, referred to as activity AN, are difficult to replicate in human subjects and explanations of this effect in humans typically include some recognition of culture (Epling & Pierce, 1996). Recent animal research using rats has also failed to support research showing activity-based anorexia during youth promotes the development of binge eating during adulthood (Cai et al., 2008). Thus, increased activity early in life may not be responsible for pathological eating behaviors, and therefore subsequent ED later in life.

Finally, much of the research examining the relationship between excessive exercise and ED has focused on exercise amount contributing to the development of ED, but has overlooked psychological variables that may mediate such a relationship. For example, Adkins and Keel (2005) found that obligatory exercise attitudes and behaviors (i.e., exercise dependence symptoms), not time (i.e., amount) spent exercising, was a positive predictor of negative eating attitudes and behaviors. Exercise dependence is defined as an uncontrollable drive for exercise resulting in significant impairment or distress as evident by physical and/or psychological symptoms (Hausenblas, & Symons Downs, 2002a). Zmijewski and Howard (2003) found that exercise dependence scores, but not exercise behavior, in female undergraduate students were positively correlated with bulimia symptoms. These results indicate that many college women may be exercising in association with either a formal or subclinical ED (Zmijewski & Howard, 2003). Similarly, Cook and Hausenblas (2008) found that

exercise dependence symptoms, not exercise behavior, mediated the relationship between exercise and eating pathology. Thus, psychological factors such as exercise dependence and not exercise behavior/amount may explain how or why the relationship exists.

The limitations of bias clinical observations (Katz, 1996), retrospective research designs (Davis, Katzman, & Kirsh, 1999), vague operational definitions of excessive exercise (APA, 2000), inconclusive animal research (Cai et al., 2008), and overlooking potential mediating psychological variables (Adkins & Keel, 2005; Cook & Hausenblas, 2008; Zmijewski & Howard, 2003) supports the need for theoretically driven models that explain the relationship between ED and the psychological motivation as well as the physical affect of exercise (Jansen, 2001; Thome & Espelage, 2007). Hausenblas and colleagues (2008) presented a conceptual model examining such relationships (see Figure 2.1). Their Exercise and ED Model states that regular exercise is associated with improvements in several physical (i.e., cardiovascular, metabolic benefits, decreased adiposity, and increases in bone density; Haskell, 1994; Mehler & Krantz, 2003), psychological (i.e., body image, depression, anxiety, stress reactivity, and self-esteem; Hausenblas, & Fallon, 2006; Paluska & Scenk, 2000; Taylor, 2003; Fox, 1999), and social benefits that are risk factors, maintenance factors, outcomes, or diagnostic criteria for ED. Thus, the Exercise and ED Model has consolidated and supported several narrative and meta-analytic reviews that have shown exercise's ability to impart positive improvements on ED risk, development, and maintenance factors.

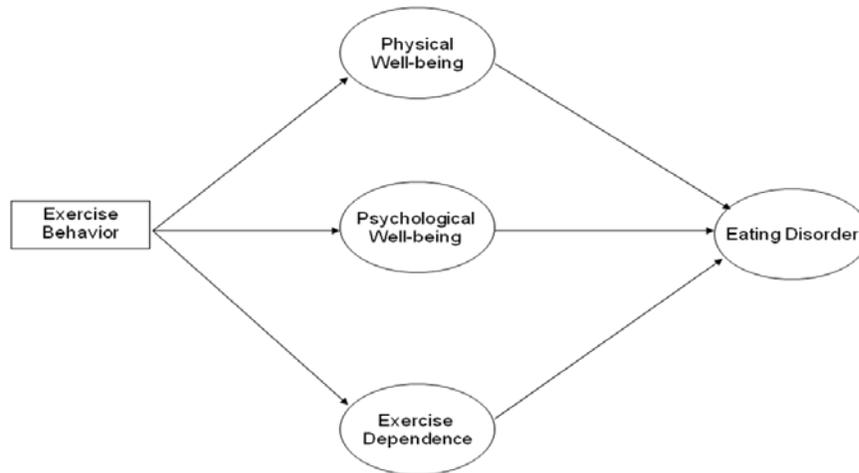


Figure 2-1. Hausenblas et al.'s, 2008 Conceptual Model

In summary, ED are serious psychiatric illness that are associated with high mortality rates, functional impairment, emotional distress, psychiatric comorbidity, chronic course and expensive treatment approaches, impaired health-related QOL, and added healthcare burden (Crow & Nyman, 2004; Harris & Baraclough, 1998; Hay & Mond, 2005; Mitchell et al., & Gerlach, 2009; Smolak & Striegel-Moore, 2004; Stice et al., 2009). The diagnosis and diagnostic criteria of several behaviors and attitudes related to ED are controversial and warrant further research (Birmingham et al., 2009). The compensatory behaviors used in ED are physically detrimental and contribute to health deficiencies during the development of the ED, independent of full threshold ED (Klump et al., 2009; Mehlenbeck, 2002; Mehler & Krantz, 2003; Pearson et al., 2002; Sobel, 2004). Therefore, researchers have argued that examining prevalence of ED as an outcome may be overlooking the impact of the disease on the individual (Abraham et al., 2006; Adair et al., 2007; Bohn et al., 2008; Engel et al., 2006; Las Hayas et al., 2006). Specifically, QOL is impacted by the ED behaviors and attitudes during the development of ED, prior to full threshold diagnosis (Engel et al., 2009; Hay & Mond,

2005). Thus, a concise understanding of the mechanisms and relationships between attitudes, behaviors, QOL, and the presence of ED is needed.

### **Health-Related Quality of Life (QOL) and Eating Disorders**

Health-related QOL refers to a person or group's perceived physical and mental health over time (Hennessy, Moriarty, Zack, Scherr, & Brackbill, 1994). QOL is a broad and generic term based on the 1947 World Health Organization definition of health that includes physical, psychological, and social aspects that relate to an individual's overall well-being (Hennessy et al, 1994; WHOQOL group, 1998). Simply stated, QOL attempts to quantify a disease or condition's affect on the overall and specific areas of physical and psychological health and well-being of an individual (Hennessy et al, 1994).

In 1990, QOL was called “the missing measurement in health care” for illnesses such as cancer, AIDS, cardiovascular disease, and arthritis; yet psychiatric illnesses were omitted from this call to inquiry (Fallowfield, 1990). Subsequently, interest in psychiatric illnesses and ED specific QOL interest has lagged behind other medical conditions and just recently piqued. The health impairments experienced by ED individuals during the development and maintenance of their illness (Haskell, 1994; Klump et al., 2009; Mehlenbeck, 2002; Mehler & Krantz, 2003; Pearson et al., 2002; Sobel, 2004) has lead ED researchers to examine QOL. Examining QOL provides the advantages of a more holistic picture of the patient and their recovery and gives researchers and clinicians an understanding of the impact of the ED on the individual (Jones, Evans, Bamford, & Ford, 2008).

Two qualitative reviews have summarized the findings of QOL and ED articles. In the first review, Hay and Mond (2005) identified 15 ED specific QOL research articles published prior to 2005. They found three main themes evident in the studies reviewed.

First, all studies used a generic measure of QOL, with the SF-36 (Ware & Sherbourne, 1992) being the most common assessment. Second, all of the studies showed significant mental health impairment in ED individuals. This finding also consistently showed more QOL detriments on the mental well-being component score than the physical well-being component score of the SF-36 scale. Third, anorexic individuals reported less subjective impairment than other ED groups. Hay and Mond (2005) concluded that an ED specific measure of QOL was needed and that future research should also measure comorbid anxiety and mood disorders when assessing QOL.

The second review identified 27 ED specific QOL articles published between 2004 and 2007 (Engel et al., 2009) and identified six themes in the literature. First, ED individuals of all subtypes (e.g., anorexia, bulimia, and eating disorder not otherwise specified) experience lower QOL than normal controls. This result was also consistent when only anorexic and bulimia individual's results were pooled. Second, QOL impairment was seen in all ED individuals regardless of severity of diagnostic status. That is, individuals with subthreshold ED also experienced lower QOL. With regard to compensatory behaviors, Engel and colleagues (2009) concluded that motivations for exercising, as well as reaction to not exercising, appeared to predict QOL scores. Third, QOL impairments in role functioning, vitality, social functioning, and emotional functioning were also experienced by family members and caregivers of those with ED. Fourth, the level of QOL impairment is similar to that of other diseases and conditions. Examples given were: patients awaiting coronary surgery for angina, candidates for heart/lung transplantation, patients selected for heart transplantation, other psychiatric disorders (e.g., somatoform disorders and alcohol abuse) and serious chronic medical

conditions such as diabetes, cancer, and pulmonary disorders. Fifth, QOL improved with ED treatment. Sixth, a gender difference exists with bulimic women reported significantly lower life satisfaction.

I conducted a search of the literature using PubMed and identified eight articles published since Engel et al.'s (2009) literature review (See Table 2.1 for a brief description of these articles). The results of these recent studies are similar to the themes identified by both Hay and Mond's (2005) and Engel et al.'s (2009) reviews. Specifically, six of these studies used generic QOL measures (Arkell & Robinson, 2009; Arostegui et al., 2009; Cook et al., under review; Herpertz-Dahlmann, Willie, Holling, Vloet, Ravens-Sieberer et al., 2008; Latner et al., 2008; Waadegaard, Davidsen, & Kjølner, 2009), one created an ED specific measure of QOL (Bohn et al., 2008; see Table 2,2), and one used a semi-structured interview technique to determine QOL (Jones et al., 2008). The SF-36 was used by four of the six that used a generic QOL measure (Arostegui et al., 2009; Cook et al., under review; Latner, Vallance, & Buckett, 2008; Waadegaard et al., 2009). Results of these recent studies confirmed that ED individuals experience lower QOL than controls (Herpertz-Dahlmann et al., 2008; Waadegaard et al., 2009), mental health was significantly more impaired than physical health (Cook et al., under review; Latner et al., 2008; Waadegaard et al., 2009), at-risk individuals engaging in ED behaviors experience lower QOL (Herpertz-Dahlmann et al., 2008), ED patients QOL was similar to that of depressed patients (Arkell & Robinson, 2009), and treatment improved QOL outcomes (Jones et al., 2008). The results from these articles also show that a need exists to measure QOL in ED populations with

disease specific measures that may more accurately assess the health-related issues pertinent to ED and QOL.

Table 2-1. Recent ED specific QOL studies

Author (year)	Country	ED groups	Participant Characteristics	QOL measure	Results
Arkell & Robinson (2009)	England	anorexia inpatients	Age 10 – 60 M=37.7 (SD = 8 years) N = 11 (10 female, 1 male) BMI = 15.8 (SD = 2kg)	WHO QOL assessment	An patients scored similarly to depression patients A negative correlation was found between depression and QOL
Arostegui, Padierna, & Quintana (2009)	Spain	anorexia and bulimia	193 Female inpatients age 16-65	SF-36	Higher levels of comorbid depression, anxiety, or the duration of ED symptoms predicted lower SF-36 scores at 2 year follow up
Bohne, Doll, Cooper, O'Connor, (2008)	England	Female ED patients	N = 123 Age = 18-65 BM =16.0–39.9 Anorexia = 8 Bulimia = 48 Eating disorder not otherwise specified = 47	Assessed against clinical assessment and trandiagnostic treatment outcomes	The CIA was shown to have high internal consistency, construct and discriminant validity, test-retest reliability, and was sensitive to change. Authors concluded that the CIA is valuable to clinicians assessing response to therapy
Cook, Hausenblas, Tuccito, Giacobbi (under review)	USA	College students	N=539 Age = 19.76 (1.30) 75.7% female BMI = 23.64 (3.65) previous ED = 2.4% current ED = .06%	SF-36	Supported lower mental health component scores. Did not find support for physical component scores.
Herpertz-Dahlmann, Wille, Hölling, Vloet, & Ravens-Sieber (2008)	Germany	Randomly sampled children	1843 children age 11-17 – 48.7% female Mean Age 14.6	KINDL-R	1/3 of females and 15% of females reported ED behaviors. All participants with ED behaviors reported significantly lower QOL scores
Jones, Evan, Bamford, & Ford (2008)	England	ED inpatients	N = 32 (31 female, 1 male) Anorexia = 20 Bulimia = 6 Eating disorder not otherwise specified = 6 Age M=25.9 (SD = 8.02 years)	Unstructured interviews to determine ED severity and secondary functional impairment	Participants who completed a 12 week treatment program reported more willingness to improve QOL aspects of their life than did those who did not complete the treatment program.
Latner, Vallance, & Buckett (2008)	New Zealand	Outpatients receiving treatment for anorexia, bulimia, Binge Eating Disorder, or eating disorder not otherwise specified	62% of participants were currently in treatment, 11% were on a treatment waiting list, and 26% were recently discharged from treatment	SF-36	Physical Health component scores were similar to controls. Mental health component scores were lower.
Waadegaard, Davidsen, & Kjølner (2009)	Denmark	At-risk for ED	16-29 year old women	SF-36	Women with risk behavior showed lower mental health component scores

A major development in the field of ED QOL since Hay and Mond's (2005) initial review has been the development and validation of several ED specific QOL measures. Engel and colleague's (2009) review concluded by summarizing four existing ED specific QOL measures published between 2006 and 2007 (see Table 2.2 for a review). These measures are reviewed below.

Table 2-2. ED specific QOL measures

QOL Measure (Author)	Domains/ Constructs	Participants	Reliability	Measures used for validation	Results
Quality of Life: Eating Disorders (Abraham et al., 2006)	1. Body Weight 2. Eating Behavior 3. Eating Disorder Scale 4. Psychological 5. Daily Living 6. Acute Medical 7. Global Score	306 Female inpatients Sample 1 N = 241 Age = 21.8(7.8) BMI = 19.5 (4.3) Anorexic (n=74) Bulimic (n=33) EDNOS (n=80), no diagnosis (n=54) Sample 2 N = 65 Age = 19.3 (5.9) BMI = 17.7 (3.0) Anorexic (n=34) Bulimic (n=10) EDNOS (n=21)	$\alpha = .93$	Eating & Exercise Examination Eating Disorder Inventory (EDI) Eating Attitudes Test (EAT) Beck Depression Inventory (BDI) State-Trait Anxiety Inventory (STAI) Short Form Health Survey 12 (SF-12) Mental Summary Score Physical Summary Score	ED measure - QOL ED domains correlated with several EAT & EDI subscales.  Psychological & physical measures - QOL ED global score correlated highest with: BDI ( $r = .639$ ) STAI state anxiety ( $r = .522$ ) Mental summary of SF-12 ( $r = -.49$ )  Pre/post treatment – QOL ED score all improved between admission and discharge.  Admission and 12 month follow up – All QOL ED scores for ED individuals were greater than for those with no diagnosis.
Eating Disorders Quality of Life Scale (Adair et al., 2007)	1. Cognitive Function 2. Education/vocation 3. Family and close relationships 4. Relationships with others 5. Future/outlook 6. Appearance 7. Leisure 8. Psychological Health 9. Emotional Health 10. Values and beliefs 11. Physical Health 12. Eating Issues	Female ED patients N=171 Age = 25.3 (10) BMI = 20.6 (4.5) Anorexic restricting type (n=48) Anorexic purging type (n=24) Bulimic (n=55) EDNOS (n=42)	$\alpha = .96$	Short Form Health Survey 12 (SF-12) Quality of Life Inventory (QoLI) 16D	EDQLS correlations with QOL measures: SF-12 $r = .42$ QoLI $r = .37$ 16D $r = .55$  EDQLS correlations with subscales of QOL measures: 16D weighted total score ( $r = .78, p < .001$ ) QoLI weighted total score ( $r = .61, p < .001$ ) Mental subscale of SF-12 ( $r = .71, p < .001$ ) Physical subscale of SF-12 ( $r = .37, p < .001$ )

Table 2-2. Continued

QOL Measure (Author)	Domains/ Constructs	Participants	Reliability	Measures used for validation	Results
Clinical Impairment Assessment (Bohne et al., 2008)	1. personal 2. cognitive 3. social	Female ED patients N = 123 Age = 18-65 BMI = 16.0 – 39.9 Anorexia = 8 Bulimia = 48 EDNOS = 47	$\alpha = .97$	Assessed against clinical assessment and trandiagnostic treatment outcomes	The CIA was shown to have high internal consistency, construct and discriminant validity, test-retest reliability, and was sensitive to change. Authors concluded that the CIA is valuable to clinicians assessing response to therapy
Eating Disorders Quality of Life instrument (Engel et al., 2006)	1. Psychological 2. Physical/Cognitive 3. Financial 4. Work/School	N=538 females Age = 21.99 Unmarried = 90.4% Caucasian = 95% College students with part time work = 51.4% College students without employment = 37.5%	$\alpha = .94$	Short Form Health Survey 36 (SF-36) Nottingham Health Profile (NHP) Neuroticism Beck Depression Inventory (BDI) Social Adjustment Scale – Self-Report (SAS-SR) Financial Global Ratings Grade Point Average (GPA)	EDQOL predicted 22% more unique variance than that predicted by the SF-36  EDQOL accounted for more additional unique variance of symptom severity than the EAT ( $R^2$ change = .25, $p < .001$ )
Health-Related Quality of Life for Eating Disorders (Las Hayas et al., 2006)	1. Symptoms 2. Restrictive Behaviors 3. Binges 4. Body Image 5. Mental Health 6. Emotional Role 7. Physical Role 8. Personality Traits 9. Social Relations	Diagnosed ED inpatients (N=324) Female = 96.3% BMI <19.1 = 38.6% 19.2 – 25.8 = 37% > 25.9 = 13% Anorexic (n=67) Bulimic (n=48) Eating disorder not otherwise specified anorexia subtype (n=83) Eating disorder not otherwise specified bulimia subtype (n=73) Eating disorder not otherwise specified binge eating (n=53)  A comparison group from the general population (N=305) Female = 95.4% BMI <19.1 = 17.8% 19.2 - 25.8 = 71.7% > 25.9 = 7%	$\alpha \geq .78$ for all domains except "binges" domain. Overall alpha was not reported	Short Form Health Survey 12 (SF-12) Eating Attitudes Test (EAT) 2 items from the Eating Disorder Inventory –2 (EDI-2)	HeRQoLED domains correlated with SF-12 physical summary score ( $r$ ranged from -.27 to -.65)  HeRQoLED domains correlated with SF-12 mental summary score ( $r$ ranged from -.38 to .75)  HeRQoLED domains correlated with EAT score ( $r$ ranged from .35 to .76)  HeRQoLED domains correlated with EDI-2 item a ( $r$ ranged from .26 to .50)  HeRQoLED domains correlated with EDI-2 item b ( $r$ ranged from .29 to .58)

### Health-Related QOL Measures

My review begins with the most commonly used measure (i.e., SF-36), then will focus primarily on the existent ED specific measures of QOL.

### **36-Item Short-Form Health Survey (SF-36)**

The SF-36 (Ware & Gandek, 1998; Ware & Sherbourne, 1992) is the most widely used QOL survey (Hays & Moralses, 2001). It is a generic measure of QOL in terms of physical and psychological well-being scores and one self-report question which assesses general health currently as compared to one year prior. Psychological and physical well-being is assessed through eight subscales. The psychological well-being score is a composite of the following four subscales: vitality, social functioning, role emotional, and mental health. The physical well-being score is a composite of the following four subscales: physical functioning, role physical, bodily pain, and general health (McHorney, Ware, Raczek, 1993; Ware & Sherbourne, 1992). The SF-36 has excellent divergent and convergent validity in comparing patients with minor medical conditions, serious medical conditions (such as complicated hypertension, diabetes, and coronary disease), solely psychiatric conditions, and psychiatric conditions that are comorbid with serious medical conditions (McHorney, Ware, Lu, & Sherbourne, 1994). More specifically, all 8 scales have high internal consistency with Cronbach's Alpha ranging from .78 for the general health scale to .93 for the physical functioning scale in 24 distinct populations (McHorney et al., 1994).

The main difficulty in assessing QOL in a specific population is finding and/or creating a measure that captures the specific health concerns of that population. For example, the SF-36 is the most widely used QOL measure in general (Hays & Moralses, 2001) and in ED populations (Hay & Mond, 2005) primarily because it conceptualizes QOL in terms of the World Health Organization definition (WHOQOL group, 1998). While these constructs of health appear relevant for many diseases, they may not accurately assess health constructs related to ED (Doll, Peterson, & Stewart-

Brown, 2005). Using a generic measure of QOL in disease specific populations has the advantage of relying on an existing validated measure rather than creating and validating a new one (Fairclough, 2002), but may overlook aspects related to a specific disease. The substantial health impact of ED (Engel et al., 2009; Hay & Mond, 2005) is often a focus of patient treatment (Carr & Higginson, 2001) but may not be captured by generic measures of QOL such as the SF-36. Thus, researchers have recently argued that the negative health consequences experienced along the continuum of ED may not be captured by generic QOL measures (Abraham et al., 2006; Adair et al., 2007; Bohn et al., 2008; Engel et al., 2006; Las Hayas et al., 2006). Not surprising, five ED specific QOL measures have since been advanced (see Table 2.2).

The development of ED specific QOL measures is encouraging. Each of the five ED specific QOL measure includes at least one construct encapsulating psychological well-being, however each of the five measures vary on conceptualizations of physical, financial, occupational/academic, and related psychological health concepts. The five ED specific QOL measures are reviewed below.

### **Quality of Life for Eating Disorders**

The Quality of Life for Eating Disorders (Abraham et al., 2006) is based on the 21-item self-report Eating and Exercise Examination (Abraham & Lovell, 1999). The Quality of Life for Eating Disorders assesses the following domains; behaviors, ED feelings, psychological feelings, effects on daily life, effects on acute medical status, and body weight. This measure also can create a global QOL score. Each item is asked for the last 28 days or the previous 3 months. Quality of Life for Eating Disorders domain scores correlate with validated measures of ED, psychological dysfunction, generic measures of QOL, and behavior and body weight. This measure of ED specific QOL

has been validated as a computer delivered questionnaire in a sample of Australian ED inpatients, and it has shown good validity and reliability ( $\alpha = .93$ ; Abraham et al., 2006).

### **Eating Disorder Quality of Life Scale**

The Eating Disorder Quality of Life Scale (Adair et al., 2007) is a 40 item measure assessing the following domains: cognitive function, education/vocation, family and close relationships, relationships with others, future/outlook, appearance, leisure, psychological health, values and beliefs, physical health, and eating issues. The Eating Disorder Quality of Life Scale correlates well with existing generic measures of QOL and was validated on a sample of ED inpatients in Canada with high internal consistency ( $\alpha = .95$ ; Adair et al., 2007).

### **Clinical Impairment Assessment**

The Clinical Impairment Assessment (Bohn et al., 2008) is a 16-item measure of the psychosocial functioning impairment experienced by individuals with ED. This scale conceptualizes impairment in terms of personal, cognitive, and social domains. The Clinical Impairment Assessment was validated on a sample of English ED inpatients, including those seeking treatment for anorexia nervosa, bulimia nervosa, and ED not otherwise specified. Validation was conducted primarily through unstructured clinical interviews and did not use previously validated measures of QOL or ED outcomes. The Clinical Impairment Assessment has excellent internal consistency ( $\alpha = .97$ ; Bohn et al., 2008).

### **The Eating Disorders Quality of Life Instrument**

The Eating Disorders Quality of Life instrument (Engel et al., 2006) includes the following subscales: psychological, physical/cognitive, financial, work/school, and a total score. The Eating Disorders Quality of Life instrument is 25 item scale and has been

found to be more sensitive to ED specific aspects of QOL than generic measures of QOL. This measure was validated on female college students, and it has shown good reliability and validity ( $\alpha = .94$ ; Engel et al., 2006).

### **Health-Related Quality of Life in Eating Disorders**

The Health-related Quality of Life in Eating Disorders (Las Hayas et al., 2006; 2007) is a 50 item measure that includes the following subscales: mental health, emotional role, physical role, personality traits, social relations, body image, and restrictive behaviors. This measure was validated on 224 ED patients recruited from health centers in Spain. The Health-related Quality of Life in Eating Disorders showed adequate reliability ( $\alpha = .73$ ).

The recent attention to ED specific QOL and attempts to create self-report surveys are an encouraging step forward. However, each of these measures has limitations. First, various conceptualizations of health constructs exist within the five measures. Four of the five attempt to measure the QOL constructs identified by the World Health Organization (Abraham et al., 2006; Adair et al., 2007; Engel et al., 2006; Las Hayas et al., 2006), and one assesses only the psychosocial component of QOL (Bohn et al., 2008). Furthermore, the measures developed by Abraham (2006), Adair (2007), Engel (2006), and Las Hayas's (2006) groups fail to ensure that the impairment assessed is secondary to ED psychopathology, omit the patients' concern about weight, are not sensitive to change, and have not been validated against independent assessments of the extent of the secondary impairment (Bohn et al., 2008). Second, validation of these measures was conducted with different populations. All but the Eating Disorders Quality of Life instrument (Engel et al., 2006) was measured using ED inpatients receiving some form of treatment. Including only inpatients receiving therapy

most likely ignores the majority of individuals with ED (Hoek & van Hoeken, 2003). A stated justification for using QOL in ED as an outcome, rather than using diagnostic status, is that health-related problems exist throughout the continuum of ED development and maintenance (Adair et al., 2006). Thus, future research must delineate the effects on QOL in both full threshold and sub-threshold ED individuals. Finally, there is little discussion of potential differences between anorexia nervosa and bulimia nervosa (Birmingham et al., 2009). Given that the intention of developing ED specific QOL measures is to more accurately capture the health effects and impairments throughout the development and course of ED, and preliminary results indicating ED behavior's differences on QOL (Engel et al., 2009; Hay & Mond, 2005), anorexia nervosa and bulimia nervosa specific measures should also be validated.

In summary, the recent attention to QOL is an encouraging and much needed advancement in the understanding of the course and overall health impact of ED. Commonly used generic measures of QOL may not accurately capture the QOL aspects that are specific to ED (Adair et al., 2006). The recent development of ED specific QOL measures may provide more detailed information to guide future research and influence treatment outcomes.

CHAPTER 3  
METHODS

**Participants**

I recruited 387 female students (age range = 17-39 years old, M age = 20.11, SD = 2.21) from a variety of disciplines in classes from seven colleges and universities in Florida, Texas, Georgia, and Pennsylvania (see Tables 3.1 - 3.3). This number of participants was needed to meet recommendations for sample size in regression analysis (Green, 1991). Incidences of ED peak during adolescence to early adulthood and are more prevalent in female populations, thereby placing this cohort at greatest risk (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Stice, 2002, Stice et al., 2009). For example, about 50% of college students engage in ED symptoms at least once per week (Berg, Frazier, & Sherr, 2009). Furthermore, women with bulimia report lower levels of life satisfaction (Engel et al., 2009; Gamma & Angst, 2001).

Table 3-1. Demographic Statistics for all Participants (*N* = 387)

Variable	Mean	Standard Deviation
Age	20.11	2.21
Height (inches)	64.90	2.82
Current Weight (pounds)	137.68	27.24
Ideal Weight (pounds)	127.77	17.40
Weight Dissatisfaction	9.71	15.79
Body Mass Index	23.73	4.12

Table 3-2. Demographic Frequencies for all Participants (*N* = 387)

Variable	Frequency
Greek Affiliation	13.69%
Eating Disorder - Ever	2.33%
Eating Disorder - Current	1.03%
Year in School	
Freshman	9.30%
Sophomore	51.42%
Junior	21.19%
Senior	16.54%
Graduate/Professional	1.03%

Table 3-2. Continued

Variable	Frequency
Ethnicity	
African American	12.92%
Asian	8.53%
Caucasian	65.89%
Hispanic	8.53%
Other	4.13%
Acculturation (number of years living in USA)	
1-5 Years	2.58%
6 - 15 Years	6.97%
16 - 25 Years	18.35%
26 - 40 Years	0.52%
Always	71.58%

Table 3-3. Recruitment Source Frequency by University

University	<i>n</i>	Percent
Concordia University	63	16.28%
Georgia State University	25	6.46%
Pensacola Junior College	23	5.94%
University of Florida	256	66.15%
University of North Florida	11	2.84%
University of Pennsylvania	1	0.26%
University of the Sciences, Philadelphia	8	2.07%
Course (University)	<i>n</i>	Percent
Abnormal Psychology	11	2.84%
Anatomy	144	37.21%
Community and Environmental Health	2	0.52%
Counseling Skills	1	0.26%
Drugs and Behavior	8	2.07%
Exercise Psychology	21	5.43%
Exercise Science	36	9.30%
Introduction to Counseling	3	0.78%
Introduction to Psychology	54	13.95%
Physiology	89	23.00%
Research Methods	8	2.07%
Statistics for Behavioral Sciences	10	2.58%

Most of the participants were not at-risk for ED (91.0%) as indicated by a score of 14 or less on the Drive for Thinness subscale (Garner, 1991). ED assessed by self-report questions revealed incidence of 2.3% previous and 1.0% current ED, while more

stringent assessment using the Eating Disorder Diagnostic Scale (Stice et al., 2004) showed slightly higher rates of full threshold anorexia (1.3%), full threshold bulimia (3.4%), full threshold Binge Eating Disorder (3.9%), subthreshold anorexia (2.6%), subthreshold bulimia (3.9%), and subthreshold binge eating disorder (1.0%; Table 3.4).

Table 3-4. Eating Disorder Diagnosis

Eating Disorder Type	<i>n</i>	Percent
Full Threshold Anorexia Nervosa	5	1.30%
Full Threshold Bulimia Nervosa	13	3.37%
Full Threshold Binge Eating Disorder	15	3.89%
Subthreshold Anorexia Nervosa	10	2.59%
Subthreshold Bulimia Nervosa	15	3.89%
Subthreshold Binge Eating Disorder	4	1.03%
No Diagnosis	324	83.93%

The sample was mostly Caucasian (65.9%), followed by African American (12.9%), Hispanic (8.5%), Asian (8.5%), and other (4.1%). The majority (89.9%) of participants had lived in the United States all of their life, thus indicating that acculturation was not a major concern in my sample. Because binge drinking behavior and tobacco use is observed at elevated rates in ED populations (Anzengruber et al., 2006; Krug et al., 2008, 2009) and amphetamines (i.e., diet pills) are a potential compensatory behavior used to prevent weight gain (APA, 2000), I also assessed the use of these substances (see Table 3.5). Most participants had not used tobacco (87.3%), amphetamines (96.6%), or binge drank (63.8%) in the past 30 days. Finally, women involved in sororities endorsed more ED attitudes and behaviors during their involvement with these groups (Alison & Park, 2004). Therefore, I assessed Greek system involvement (i.e., sorority membership) and found that 13.7% of my sample was participating in a sorority.

Table 3-5. Alcohol, Tobacco, and Amphetamine Use

Number of Alcoholic Drinks per week	$M = 2.11$ ( $SD = 3.33$ )
<b>Alcohol Use Frequency</b>	
0 days	29.46%
1 - 2 days	24.29%
3 - 5 days	24.55%
6 - 9 days	15.76%
10 - 19 days	5.68%
20 - 29 days	0.26%
All 30 day	0.0%
<b>Binge Drinking Frequency</b>	
None	63.82%
Once	17.57%
Twice	9.30%
3 - 5 times	8.53%
6 - 9 times	0.78%
<b>Tobacco Use Frequency</b>	
0 days	87.34%
1 - 2 days	5.68%
3 - 5 days	1.29%
6 - 9 days	2.33%
10 - 19 days	.78%
20 - 29 days	1.03%
All 30 days	1.55%
<b>Amphetamine Use Frequency</b>	
0 days	96.65%
1 - 2 days	0.77%
3 - 5 days	0.77%
6 - 9 days	0.52%
10 - 19 days	0.52%
20 - 29 days	0.0%
All 30 days	0.77%

Note:  $M$  = Mean;  $SD$  = Standard Deviation

## Measures

### Demographic Questionnaire

The Demographic Questionnaire assessed the participant's year in school, major, age, weight, ideal weight, height, ED history, ethnicity, smoking and binge drinking status (Anzengruber et al., 2006; Krug et al., 2008, 2009; Presley & Vineyard, 2004), acculturation (Chamorro, 1997; Chamorro & Flores-Ortiz, 2000) and sorority membership (Alison & Park, 2004). (see Appendix A)

### **Drive for Thinness Subscale**

The Drive for Thinness subscale of the Eating Disorder Inventory-2 (Garner, 1991) measures excessive concerns with dieting and weight preoccupation. Participants rated each item on a 6-point Likert scale ranging from 1 (never) to 6 (always). Ratings totaling a higher score indicate greater endorsement of the attitudinal and behavioral correlates of ED and a score of 14 or greater indicates ED risk. Extensive research supports the validity and reliability of the Drive for Thinness subscale (Garner, 1991). (see Appendix B)

### **Exercise Dependence Scale**

The Exercise Dependence Scale (Hausenblas & Symons Downs, 2002b) is a 21-item measure of exercise dependence symptoms on the following seven subscales based on the criteria for substance dependence (APA, 2000): Tolerance (e.g., I continually increase my exercise frequency to achieve the desired effects/benefits), Withdrawal Effects (e.g., I exercise to avoid feeling tense), Continuance (e.g., I exercise despite persistent physical problems), Lack of Control (e.g., I am unable to reduce how intense I exercise), Reductions in Other Activities (e.g., I think about exercise when I should be concentrating on school/work), Time (e.g., I spend a lot of time exercising), and Intention (e.g., I exercise longer than I expect; Hausenblas & Symons Downs, 2002b). Responses to the items are on a 6-point Likert scale ranging from 1 (never) to 6 (always). A lower score reveals less exercise dependence symptoms. The psychometric properties of this scale are good (Hausenblas & Symons Downs, 2002b, Symons Downs, Hausenblas, & Nigg, 2004). (see Appendix C)

## **Leisure-Time Exercise Questionnaire**

The Leisure-time Exercise Questionnaire is a self-report of the frequency and duration that an individual engages in strenuous, moderate, and mild bouts of exercise during a typical week (Godin & Shepard, 1985). Each of the intensity scores are converted into metabolic equivalents (METs; [Mild x 3] + [Moderate x 5] + [Strenuous x 9]) and summed to provide an estimate of total METs expenditure from exercise for an average week. The Leisure-time Exercise Questionnaire is a valid and psychometrically sound measure that is frequently used to assess exercise behavior. The MET values for the Leisure-time Exercise Questionnaire are based on published reports of its validity (e.g., Godin & Shephard, 1985; Jacobs, Ainsworth, Hartman, & Leon, 1993), and this measure is considered the gold standard for self-report exercise assessment (Courneya et al., 2003). Minutes engaged in mild exercise were not used in these analyses, but the category was included in the questionnaire to ensure that participants did not report mild exercise minutes in the moderate intensity category (Haskell, Lee, Pate, Powell, Blair et al., 2007). My interest in only moderate and strenuous exercise minutes is based on the public health recommendations that moderate to strenuous intensity activity is required to obtain health benefits (USDHHS, 2008). (see Appendix D)

## **The Eating Disorders Quality of Life Instrument**

The Eating Disorders Quality of Life instrument is an ED specific QOL measure that includes the following subscales: psychological, physical/cognitive, financial, work/school, and a total score (Engel et al., 2006). The EDQOL is 25 item scale, and it is more sensitive to ED specific aspects of QOL than generic measure of QOL. This measure was validated on female college students, and it has good reliability and validity ( $\alpha = .94$ ; Engel et al., 2006). The Eating Disorder Quality of Life instrument was

chosen for use in my dissertation over the other existing ED QOL measures discussed in Chapter 2 for the following 2 main reasons: (a) its relatively short length and (b) it was validated on American college students. (see Appendix E) Because the wording of items in the Eating Disorders Quality of Life instrument is double barreled, I also examined if item wording affected participants response. (see Appendix G)

### **Eating Disorder Diagnosis**

The Eating Disorder Diagnostic Scale (Stice et al. 2000, 2004) was used to determine if the participants currently have or have a history of an ED. The Eating Disorder Diagnostic Scale is a brief and psychometrically sound measure for diagnosing anorexia nervosa, bulimia nervosa, and binge eating disorder. This self-report measure was selected because psychiatric interviews are time consuming and expensive to conduct with large sample. The Eating Disorder Diagnostic Scale has shown adequate reliability ( $\alpha = .89$ ; Stice et al., 2000; see Appendix F).

## **Procedure**

### **Data Collection**

All study procedures were reviewed and approved by the Institutional Review Board at the University of Florida. Participants were recruited through announcements made in large lecture style classes. The announcement was for a study examining the relationship between exercise, health, and psychological states. Interested students were given a pen and paper survey to complete during class time. All participants read an informed consent before beginning the survey then signed one copy and keep one copy for their records. They were also instructed to treat this survey as they would a test and thus sit spaced apart as much as possible, avoid inspecting other students' responses, and return the complete survey and a signed copy of the informed consent

sheet to an envelope and hand the envelope to me immediately after completion. The survey took about 15 minutes to complete. Extra credit was given at the discretion of the course instructors.

## **Data Analysis**

### **Preliminary Analysis**

First, descriptive statistics such as means, standard deviations, frequencies, and alpha values, were conducted for the primary and secondary purpose study variables. Next, ANOVAS used to compare all demographic and study variables for the data collection from each recruitment site to determine if differences existed on the outcome measures.

### **Primary Purpose**

For my primary purpose I first ran correlations on all study variables. Next a series of multiple regressions were performed on each path proposed in the Exercise and ED Model (Hausenblas et al., 2008). Specifically, a multiple regression was run with ED status as the dependent variable and exercise dependence, physical well-being and mental well-being as the independent variables. Next, a regression was also run with physical well-being as the dependent variable and exercise behavior as the independent variable. Similarly, a regression was also run with mental well-being as the dependent variable and exercise behavior as the independent variable. Finally, a regression was run with exercise dependence as the dependent variable and exercise behavior as the independent variable. The beta weights of each of these regressions indicated the path coefficients. The portion of the variance explained by independent variables was represented by  $R^2$  values.

## Secondary Purpose

The procedure for the secondary purpose of this dissertation, examining the hypothesized relationship of Leisure-time Exercise scores (LTEQ), the 7 criteria of the Exercise Dependence Scale (EDS), and The Eating Disorder Diagnostic Scale (EDDS) scores, was followed as detailed by Baron and Kenny (1986). My independent variables were LTEQ scores, and the 7 criteria of the EDS scores and my dependent variable was EDDS scores. First, correlations were used to determine the relationship between the independent and dependent variables. A significant correlation indicates a mediator effect, while a nonsignificant correlation indicates a moderator effect (Baron & Kenny, 1986). This method specifies that three regressions must meet the following conditions to show a mediator effect (Baron & Kenny, 1986):

1. Variations in the independent variable significantly account for variations in the mediator variable (figure 3.1; path a),
2. Variations in the mediator variable significantly account for the dependent variable (figure 3.1; path b),
3. When both path a and b are controlled, the significant relationship observed in independent and dependent variables disappears (figure 3.1; path c).

This three-step procedure was run for the overall exercise dependence scale score and each of the seven criteria. Thus, 28 total regressions were run to ascertain mediation effects. Baron and Kenny's (1986) procedure for moderation was followed for all other appropriate study variables that warranted moderation analysis.

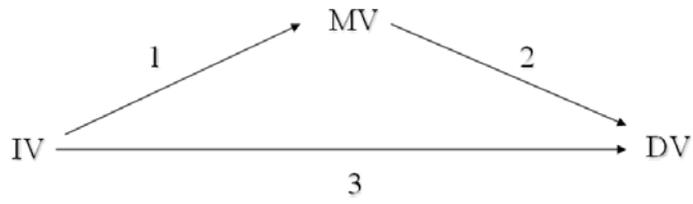


Figure 3-1. Conceptual model of mediation

CHAPTER 4  
RESULTS

**Preliminary Analyses**

**Descriptive Statistics for Outcome Variables**

First, descriptive statistics of the mean, standard deviation, and alpha values were conducted for all the relevant study measures (see Table 4.1). All the alpha values were in the good to excellent range. The mean and standard deviation scores for the Drive for Thinness subscale were 3.94 (5.40), the Exercise Dependence Scale were 41.31 (16.90), the Eating Disorder Diagnostic Scale were 34.86 (11.98), the Eating Disorder Quality of Life Instrument were 0.40 (0.45), and the Leisure-time Exercise Questionnaire were 30.89 (23.91).

Table 4-1. Means (*M*), Standard Deviations (*SD*), and Alpha Values ( $\alpha$ ) for Study Measures

Variable	<i>M</i>	<i>SD</i>	$\alpha$
Drive for Thinness Subscale	3.94	5.40	.90
Exercise Dependence Scale	41.31	16.90	.95
Eating Disorder Diagnostic Scale	16.26	11.98	.83
Eating Disorder Quality of Life Instrument	0.40	0.45	.93
Leisure Time Exercise Questionnaire	30.89	23.91	
Eating Disorder Quality of Life Subscales	<i>M</i>	<i>SD</i>	$\alpha$
Psychological	0.73	0.82	.94
Physical/Cognitive	0.43	0.61	.88
Financial	0.11	0.34	.84
Work/School	0.06	0.30	.94
Exercise Dependence Scale Subscales	<i>M</i>	<i>SD</i>	$\alpha$
Continuance	5.19	3.03	.89
Intention	5.61	3.12	.95
Lack of Control	4.82	2.98	.93
Reduction in Other Activities	4.40	2.10	.73
Time	5.84	3.03	.89
Tolerance	7.74	3.97	.93
Withdrawal Effects	7.82	3.75	.89

Mean, standard deviation, and alpha values were also conducted for subscales of the Eating Disorder Quality of Life Instrument and Exercise Dependence Scale because

these subscales were used in my primary and secondary analyses. All the alpha values for the subscales were in the good to excellent range. Specifically, the alpha values for the Eating Disorder Quality of Life Instrument subscales ranged from .84 to .94 and alpha values for the Exercise Dependence Scale subscales ranged from .73 to .95.

### **Recruitment Source**

One-way ANOVAS were run on all the study variables to determine if differences existed among the students' responses by the seven different universities where recruitment occurred (Table 4.2). Only one student was recruited from the University of Pennsylvania. This student was included with those recruited from the University of the Sciences Philadelphia for these analyses because of the close proximity of these two institutions. Significant group differences by university were found for body mass index [ $F(5, 379) = 5.12, p = .01$ ] and weight dissatisfaction [ $F(5, 376) = 4.39, p = .01$ ]. Tukey Post Hoc analysis revealed that students recruited from the University of Florida reported significantly lower body mass index than students from Concordia University ( $p = .02$ ) and Pensacola Junior College ( $p = .01$ ). Similarly, a Tukey Post Hoc analysis revealed that students recruited from the University of Florida reported significantly less weight dissatisfaction than students from Concordia University ( $p = .03$ ) and Pensacola Junior College ( $p = .01$ ). No differences were found in Drive for Thinness scores [ $F(5, 381) = 1.75, p = .12$ ], Exercise Dependence Scale scores [ $F(5, 371) = 0.77, p = .57$ ], Eating Disorder Diagnostic Scale [ $F(5, 372) = 1.75, p = .12$ ], and Leisure-time Exercise Questionnaire [ $F(5, 377) = 1.60, p = .16$ ]. A one-way ANOVA revealed significant group differences for Eating Disorder Quality of Life [ $F(5, 377) = 3.79, p = .01$ ]. However, closer examination using a Tukey Post Hoc analyses revealed no significant differences between any school and Eating Disorder Quality of Life scores. Because of the minor

differences found regarding the variables by university, recruitment site was not used as a covariate in the main analyses.

Table 4-2. Scale Mean (*M*) and Standard Deviation (*SD*) Scores by Recruitment Source

School	DT <i>M (SD)</i>	EDS <i>M (SD)</i>	EDDS <i>M (SD)</i>	EDQOL <i>M (SD)</i>	LTEQ <i>M (SD)</i>
Concordia University	5.19(6.08)	43.37(18.20)	19.06(12.75)	0.54(0.51)	31.98(25.79)
Georgia State University	3.64(5.05)	44.67(17.32)	13.48(11.77)	0.28(0.41)	28.88(18.85)
Pensacola Junior College	5.48(5.22)	39.27(14.27)	19.87(12.71)	0.64(0.56)	28.09(12.71)
University of Florida	3.53(5.24)	40.52(16.47)	15.47(11.47)	0.36(0.43)	30.87(23.70)
University of North Florida	2.73(4.63)	46.18(19.41)	14.45(16.51)	0.18(0.25)	46.27(31.03)
University of the Sciences/ University of Pennsylvania	6.00(5.38)	38.63(22.33)	19.00(9.99)	0.50(0.50)	17.67(18.10)

Note: DT = Drive for Thinness; EDS = Exercise Dependence Scale; EDDS = Eating Disorder Diagnostic Scale; LTEQ = Leisure-time Exercise Questionnaire

### Categorical Demographic Differences

One-way ANOVAS were conducted to determine if there were differences in each level of year in school, ethnicity, acculturation, binge drinking, and alcohol use with the relevant outcome variables (see Table 4.3). Results revealed no significant differences for acculturation, binge drinking, or alcohol use on my outcome variables. Significant group differences by year in school were found for body mass index [ $F(4, 378) = 2.40, p = .05$ ] and Exercise Dependence Scale scores [ $F(4, 370) = 3.99, p = .01$ ]. However, closer examination using a Tukey Post Hoc analysis revealed no significant differences between any level of year in school and body mass index or Exercise Dependence Scale scores. For ethnicity, significant group differences were found for body mass index [ $F(4, 380) = 4.83, p = .01$ ]. Tukey Post Hoc analysis revealed that the African

American participants reported significantly higher body mass index scores than the Asian ( $p = .01$ ) and Caucasian participants ( $p = .05$ ).

Table 4-3. ANOVA Results

Variable	F	df	<i>p</i>
Year in School			
body mass index	2.40	4, 378	.05
Drive for Thinness	1.95	4, 380	.10
Exercise Dependence	3.99	4, 370	.01
Eating Disorder Quality of Life	2.26	4, 376	.06
Eating Disorder Diagnostic Scale	1.94	4, 371	.10
Ethnicity			
body mass index	4.83	4, 380	.01
Drive for Thinness	.23	4, 382	.92
Exercise Dependence	.29	4, 372	.89
Eating Disorder Quality of Life	.65	4, 378	.63
Eating Disorder Diagnostic Scale	.78	4, 373	.54
Acculturation			
body mass index	1.60	3, 374	.19
Drive for Thinness	.91	3, 379	.44
Exercise Dependence	1.56	3, 371	.20
Eating Disorder Quality of Life	1.55	3, 378	.19
Eating Disorder Diagnostic Scale	.55	3, 383	.65
Alcohol Use			
body mass index	.55	5, 379	.74
Drive for Thinness	.96	5, 381	.44
Exercise Dependence	1.13	4, 372	.34
Eating Disorder Quality of Life	1.29	5, 377	.27
Eating Disorder Diagnostic Scale	1.32	5, 372	.26
Binge Drinking			
body mass index	.27	4, 380	.90
Drive for Thinness	1.41	4, 382	.23
Exercise Dependence	.21	4, 372	.93
Eating Disorder Quality of Life	1.71	4, 378	.15
Eating Disorder Diagnostic Scale	1.32	4, 373	.26

Because of the low number of individuals who reported any amount of tobacco or amphetamine use, I combined all levels of use and examined those who reported use versus those who reported no use. Then, an independent sample t-test was used to examine differences in my outcome variables for those who use tobacco and those who do not use tobacco. Levene's test for equality of variance was examined and when

significant the results were interpreted using the equal variances not assumed values. Individuals who reported using tobacco had significantly higher ED Diagnostic Scale scores [ $t(376) = -3.08, p = .01$ ], Drive for Thinness scores [ $t(58.47) = -3.18, p = .01$ ], and ED QOL scores [ $t(53.51) = -2.99, p = .01$ ], but significantly lower Leisure-time Exercise Questionnaire scores [ $t(73.44) = -2.39, p = .02$ ] than those who do not use tobacco. No significant differences were found for Exercise Dependence Scale scores [ $t(375) = 1.09, p = .28$ ].

Similarly, an independent sample t-test was used to examine differences in my outcome variables for those who use amphetamines and those who do not use amphetamines. Levene's test for equality of variance was examined and when significant the results were interpreted using the equal variances not assumed values. Individuals who reported using amphetamines had significantly higher Drive for Thinness scores [ $t(385) = -2.77, p = .01$ ]. No significant group differences for amphetamine use was found for Eating Disorder Diagnostic Scale [ $t(12.44) = -1.79, p = .10$ ], Eating Disorder Quality of Life [ $t(381) = -1.204, p = .23$ ], Exercise Dependence Scale [ $t(12.31) = -2.06, p = .06$ ], or Leisure-time Exercise Questionnaire scores [ $t(12.36) = -1.22, p = .24$ ].

### **Eating Disorder Diagnostic Category Examination**

Finally, frequencies were run on tentative ED diagnostic category assessed by the Eating Disorder Diagnostic Scale (Stice et al., 2000, 2004). Study variable mean and standard deviation scores for all ED categories are presented in Table 4.4. T-tests were run to determine differences on study variables between those with ED (i.e., full and subthreshold anorexia or bulimia) and those with no ED diagnosis. Levene's test for equality of variance was examined and when significant the results were interpreted

using the equal variances not assumed values. Grouping only individuals with full or subthreshold anorexia or bulimia while excluding those with full or subthreshold binge ED was chosen because anorexia and bulimia, but not binge eating disorder, were identified as the outcome in the Exercise and ED Model (Hausenblas et al., 2008) and the continuum model of ED supports the inclusion of full and subthreshold anorexia and bulimia, but not binge eating disorder (Fairburn & Bohn, 2005; Levine & Smolak, 2006).

ED and nonED individuals did not significantly differ on their weight dissatisfaction scores [ $t(360) = -1.14, p = .25$ ] or Leisure-time Exercise Questionnaire scores [ $t(361) = .81, p = .42$ ].

Significant group differences between the ED and nonED participants, however, were found for body mass index, Drive for Thinness scores, Eating Disorder Quality of Life Instrument scores, and Exercise Dependence Scale scores. Specifically, ED individuals reported lower body mass index than nonED individuals [ $t(363) = -3.54, p = .01$ ]. For Drive for Thinness scores, ED individuals reported significantly higher Drive for Thinness scores than nonED individuals [ $t(47.01) = 3.66, p = .01$ ]. For Eating Disorder Quality of Life Instrument scores, ED individuals reported higher QOL scores (indicating lower QOL) than non ED individuals [ $t(43.86) = -4.21, p = .01$ ]. For Exercise Dependence Scale scores, ED individuals reported higher Exercise Dependence Scale scores than non ED individuals [ $t(45.94) = 2.25, p = .03$ ].

Table 4-4. Mean (*M*) and Standard Deviation Scores (*SD*) for the Study Variables by Tentative Eating Disorder Diagnostic Category from the Eating Disorder Diagnostic Scale

	BMI <i>M (SD)</i>	Weight Dissatisfaction <i>M (SD)</i>	DT <i>M (SD)</i>	EDS <i>M (SD)</i>	LTEQ <i>M (SD)</i>	EDQOL <i>M (SD)</i>
Full Threshold Anorexia ( <i>n</i> = 5)	16.96(1.21)	-3.60(4.16)	.20(.45)	30.50(8.27)	14.25(25.28)	0.13(0.17)
Full Threshold Bulimia ( <i>n</i> = 13)	24.12(2.53)	15.77(7.85)	14.62(4.96)	58.31(28.82)	42.46(29.61)	1.28(0.52)

Table 4-4. Continued

	BMI <i>M (SD)</i>	Weight Dissatisfaction <i>M (SD)</i>	DT <i>M (SD)</i>	EDS <i>M (SD)</i>	LTEQ <i>M (SD)</i>	EDQOL <i>M (SD)</i>
Full Threshold Binge Eating Disorder ( <i>n</i> = 15)	27.27(6.06)	27.80(31.89)	7.93(6.08)	42.87(19.70)	20.07(19.30)	0.80(0.42)
Subthreshold Anorexia ( <i>n</i> = 10)	18.75(.34)	-2.30(3.83)	2.20(5.01)	40.00(24.96)	29.30(25.41)	0.33(0.49)
Subthreshold Bulimia ( <i>n</i> = 15)	22.90(2.66)	8.07(7.24)	7.40(6.02)	50.73(15.70)	34.47(26.17)	0.78(0.57)
Subthreshold Binge Eating Disorder ( <i>n</i> = 4)	21.80(2.03)	7.75(3.30)	1.25(1.25)	49.259(7.93)	56.25(19.91)	0.49(0.40)
No Eating Disorder Diagnosis ( <i>n</i> = 324)	23.87(3.99)	9.32(14.97)	3.34(4.83)	40.20(15.57)	30.59(23.42)	0.33(0.39)
Full & Sub Threshold Anorexia and Bulimia ( <i>n</i> = 43)	21.62(3.38)	6.63(9.89)	7.53(7.29)	48.60(23.46)	33.79(27.30)	0.77(0.65)
Full & Sub Threshold Anorexia, Bulimia, and Binge Eating Disorder ( <i>n</i> = 62)	23.00(4.73)	11.82(19.60)	7.23(6.91)	47.23(21.82)	31.89(26.32)	0.76(0.58)
Full Threshold Anorexia and Bulimia ( <i>n</i> = 18)	22.13(3.97)	10.39(11.28)	10.61(7.85)	51.76(27.99)	35.82(30.49)	1.01(0.68)
Full Threshold Anorexia, Bulimia, and Binge Eating Disorder ( <i>n</i> = 33)	24.47(5.58)	18.30(24.29)	9.39(7.12)	47.59(24.49)	28.44(26.68)	0.911(0.57)
Subthreshold Anorexia and Bulimia ( <i>n</i> = 25)	21.24(2.91)	3.92(7.93)	5.32(6.11)	46.44(20.15)	32.40(25.46)	0.59(0.57)
Subthreshold Anorexia, Bulimia, and Binge Eating Disorder ( <i>n</i> = 29)	21.32(2.78)	4.45(7.54)	4.76(5.85)	46.83(18.86)	35.69(25.85)	0.58(0.55)

Note: BMI = Body Mass Index; DT = Drive for Thinness; EDS = Exercise Dependence Scale; EDDS = Eating Disorder Diagnostic Scale; LTEQ = Leisure-time Exercise Questionnaire; EDQOL = Eating Disorder Quality of Life Instrument

### Primary Purpose

The primary purpose of my dissertation was to examine several of the paths among variables proposed in Hausenblas and colleague's (2008) Exercise and ED Model. Specifically, I examined the effect of exercise on physical well-being, psychological well-being, and exercise dependence. Furthermore, I examined the subsequent effect of physical well-being, psychological well-being, and exercise

dependence on ED (Figure 4.1). The financial and work/school subscales of the Eating Disorder Quality of Life Instrument were excluded from these analyses because these constructs were not included in the Exercise and ED Model (Hausenblas et al., 2008).

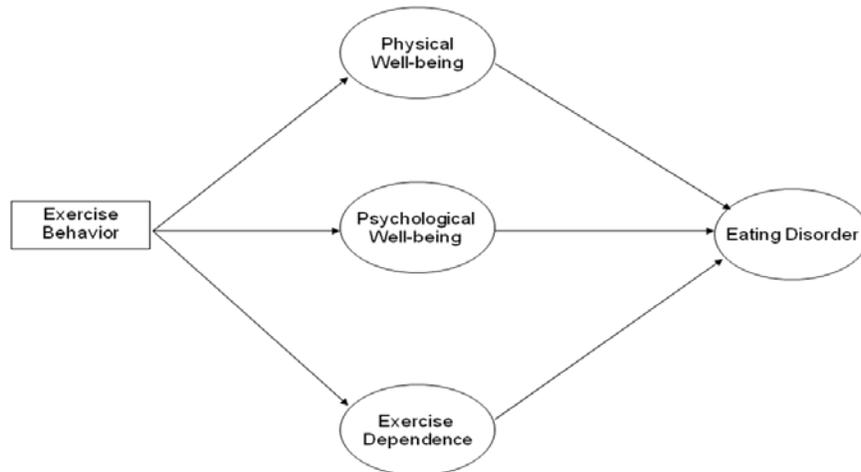


Figure 4-1. Hausenblas et al.'s, 2008 Model

First, correlations were run on exercise, physical well-being, psychological well-being, exercise dependence, and ED (Table 4.5). Specifically, exercise behavior was not significantly correlated with physical well-being ( $r = -.051, p = .32$ ) or psychological well-being ( $r = .07, p = .18$ ), but was significantly correlated with exercise dependence ( $r = .59, p = .01$ ). ED was significantly correlated to exercise ( $r = .12, p = .02$ ), physical aspects well-being ( $r = .40, p = .01$ ), psychological well-being ( $r = .77, p = .01$ ), and exercise dependence ( $r = .37, p = .01$ ).

Table 4-5. Primary Purpose Variables Correlations

	EDDS	EDS	Psychological	Physical/Cognitive
LTEQ	.12*	.59**	.07	-.05
Physical/Cognitive	.40**	.22**	.47**	
Psychological	.77**	.30**		
EDS	.37**			

Note: \* =  $p < .05$ ; \*\*  $p < .01$ ; EDS = Exercise Dependence Scale; EDDS = Eating Disorder Diagnostic Scale; LTEQ = Leisure-time Exercise Questionnaire

Next, a series of regressions were run on the paths proposed in Hausenblas and colleague's (2008) model. First, a linear regression was run to examine the path between exercise (independent variable) and physical well-being (dependent variable). The results of this regression revealed that exercise did not have a significant effect on physical well-being ( $\beta = -.05, p = .32$ ). This regression also showed that exercise accounted for 0.3% of the variance in physical well-being. Second, a linear regression was run to examine the path between exercise (independent variable) and psychological well-being (dependent variable). The results of this regression revealed that exercise did not have a significant effect on psychological well-being ( $\beta = .07, p = .18$ ). This regression also showed that exercise accounted for 0.5% of the variance in physical aspects well-being. Third, a linear regression was run to examine the path between exercise (independent variable) and exercise dependence (dependent variable). The results of this regression revealed that exercise did have a significant effect on exercise dependence ( $\beta = .59, p = .01$ ). This regression also showed that exercise accounted for 34.4% of the variance in exercise dependence. Finally, a multiple regression was run to examine the path between physical well-being, psychological well-being, and exercise dependence (independent variables) and ED (dependent variable). The results of this regression revealed that physical well-being did not have a significant effect on ED ( $\beta = .04, p = .34$ ), psychological well-being did have a significant effect on ED ( $\beta = .71, p = .01$ ), and exercise dependence did have a significant effect of ED ( $\beta = .15, p = .01$ ). Together, physical well-being, psychological well-being, and exercise dependence explained 61.7% of the variance in ED scores.

Figure 4.2 shows each of the paths proposed in the Exercise and ED Model with path coefficients.

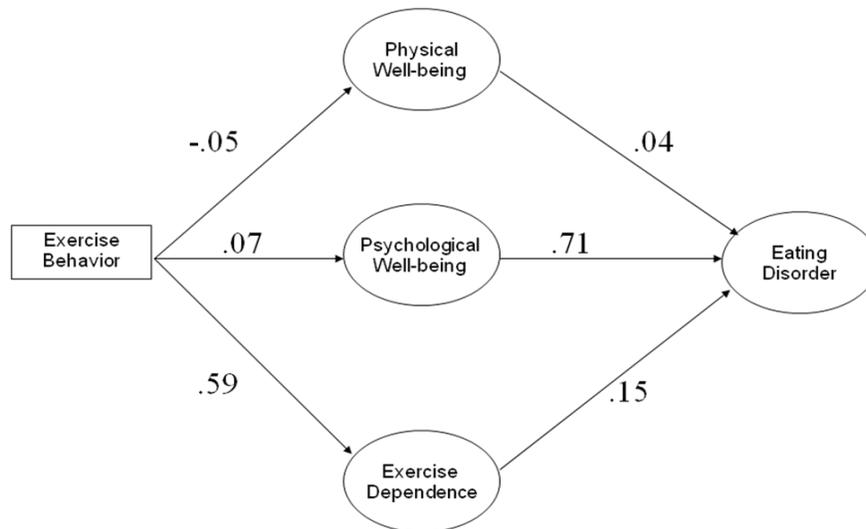


Figure 4-2. Model with coefficients

### Secondary Purpose

The Secondary purpose of my dissertation was to more closely examine the mediation relationship of exercise dependence on the relationship between exercise and ED (Cook & Hausenblas, 2008) by examining potential mediation effects of each subscale of the Exercise Dependence Scale. Figure 4.3 shows mediation conceptually. Eating Disorder Diagnostic Scale scores were chosen as the dependent variable in these analyses because they have been validated for use as a measure of ED symptoms (Stice et al., 2004). Results are presented below for Exercise Dependence Scale total scores as well as all seven subscales. Each correlation relevant to the specific mediation analysis is presented below, and correlations between all study variables are presented in table 4.6.

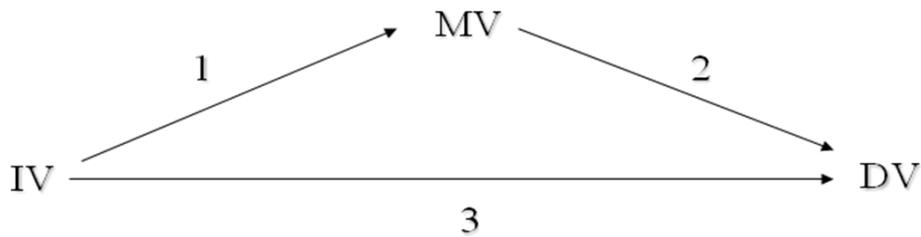


Figure 4-3. Conceptual Model of Mediation

Table 4-6. Secondary Purpose Variables Pearson Correlations

	LTEQ	Int	Time	Red	Lack	Tol	Cont	With	EDS
EDDS	.12*	.32**	.25**	.39**	.30**	.25**	.25**	.24**	.37**
EDS	.59**	.80**	.86**	.76**	.75**	.79**	.67**	.75**	
With	.50**	.45**	.55**	.47**	.40**	.56**	.46**		
Cont	.31**	.45**	.55**	.52**	.43**	.39**			
Tol	.52**	.57**	.68**	.46**	.45**				
Lack	.37**	.60**	.63**	.58**					
Red	.34**	.60**	.64**						
Time	.62**	.69**							
Int	.40**								

Note: \* =  $p < .05$ ; \*\*  $p < .01$ ; EDS = Exercise Dependence Scale; EDDS = Eating Disorder Diagnostic Scale total score; LTEQ = Leisure -time Exercise Questionnaire: Int = Intention; Lack = Lack of Control; Red = Reduction in Other Activities; Tol = Tolerance; Cont = Continuance; With = Withdrawal

### Exercise Dependence Total Score

Correlations were performed between Exercise Dependence Scale scores, Eating Disorder Diagnostic Scale scores, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Exercise Dependence Scale scores [ $r = .59, p = .01$ ], followed by Exercise Dependence Scale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .37, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were

significantly correlated and Leisure-Time Exercise Questionnaire scores and Exercise Dependence Scale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). Furthermore, exercise and exercise dependence exhibit a temporal relationship with exercise preceding exercise dependence (Hausenblas & Symons Downs, 2002; Symons Downs, Hausenblas, & Nigg, 2004). This is also an indication that the relationship may potentially be that of a mediator and not a moderator (Baron & Kenny, 1986; Kreamer et al., 2001). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Exercise Dependence Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .59, p = .01$ ) resulted in higher Exercise Dependence Scale scores [ $F(1,372) = 195.34, p = .01$ ]; with 34.4% of the variance in Exercise Dependence Scale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Exercise Dependence Scale scores explained by Leisure-time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-time Exercise Questionnaire scores and Exercise Dependence Scale scores (independent variables).

This regression found that Exercise Dependence Scale scores and Leisure-time Exercise Questionnaire scores explained 14.8% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,363) = 31.54, p = .01$ ], with Leisure-time Exercise Questionnaire scores ( $\beta = -.15, p = .02$ ) and Exercise Dependence Scale scores ( $\beta = .45, p = .01$ ) being a significant predictor of Eating Disorder Diagnostic Scale scores.

For mediation to be found, the independent variable in the first regression (Leisure-time Exercise Questionnaire scores) must affect the mediator (Exercise Dependence Scale scores). The second regression must show that the independent variable (Leisure-time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Exercise Dependence Scale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a partial mediator effect for exercise dependence on the relationship among Leisure-time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.4).

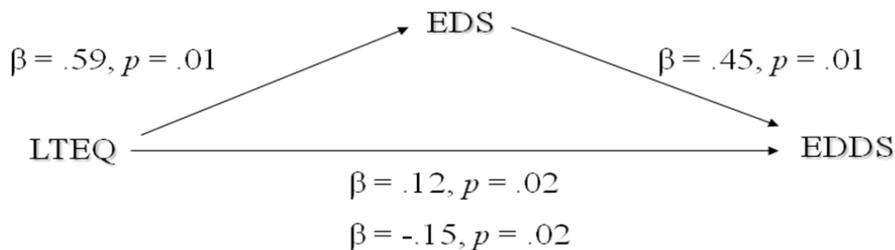


Figure 4-4. Mediation – Exercise Dependence Total Score

## Withdrawal Subscale Score

Correlations were performed between Withdrawal Subscale scores, Eating Disorder Diagnostic Scale scores, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Withdrawal Subscale scores [ $r = .50, p = .01$ ], followed by Withdrawal Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .24, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Withdrawal Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Withdrawal Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .50, p = .01$ ) resulted in higher Withdrawal Subscale scores [ $F(1,377) = 127.21, p = .01$ ]; with 25.2% of the variance in Withdrawal Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder

Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Withdrawal Subscale scores (independent variables). This regression found that Withdrawal Subscale scores and Leisure-Time Exercise Questionnaire scores explained 6.3% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,368) = 12.32, p = .01$ ], with only Withdrawal Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .26, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Withdrawal Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Withdrawal Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for Withdrawal Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.5).

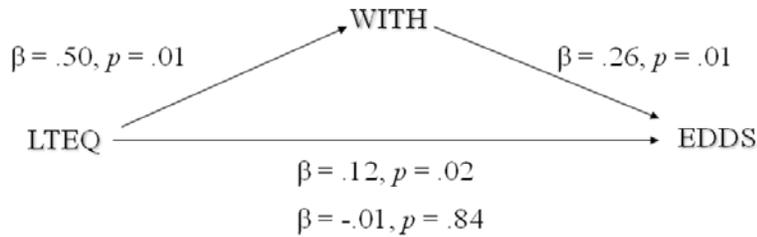


Figure 4-5. Mediation – Withdrawal

### Continuance Subscale Score

Correlations were performed between Continuance Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Continuance Subscale scores [ $r = .31, p = .01$ ], followed by Continuance Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .25, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Continuance Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Continuance Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .31, p = .01$ ) resulted in higher Continuance Subscale scores [ $F(1,378) = 40.58, p = .01$ ]; with

9.7% of the variance in Continuance Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Continuance Subscale scores (independent variables). This regression found that Continuance Subscale scores and Leisure-Time Exercise Questionnaire scores explained 6.3% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,369) = 12.42, p = .01$ ], with only Continuance Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .23, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Continuance Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Continuance Subscale scores) affects the dependent variable (Continuance Subscale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for

Continuance Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.6).

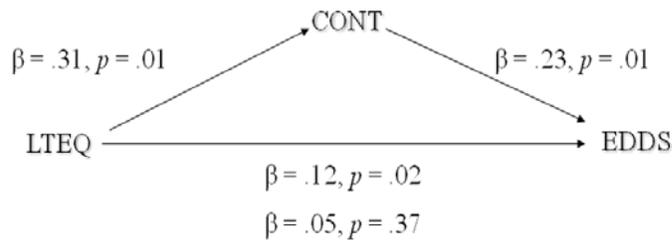


Figure 4-6. Mediation – Continuance

### **Tolerance Subscale Score**

Correlations were performed between Tolerance Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Tolerance Subscale scores [ $r = .52, p = .01$ ], followed by Tolerance Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .25, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Tolerance Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Tolerance Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that

higher Leisure-Time Exercise Questionnaire scores ( $\beta = .52, p = .01$ ) resulted in higher Tolerance Subscale scores [ $F(1,377) = 139.58, p = .01$ ]; with 27.0% of the variance in Tolerance Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-time Exercise Questionnaire (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Tolerance Subscale scores (independent variables). This regression found that Tolerance Subscale scores and Leisure-Time Exercise Questionnaire scores explained 6.5% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,368) = 12.70, p = .01$ ], with only Tolerance Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .26, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Tolerance Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Tolerance Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable

becomes non significant, then there is complete mediation (Baron & Kenny, 1986).

Based on these criteria and the results of these three regressions, a full mediator effect for Tolerance Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.7).

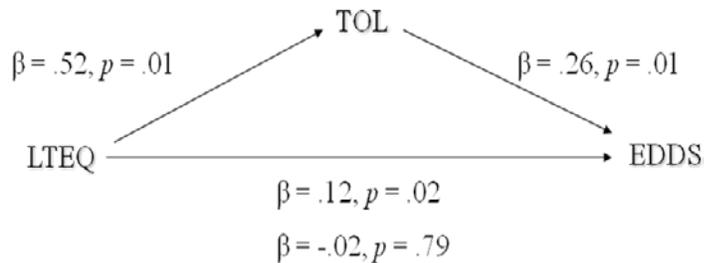


Figure 4-7. Mediation – Tolerance

#### **Lack of Control Subscale Score**

Correlations were performed between Lack of Control Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Lack of Control Subscale scores [ $r = .37, p = .01$ ], followed by Lack of Control Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .25, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores score were significantly correlated and Leisure-Time Exercise Questionnaire scores and Lack of Control Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry

regressions must be performed. First, a simple linear regression with forced entry was performed with Lack of Control Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-time Exercise Questionnaire scores ( $\beta = .37, p = .01$ ) resulted in higher Lack of Control Subscale scores [ $F(1,374) = 60.50, p = .01$ ]; with 13.9% of the variance in Lack of Control Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Lack of Control Subscale scores (independent variables). This regression found that Lack of Control Subscale scores and Leisure-Time Exercise Questionnaire scores explained 8.7% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,365) = 17.37, p = .01$ ], with only Lack of Control Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .29, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Lack of Control Subscale scores). The second regression must show that the independent variable

(Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Lack of Control Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for Lack of Control Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.8).

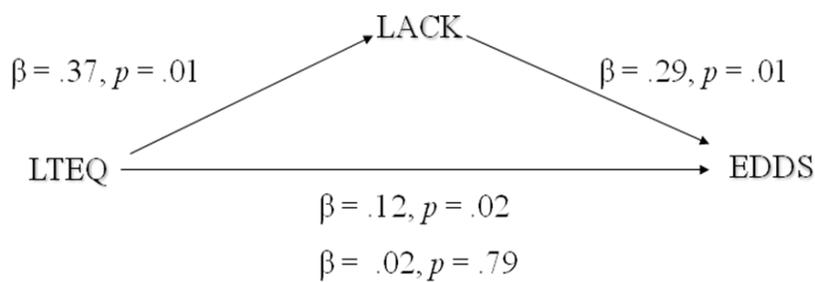


Figure 4-8. Mediation – Lack of Control

### Reductions in Other Activities Subscale Score

Correlations were performed between Reductions in Other Activities Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Reductions in Other Activities Subscale scores [ $r = .34, p = .01$ ], followed by Reductions in Other Activities Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .39, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r =$

.12,  $p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Reductions in Other Activities Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Reductions in Other Activities Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .34$ ,  $p = .01$ ) resulted in higher Reductions in Other Activities Subscale scores [ $F(1,377) = 48.18$ ,  $p = .01$ ]; with 11.3% of the variance in Reductions in Other Activities Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12$ ,  $p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87$ ,  $p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Reductions in Other Activities Subscale scores (independent variables). This regression found that Reductions in Other Activities Subscale scores and Leisure-Time Exercise Questionnaire scores explained 15.4% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,368) =$

33.51,  $p = .01$ ], with only Reductions in Other Activities Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .40, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Reductions in Other Activities Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Reductions in Other Activities Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for Reductions in Other Activities Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.9).

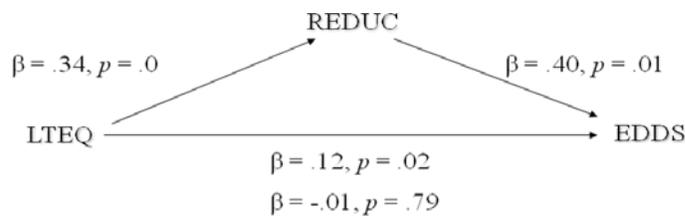


Figure 4-9. Mediation – Reduction in Other Activities

**Time Subscale Score**

Correlations were performed between Time Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire scores were significantly correlated with Time Subscale scores [ $r = .62, p = .01$ ],

followed by Time Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .25, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Time Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Time Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .62, p = .01$ ) resulted in higher Time Subscale scores [ $F(1,377) = 237.38, p = .01$ ]; with 38.6% of the variance in Time Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Time Subscale scores (independent variables). This regression found that Time Subscale scores and Leisure-

Time Exercise Questionnaire scores explained 6.4% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,368) = 12.55, p = .01$ ], with only TIME scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .29, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Time Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Time Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for Time Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.10).

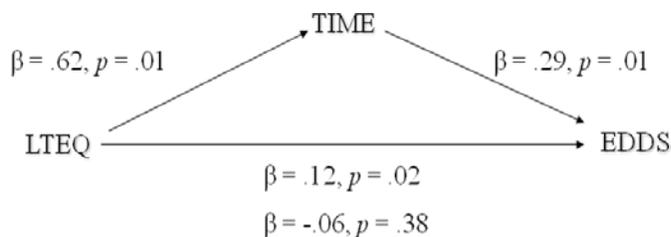


Figure 4-10. Mediation – Time

### Intention Subscale Score

Correlations were performed between Intention Subscale scores, Eating Disorder Diagnostic Scale, and Leisure-Time Exercise Questionnaire scores. I found that all of the variables were significantly correlated. That is Leisure-Time Exercise Questionnaire

scores were significantly correlated with Intention Subscale scores [ $r = .40, p = .01$ ], followed by Intention Subscale scores and Eating Disorder Diagnostic Scale scores being significantly correlated [ $r = .32, p = .01$ ], and Leisure-Time Exercise Questionnaire scores being significantly correlated with Eating Disorder Diagnostic Scale scores [ $r = .12, p = .02$ ]. Because Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores were significantly correlated and Leisure-Time Exercise Questionnaire scores and Intention Subscale scores were also significantly correlated, mediation was assumed and a three-step mediation model was followed (Baron & Kenny, 1986). This model outlines that three forced entry regressions must be performed. First, a simple linear regression with forced entry was performed with Intention Subscale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-time Exercise Questionnaire scores ( $\beta = .40, p = .01$ ) resulted in higher Intention Subscale scores [ $F(1,376) = 72.33, p = .01$ ]; with 16.1% of the variance in Intention Subscale scores explained by Leisure-Time Exercise Questionnaire scores. Next, Eating Disorder Diagnostic Scale scores (dependent variable) was regressed on Leisure-Time Exercise Questionnaire scores (independent variable). Results of this regression showed that higher Leisure-Time Exercise Questionnaire scores ( $\beta = .12, p = .02$ ) resulted in higher Eating Disorder Diagnostic Scale scores [ $F(1,373) = 5.87, p = .02$ ]; with 1.5% of the variance in Eating Disorder Diagnostic Scale scores explained by Leisure-Time Exercise Questionnaire scores. Finally, a forced entry multiple regression was performed with Eating Disorder Diagnostic Scale scores (dependent variable) regressed on Leisure-Time Exercise Questionnaire scores and Intention Subscale

scores (independent variables). This regression found that Intention Subscale scores and Leisure-Time Exercise Questionnaire scores explained 10.2% of the variance in Eating Disorder Diagnostic Scale scores [ $F(2,367) = 20.81, p = .01$ ], with only Intention Subscale scores being a significant predictor of Eating Disorder Diagnostic Scale scores ( $\beta = .32, p = .01$ ).

For mediation to be found, the independent variable in the first regression (Leisure-Time Exercise Questionnaire scores) must affect the mediator (Intention Subscale scores). The second regression must show that the independent variable (Leisure-Time Exercise Questionnaire scores) must affect the dependent, or outcome, variable (Eating Disorder Diagnostic Scale scores). Finally, the third regression must show that mediator (Intention Subscale scores) affects the dependent variable (Eating Disorder Diagnostic Scale scores). If the coefficient of the independent variable becomes non significant, then there is complete mediation (Baron & Kenny, 1986). Based on these criteria and the results of these three regressions, a full mediator effect for Intention Subscale scores on the relationship among Leisure-Time Exercise Questionnaire scores and Eating Disorder Diagnostic Scale scores was found (Figure 4.11).

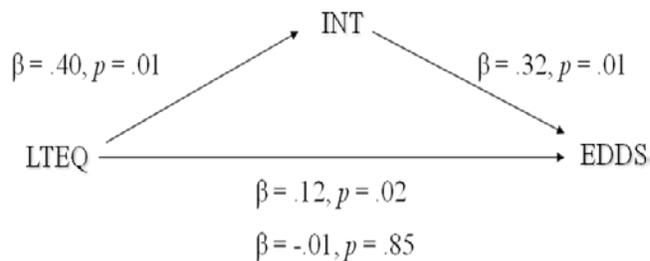


Figure 4-11. Mediation – Intention

Several of the coefficients in the third regression of each mediation analysis were in a negative direction, indicating that multicollinearity of the mediating variable (Exercise Dependence Scale Subscales) and independent variable (exercise) may have influenced the mediation analysis. Mediating variables must be correlated to independent variables; therefore multicollinearity is unavoidable (Baron & Kenny, 1986). Multicollinearity was checked by examining  $R^2$ , tolerance, and Variance Inflation Factor (VIF) values. A  $R^2$  value close to 1 indicates multicollinearity (Agresti & Finlay, 1999). A tolerance value of less than 0.20 or 0.10 and/or a VIF value of 5 or 10 and above indicates a multicollinearity problem (O'Brien, 2007). None of these values in my dissertation indicated that multicollinearity was a problem in my mediation analysis (see Table 4.7).

Table 4-7. Collinearity Diagnostic Values for Exercise Dependence Scale

	Tolerance	VIF	$R^2$
Exercise Dependence Scale	.65	1.53	.15
Withdrawal	.75	1.34	.06
Continuance	.90	1.10	.06
Tolerance	.73	1.37	.07
Lack of Control	.86	1.16	.09
Reduction	.89	1.13	.15
Time	.61	1.64	.06
Intention	.84	1.19	.10

## CHAPTER 5 DISCUSSION

### Overview

The purpose of my dissertation was to further examine the associations presented in the Exercise and ED Model (Hausenblas et al., 2008). This purpose was twofold. First, I examined each association proposed in the Exercise and ED model. I hypothesized that the associations proposed in the original conceptual model would be supported (APA, 2007; Haines & Neumark-Sztainer, 2006; Hausenblas et al., 2008). That is, the associations among exercise and physical well-being, exercise and psychological well-being, exercise and exercise dependence, physical well-being and ED, psychological well-being and ED, and exercise dependence and ED would be supported. This hypothesis was partially supported. Specifically, only the associations of exercise and exercise dependence, psychological well-being and ED, and exercise dependence and ED were supported. Second, the mediation effect of exercise dependence on the relationship between exercise and ED was examined in detail. I hypothesized that the psychologically-based criteria of exercise dependence would act as mediators, while the physiologically-based criteria would not (Blatt, 1995; Gulker et al., 2001; Hollander, 1993). This hypothesis was partially supported also. Specifically, the psychologically- based subscales showed a mediation effect on the exercise and ED relationship, however the physiologically-based subscales also showed a mediation effect. Implications and limitations of these findings and recommendations for future research are discussed below.

## Study Findings

### Primary Purpose

The primary purpose of my dissertation was to further examine the relationships proposed in the Exercise and ED Model (Cook et al., under review; Hausenblas et al., 2008) with a more diverse health sample and an ED specific QOL measurement. In contrast to my hypothesis, the results of my dissertation failed to show an association of exercise with the physical well-being and psychological well-being constructs of the Exercise and ED Model, but exercise did show an association with the exercise dependence construct. Physical well-being failed to show an association with ED, while the associations of psychological well-being and ED, and exercise dependence and ED were supported. These results were similar to the only other study to date that has examined the Exercise and ED Model (Cook et al., under review).

My dissertation improved upon previous research examining the Exercise and ED Model (Cook et al., under review) by recruiting a more heterogeneous sample (i.e., I included individuals from several universities in varying geographic areas) and measured QOL with an ED specific QOL assessment. That is, I recruited from a variety of courses and disciplines at seven different schools from four different States. By recruiting from various schools and disciplines, I attempted to avoid the homogeneous sample (i.e., participants from one university who were attending health oriented courses) by Cook et al. (under review). Before examining my primary and secondary purposes, I examined the outcome and demographics variables to see if any differences existed by university. I found that the UF students had significantly lower weight dissatisfaction and body mass index compared to Pensacola Junior College. This is not surprising considering that lower body mass index often results in lower body

dissatisfaction (Stice, 2002). This is notable because weight dissatisfaction is a risk factor for ED (Stice, 2002, Stice Marti, & Shaw, 2007). This weight dissatisfaction difference was most likely due to differences in body mass index scores also being significantly different between individuals recruited from these two schools. No other demographic variables by recruitment were significant, thus, recruitment site was not used as a covariate in my main analyses.

My dissertation also included individuals with ED, without ED, and at-risk for ED. This was conceptually relevant to the purposes of this dissertation because the Exercise and ED Model does not focus on a specific ED groups. That is, recruiting a variety of individuals allows examination of the premise of this framework that a relationship occurs whereby exercise results in improvements in well-being (USDHSS, 2008). Similarly, a relationship occurs whereby improved well-being results in decreased ED risk factors; ultimately resulting in decreased prevalence of ED (Hauenblas et al., 2008). Thus, there was no a priori rationale for why the model structure should differ for those with or without ED or to exclude either group. Because of the limited differences by ED type, this was not used as a covariates in my main analyses.

A strength of my dissertation study was that I used a disease specific assessment of QOL designed and validated to capture the nature of ED behaviors and attitudes impact on QOL. Measuring model constructs with an ED specific QOL assessment was needed because generic measures of QOL may overlook aspects related to a specific disease (Jones et al., 2008). Simply stated, the substantial health impact of ED (Engel et al., 2009; Hay & Mond, 2005) is often a focus of patient treatment (Carr & Higginson, 2001) but may not be captured by generic measures of QOL such as the SF-36.

Because the conceptualization of health constructs differs in generic and disease specific measures of QOL, results derived from ED specific measures of QOL may not be able to be compared to those assessed by generic measure of QOL. However, this is not considered a limitation of my dissertation because ED specific QOL measures have been shown to more accurately assess the health impact of the disease than generic measures of QOL (Engel et al., 2009). For example, the Quality of Life: Eating Disorders Scale (Abraham et al., 2006), the Eating Disorders Quality of Life Scale (Adair et al., 2007), the Eating Disorders Quality of Life Instrument (Engel et al., 2006), and the Health-related Quality of Life for Eating Disorders (Las Hayas et al., 2006) all compared ED specific QOL scales with either the SF-12 or SF-36 (which are generic QOL measures) in their validation studies, and the researchers found that each of the ED specific scales predicted more unique variance than that predicted by the SF-12 or SF-36. Thus, using ED specific QOL measures may allow for more specific inferences to be drawn regarding the association among constructs in the Exercise and ED Model.

Similar to Cook et al. (under review) my analyses failed to show an association between exercise and either physical or psychological well-being. Cook et al. (under review) proposed that the homogeneity in their sample may be the cause of this nonsignificant result. There are at least three potential explanations for the nonsignificant results in my dissertation. First, although I attempted to control for the sample homogeneity limitation of Cook et al. (in review), my sample was still convenient and fairly homogenous (i.e., university students). Future researchers are encouraged to recruit heterogeneous samples that vary in exercise amount, exercise dependence, and incidences of eating disorder.

Second, the measurement of exercise and physical and psychological-well being may not be accurate. Specifically, exercise produces measurable physiological changes (USDHHS, 2008). However, the physical aspects of QOL are measured by ordinary functional activities that are theorized to be essential to a sense of well-being and satisfaction in life (Hays, Hahn, & Marshall, 2002). Therefore, substituting the physical and psychological measurements included in QOL scales for validated measurements of these constructs in general may inadvertently measure the association with exercise inaccurately. They may, however, be accurately measuring the association of these constructs with ED. Thus, it is not surprising that the psychological well-being, but not physical well-being, aspects of QOL showed an association with ED. This finding is also consistent with previous research (Doll et al., 2005; Mond et al., 2004; Padierna et al., 2000, 2002). Continued examination of the association of exercise and QOL in ED is needed to help develop and advance theoretical models.

Third, theoretically-based models that include the association of exercise and ED are needed (Jansen, 2001; Leventhal, Weinman, Leventhal, & Phillips, 2008; Thome & Espelage, 2007). The Exercise and ED Model (Hausenblas et al., 2008) provides the conceptual basis for the development of such a model. Research focused on the development of this model must provide an empirical basis, and examine potential modifications to the model to provide enough a priori knowledge to examine the structural paths using experimental designs. My dissertation attempted to test the relationships proposed in the model. The results of my dissertation provide initial support for the associations between exercise and exercise dependence, psychological well-being and ED, and exercise dependence and ED. Future research must continue to

examine the associations among exercise and physical well-being, exercise and psychological well-being, and physical well-being and ED. Furthermore, my results raise the possibility that the effect of exercise on the physical and psychological well-being constructs differs from the way these same constructs are conceptualized in both generic and disease specific (i.e., ED) QOL. Thus, revisions to the model may be needed.

Specifically, my dissertation supports previous findings suggesting a revised Exercise and ED Model that does not include the physiological well-being construct (Cook et al., under review). Taken together, these preliminary examinations of the Exercise and ED Model suggests that the physiological well-being construct may not be of as much importance as originally conceptualized by Hausenblas and colleagues (2008). However, the cross-sectional design of both Cook et al.'s (under review) study and my dissertation precludes causal inferences. Furthermore, the overwhelmingly nonsymptomatic ED samples in my dissertation and Cook et al. (under review) may not have been able to identify the health detriments commonly observed in ED (Haskell, 1994; Klump et al., 2009; Mehlenbeck, 2002; Mehler & Krantz, 2003; Pearson et al., 2002; Sobel, 2004). Therefore, suggesting that the Exercise and ED Model would benefit from the removal of an entire construct (i.e. physiological well-being) would be premature. Thus, future research using experimental and longitudinal designs with diverse samples is needed to further examine the proposed relationships in the Exercise and ED Model and potential changes to model constructs.

### **Secondary Purpose**

The secondary purpose of this dissertation was to further examine the mediation effect of exercise dependence on the relationship between exercise and ED (Cook &

Hausenblas, 2008; Cook et al., under review; Hausenblas et al., 2008). A mediator is any variable that explains how or why a relationship exists (Baron & Kenny, 1986; Kraemer et al., 2001). A potentially mediating variable (e.g., Exercise Dependence Subscales) must be correlated to the independent variable (exercise). Put another way, a mediator is a variable that is present and correlated to the independent variable, which helps to explain how or why the independent variable affects the dependent variable.

Researchers have established a mediation effect for exercise dependence on the relationship between exercise and ED (Cook & Hausenblas, 2008; Cook et al., under review). Exercise dependence includes both physiological aspects (e.g., time, tolerance, and withdrawal effects) and psychological aspects (e.g., continuance, intention, lack of control, and reduction in other activities). Research examining the mediation effect of exercise dependence has not examined the potential that physiological and psychological aspects of exercise dependence may differ in their influence on the mediation of the relationship of exercise and ED. Because of this lack of research, I examined potential mediation effects for each of the Exercise Dependence Scale Subscales. My rationale for examining this was twofold. First, the amount of variance explained in ED (i.e., dependent variable) by exercise dependence (i.e., mediating variable) by Cook and Hausenblas (2008) was small. This raised the question of which subscales explained more variance than others or if the Exercise Dependence Scale's total score alone best explained the observed mediation effect. Second, the psychological aspects may reflect the obsessional nature of exercise dependence (Blatt, 1995; Gulker et al., 2001; Hausenblas & Symons Downs, 2002b; Hollander,

1993). Studies have linked excessive exercise in ED with obsessive-compulsiveness (Davis & Kaptein, 2006), obsessive-compulsive features (APA, 2000) and report that anorexia and obsessive-compulsive disorder are comorbid (Jacobi et al., 2004); thus suggesting that obsessional features of exercise dependence may account for the relationship between exercise and ED.

The results of my analyses suggested that there may be a partial mediation effect for exercise dependence on the relationship between exercise and ED, while each of the seven subscales of the Exercise Dependence Scale may exhibit a full mediation relationship between exercise and ED. A partial mediation effect for exercise dependence and full mediation effect for each of the subscales seems reasonable due to how full and partial mediators dominate the relationship with dependent variables. Domination refers to when a variable best predicts a dependent variable (Kraemer et al., 2001). In regards to mediators, full mediation occurs when the independent and mediating variables codominate. Partial mediation occurs when the mediator variable alone dominates the independent variable. The partial mediation effect of exercise dependence indicates that exercise dependence alone best predicts the outcome of ED. The full mediation effect observed in each of the seven subscales indicates that the mediator (each subscale) with exercise best predicts the outcome of ED.

These results support identified mediation effect of exercise dependence on the relationship between exercise and ED (Cook & Hausenblas, 2008) and the path including exercise dependence as presented in the Exercise and ED Model (Cook et al., under review; Hausenblas et al., 2008). My dissertation furthers the understanding of this mediation effect in regards to the Exercise and ED Model in several ways. First, the

measurement of ED in the Cook and Hausenblas (2008) study used the Drive for Thinness Subscale of the Eating Disorder Inventory (Garner, 1991) as the dependant measure of ED. Drive for Thinness is a main precursor to ED (Garner, Olmstead, & Polivy, 1983), however the Exercise and ED Model identifies ED as the outcome. Therefore, I used a measure of ED symptoms (i.e., ED Diagnostic Scale; Stice et al., 2000; 2004) as my dependent variable. My dissertation improved the understanding of exercise dependence's mediation effect by measuring ED with a measure of behaviors and attitudes (i.e., ED Diagnostic Scale) rather than a risk factor (i.e., Drive for Thinness). Because individuals engaging in ED behaviors and exhibiting ED symptoms display the same behaviors, attitudes, and symptoms as those with full threshold ED but not at the frequency needed to diagnose a full threshold ED (Tylka & Subich, 2002), it may be conceptually relevant to the Exercise and ED Model to measure the outcome (i.e., ED) with an assessment of symptoms (i.e., ED Diagnostic Scale) rather than risk (i.e., Drive for Thinness).

Second, examining potential mediators with a continuous measure of ED symptoms (e.g., ED Diagnostic Scale) rather than risk (e.g., Drive for Thinness) provides the opportunity to examine a potential mediation effect with an outcome variable that is more representative to the entire spectrum of ED. That is, Drive for Thinness is a cardinal feature of anorexia (Garner, 1991). Thus, by using a measure of ED symptoms, my dissertation explained more variance than previous research. Specifically, Cook and Hausenblas (2008) reported 4.6% of the variance in Drive for Thinness (dependent variable) was explained by exercise (independent variable) and exercise dependence (mediating variable). My dissertation found that exercise and

exercise dependence accounted for 14.8% of the variance in ED symptoms. This increase in variance explained furthers our understanding of exercise dependence's role as a mediator in the exercise and ED relationship by measuring ED with a measure of symptoms rather than risk. Moreover, my dissertation showed that the mean score for drive for thinness in individuals with full threshold anorexia were 0.20, individuals with subthreshold anorexia were 2.20, individuals with full threshold bulimia were 14.62, and subthreshold bulimia were 8.07. Drive for Thinness score differences between individuals with anorexia and bulimia is consistent with previous research (Kaltiala-Henio, Rantanen, & Koivisto, 2005), and indicates that Drive for Thinness may not be the most appropriate outcome variable to establish a mediation effect. Because the Drive for Thinness Subscale assesses excessive concerns with dieting and weight preoccupation (Garner, 1991), which is a main precursor to ED (Garner, Olmstead, & Polivy, 1983), my dissertation furthers our understanding of exercise dependence as a mediator by suggesting that the mediation effect of exercise dependence may not be limited to attitudes directed toward weight loss in either at-risk or developing cases of ED.

Finally, my dissertation failed to support my hypothesis that the psychological subscales, but not the physiological subscale, of exercise dependence would act as mediators of the relationship between exercise and ED. An explanation for this finding is that the physiological aspects of exercise dependence may be an artifact of exercise behavior (ACSM, 2000; Hausenblas & Symons Downs, 2002b; USDHHS, 2008). This is important because mediators should show a temporal relationship with the independent variable (exercise) preceding the mediating variable (exercise dependence subscales;

Kraemer et al., 2001). Simply stated, time spent exercising, tolerance of exercise, and withdrawal effects when exercise is stopped must precede exercise behavior. Thus, it is reasonable that the physiological subscales may be mediators.

A closer examination of these findings also revealed that the psychological subscales explained more of the variance than did the physiological subscales (see Table 5.1). Specifically for the psychological subscales, the reduction in other activities subscale explained 15.4% of variance, the intention subscale explained 10.2% of variance, the lack of control subscale explained 8.7% of variance, and the continuance subscale explained 6.3% of variance. Specifically for the physiological subscales, the tolerance subscale explained 6.5% of variance, the time subscale explained 6.4% of variance, and the withdrawal subscale explained 6.3% of variance. One of the rationales I had for examining potential differences was that Cook and Hauenblas's (2008) results showed small variance explained in the mediation relationship of exercise dependence on ED. Consequently, I was curious if certain subscales were more relevant than others in explaining this result. Although my hypothesis concerning the overall mediation effects of physical and psychological subscales was not supported, my results supported that there may be differences in amount of variance explained by the two types of subscales. Because mediators explain why a relationship occurs, and therefore where interventions should be directed (Baron & Kenny, 1986; Kraemer et al., 2001), my results suggested that interventions be directed at the psychological subscales of exercise dependence. Future researchers are encouraged to examine any potential differences in the Exercise Dependence Subscales mediation effects on the relationship between exercise and ED.

Table 5-1. Amount of Variance Explained by Exercise Dependence Subscales

Exercise Dependence Scale Subscale	% of Variance Explained
Reduction in Other Activities*	15.4
Intention*	10.2
Lack of Control*	8.7
Tolerance	6.5
Time	6.4
Continuance *	6.3
Withdrawal	6.3

Note: \* indicates psychological type subscales

### Limitations

Although I attempted to improve upon past study designs, study limitations were present in my dissertation. First, exercise did not show an association with either physical or psychological well-being scores despite the well-established positive relationship between exercise and physical and psychological well-being (see USDHHS, 2008). Although this finding is consistent with Cook et al. (under review) research examining the Exercise and ED Model, my dissertation further illuminates potential reasons why no association between these constructs has been established. Specifically, Cook and colleagues (under review) suggested that their lack of association among these constructs may be due to a relatively homogenous sample. My dissertation attempted to avoid this sample limitation by recruiting a more diverse sample from several recruitment sources. Thus, the recurring finding of a lack of association between these constructs raises the possibility that the conceptualization of QOL and how it relates to constructs in the Exercise and ED Model warrants further examination.

The definition of QOL (Hennessy et al, 1994; WHOQOL group, 1998), as well as the specific health-related constructs that should be assessed when measuring overall QOL, have been widely debated (Engel et al., 2009; Hay & Mond, 2005). Specifically,

critics of generic QOL measures, such as the SF-36, argue that the underlying assumption of these measures is that ordinary functional activities are essential to a sense of well-being and life satisfaction (Hays, Hahn, & Marshall, 2002). These conceptualizations of constructs are theorized to equate to a degree of QOL, but may not reflect the health impact of disease specific symptoms or behaviors (Jones et al., 2008). Furthermore, ED affect an individual's health, and therefore QOL, in specific ways (Klump et al., 2009; Mehler & Krantz, 2003). Thus, recent efforts have been made to create ED specific measures of QOL (Abraham et al., 2006; Adair et al., 2007; Bohn et al., 2008; Engel et al., 2006; Las Hayas et al., 2006). These ED specific QOL measures have varying constructs and wording of items. That is, each ED specific QOL measure identifies different constructs conceptualized as related to ED. The physical and psychological well-being constructs are complex and can encompass many aspects of health (e.g., sleep, heart disease, mood). Thus, it is not surprising that researchers operationalize these measures in various ways, resulting in several difference (although similar) types of measures. Thus, the measurement of each of the physical and psychological well-being constructs may not accurately reflect the original conceptualization of psychological and physical well-being in Hausenblas and colleague's (2008) model. Consequentially, the lack of association between exercise and physical and psychological well-being observed in my dissertation may have been due to inaccurate measurement of the associations among these key constructs in the model. Future researchers are encouraged to use more objective methods of measuring physical and psychological constructs in the Exercise and ED Model.

Self-report measurement of the variables in my dissertation was a limitation pertinent to all variables, not just QOL. For example, with regard to exercise, it is well-established in the literature that women overestimate the amount of total exercise duration (Buchowski et al., 1999; Irwin et al., 2001; Jakicic et al., 1998). Self-report measures are potentially inaccurate due to response styles that bias responding in a particular direction; referred to as response distortions (Lanyon & Goodstein, 1997). This may have been evident in my dissertation by negatively worded items and responses in the Drive for Thinness (Garner, 1991) and response options that encourage agreement acquiescence (Paulhaus, 1991), such as those on the ED QOL (Engel et al., 2006). Agreement acquiescence happens when response options generate a tendency for “yes/no” or “true/false” responses for an entire survey. The mean and standard deviation scores on the financial and work/school subscales of the ED QOL exemplify this possible limitation in my dissertation. However, this was not a major limitation because these two subscales were not pertinent to either the primary or secondary purposes of my dissertation.

ED have been described as secretive (Fairburn, 1995; Fairburn & Cooper, 1982; Hoek, 1995; Hoek & van Hoeken, 2003), thus suggesting that they are not socially acceptable or carry a certain degree of social stigma (Levine & Smolak, 2006). Accordingly, self-report measures are subject to social desirability bias (Edwards, 1953). For example, previous research reports that it is easy to lie on the Eating Disorder Inventory-2 (Garner, 1991; O'Connor, Lewis, & Kirchner, 1995). I used the Drive for Thinness subscales of the Eating Disorder Inventory-2 and found much lower scores than expected reported by individuals with anorexia. Thus, social desirability

may explain why my sample reported lower than expected Drive for Thinness scores. My dissertation attempted to assess both socially undesirable behaviors and attitudes (i.e., ED) but also socially desirable behaviors (i.e., exercise; USDHHS, 2008). Thus, some participants may have under-reported ED while over-reporting exercise. Anecdotally, after a participant handed me her completed survey, she informed me that she had lied only about ED questions because she had an ED. Instances such as this, while not the norm, illustrate that some individuals influence their responses by the social desirability of the behaviors and attitudes being assessed. Future research is encouraged to include social desirability scales, such as the Marlow-Crowne Social Desirability Scale (Crowne & Marlow, 1960) to detect social desirability bias.

Self-report methods may not be able to identify the physical problems associated with disease until they have reached a more severe level. Therefore, my dissertation's cross-sectional design may have accounted for the lack of association between exercise and physical-well being. Specifically, the physical detriments associated with ED arise as consequences of compensatory behaviors (Klump et al., 2009; Mehler & Krantz, 2003; Pearson et al., 2002; Sobel, 2004). In other words, they may be present during ED development, but are not yet severe enough to cause problems. Thus, developing physical problems may not be at a level that is either noticeable or within an individuals awareness, and therefore able to be reported on a self-report measure. For example, if you eat a super sized fast food meal for lunch every day (i.e., a diet high in calories, saturated fat, and trans fat), the plaque in your arteries will most likely build up (USDHHS, 2005). But it won't be until you have significant physical symptoms such as weakness, shortness of breath, chest pains, heart attack, or stroke before it is

measurable by self-report techniques analogous to the self-report questionnaires used in my dissertations. An analogy such as this points to the difficulties in measuring physical detriments with self-report assessments. Attempting to measure osteoporosis with self-report measures would be an example specific to ED.

Next, cross-sectional design was a limitation of my dissertation. Accordingly, these data should be interpreted as exploratory, rather than confirmatory and therefore do not imply causation. Simply stated, cross-sectional examination of factors associated with ED may not capture the etiology of development of ED (Wichstrøm, 2000). Furthermore, cross-sectional designs do not delineate the potentially reciprocal relationships among motivations for exercise, affect regulation, and ED risk. Continued use of cross-sectional designs should include nonclinical and clinical ED samples to allow for better comparisons and inferences of the proposed relationships reported for this model.

Finally, the classification of ED may be considered a potential limitation of my dissertation for two reasons. First, I included subthreshold and full threshold AN and BN as one group labeled ED. This was based on the continuum model of ED (Fairburn & Bohn, 2005; Fairburn, Cooper, & Shafran, 2003; Hay & Fairburn, 1998) which states that the behaviors and attitudes observed in full threshold ED individuals begin with less severity and progress linearly, culminating in AN or BN. These behaviors also begin to affect the individual's health, even early on during the progression of the ED (Pearson, Goldklang, & Striegel-Moore, 2002). However, recent research has not supported the continuum model of ED and suggests that AN and BN are separate disorders (Birmingham, Touz, & Harbottle, 2009). Second, the DSM-V Eating Disorder Work

Group is assessing the clinical utility and possible alterations of existing diagnostic criteria of all variants of ED (Walsh, 2009). Excessive exercise is one criterion that is being debated regarding how best to define it (Walsh, 2004), or even whether to include it as a compensatory behavior for bulimia nervosa (Herzog & Delinsky, 2001). Future research testing the Exercise and ED Model must stay aware of potential changes in the forthcoming DSM-V regarding diagnostic criteria and/or ED behaviors.

### **Future Studies**

Future research must continue to elucidate the relationships observed in my study by applying experimental and longitudinal designs and examining changes in both psychological and physical well-being and ED before, during, and after a regular sustained exercise intervention with objective methods of data collection (i.e., accelerometers for exercise level, biomarkers for physical variables, diagnostic interviews for eating disorders). More specifically, experimental designs are needed to further understand the relationship between exercise, QOL variables, exercise dependence, and ED prior to and during the development and maintenance of ED. For example, future research should examine changes in ED symptoms, ED attitudes, exercise dependence, and psychological and physical well-being resulting from a structured exercise program that reflects current exercise guidelines. Furthermore, a better understanding of the temporal progression from asymptomatic to subthreshold and full threshold ED may be found by comparing groups of various exercise levels (e.g., those who do not exercise, and low, moderate, and high amounts of exercise) and ED status (e.g., full and subthreshold AN or BN and no diagnosis).

As previously discussed, a result observed in my dissertation, as well as in previous research examining the Exercise and ED Model (Cook et al., under review),

was that exercise does not appear to have an association with physical and psychological benefits. Previous research has shown that exercise does have a beneficial relationship with physical and psychological well-being (USDHHS, 2008). Thus, future study designs and measurement must better assess these constructs as presented in Hausenblas and colleague's (2008) original model. For example, the physical and psychological constructs are theorized to impact QOL. Because generic and ED specific QOL measures theorized that physical and psychological constructs affect overall QOL, my dissertation also assessed physical and psychological constructs with QOL measures (Engel et al., 2006). Based on the lack of association among exercise, physical, and psychological constructs in my dissertation and Cook et al. (under review), future research should not assume that physical and psychological constructs interact with exercise as they do with QOL. Therefore, the association of exercise with the specific physical (e.g., body mass index, cardiovascular disease) and psychological (e.g., anxiety, depression, self-esteem) should be assessed using individual measures for each construct. The subsequent effect of these constructs can then be tested to find associations with ED specific QOL (see Figure 5.1). Using ED specific QOL has also been suggested as an outcome, rather than using ED diagnosis or status (Adair et al., 2007). Accordingly, ED specific QOL should be examined as a possible outcome rather than latent construct in the Exercise and ED Model, provided that the mediation effect of exercise dependence is accounted for.

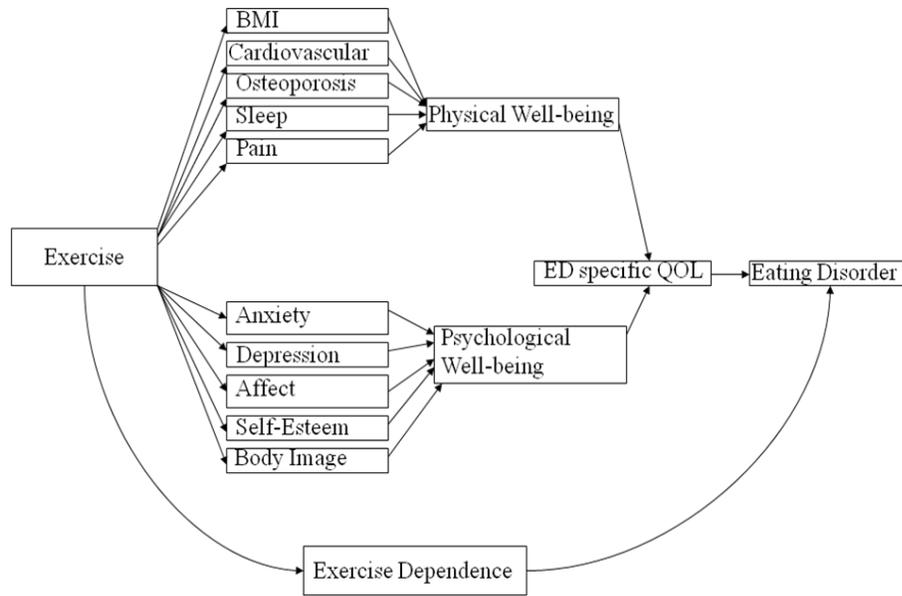


Figure 5-1. Proposed Measurement Changes to the Exercise and ED Model

My dissertation also supported Cook et al.'s (under review) finding that physical well-being did not have an effect on ED. This consistent finding suggests further examination of the physical well-being construct and possible modifications to the Exercise and ED Model are needed. That is, the original conceptual model (Hausenblas et al., 2008) suggests the effect of physical well-being precedes ED, however, the physical effects of ED have been noted as consequences of ED and ED behaviors (Haskell, 1994; Klump et al., 2009; Mehlenbeck, 2002; Mehler & Krantz, 2003; Pearson et al., 2002; Sobel, 2004). Therefore, future researchers are encouraged to test alternative models that account for this conceptual difference. Specifically, researchers are encouraged to examine a model that includes ED preceding the physical well-being construct (see Figure 5.2). Changing the structure of the Exercise and ED Model to include the physical aspects of QOL construct as an outcome, rather than ED status as an outcome, would also reflect recent recommendations for ED research to examine QOL, and not ED status, as an outcome (Adair et al., 2007).

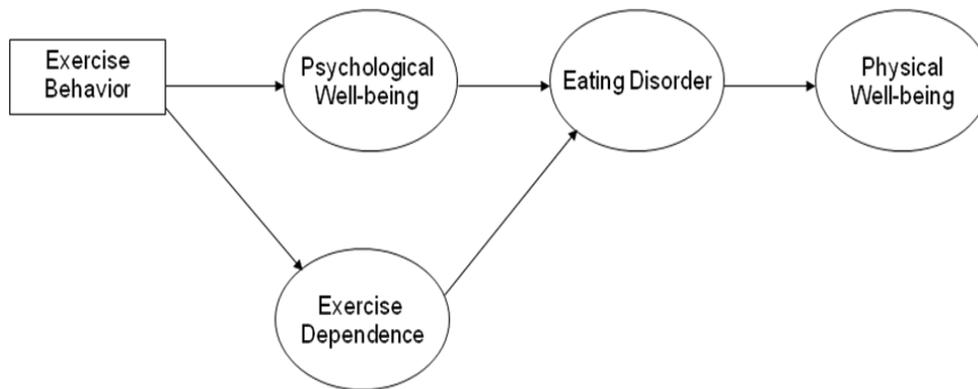


Figure 5-2. Modification of the Exercise and ED Model

The relationship and conceptualization of mediators and moderators is often confused (Baron & Kenny, 1986; Holmbeck, 1997). Delineating mediator and moderator effects in regards to ED exemplifies this confusion. For example, exercise dependence (i.e., compulsion) has been identified as a mediator of the relationship between exercise and ED (Cook & Hausenblas, Cook et al., under review) while excessive exercise (i.e., amount) has been identified as a moderator of this same relationship (Davis et al., 1997, 1998, 1999). Furthermore, the results of my dissertation suggest that ED group differences exist for Drive for Thinness scores, ED QOL scores, and exercise dependence scores. These differences, coupled with the mediation effect of exercise dependence observed in this dissertation and previous research (Cook & Hausenblas, 2008; Cook et al., under review) raises the possibility that a moderated mediation effect may exist.

Moderated mediation occurs when a variable acts as a mediator stronger for one group than for another (Baron & Kenny, 1986; Bauer, Preacher, & Gil, 2006; Edwards & Lambert, 2007). Specific to the variables of concern to my dissertation, a significant difference between ED and non ED individuals in exercise dependence scores [ $t(45.94) = 2.25, p = .03$ ], but not in exercise amount [ $t(361) = .82, p = .42$ ] was observed.

Furthermore, exercise dependence and ED were positively correlated ( $r = .37, p < .01$ ). High amounts of exercise have been reported in ED groups (Shroff et al., 2006). These results may indicate that the mediation effect is stronger for those with an ED than for those without. Thus, future research should continue to investigate potential moderated mediation effects of ED, exercise dependence, and exercise. Examination of these variables with a moderated mediation framework may also help determine if differences exist among the psychological and physiological subscales of the Exercise Dependence Scale.

## **Conclusion**

The relationship between exercise and ED has been proposed to be both detrimental (Carter, Blackmore, Sutandar-Pinnock, & Woodside, 2004; Darby, Hay, Mond, Rogers, & Owen, 2007; Shroff et al., 2006) and potentially beneficial (Hausenblas et al., 2008). Much of research, however, proposing that exercise is detrimental for ED is limited by bias clinical observations (Katz, 1996), retrospective research designs (Davis, Katzman, & Kirsh, 1999), vague operational definitions of excessive exercise (APA, 2000), inconclusive animal research (Cai et al., 2008), and overlooking potential mediating psychological variables (Adkins & Keel, 2005; Cook & Hausenblas, 2008; Zmijewski & Howard, 2003). Therefore a need exists for theoretically driven models that explain the relationship between ED and the psychological motivation as well as the physical affect of exercise (Jansen, 2001; Thome & Espelage, 2007). Hausenblas and colleagues (2008) provided a conceptual model of how exercise may be associated with both detrimental effects (i.e., exercise dependence) and beneficial effects (i.e., improvements in physical and psychological aspects of QOL, and decrease ED) on ED. This dissertation provides initial testing of that conceptual model

by empirically testing several of the paths proposed to illustrate associations among constructs.

The results of this dissertation add to the development of this model by identifying which paths may be of most interest for future testing of this model. Specifically, I found support for the beneficial association of psychological well-being on ED as well as the detrimental association of exercise dependence on ED. These results also support previous research examining the same associations (Cook & Hausenblas, 2008; Cook et al., under review). Future researchers are encouraged to examine the entire model while focusing on further clarifying the associations between exercise and physical and psychological aspects of QOL (Hausenblas et al., 2008). Furthermore, my dissertation failed to elucidate the mediation effect of exercise dependence on the relationship between exercise and ED (Cook & Hausenblas, 2008), but raised the possibility of a moderator or moderated mediation exists (Baron & Kenny, 1986). Future researchers are also encouraged to delineate if a mediation or moderation relationship, or potentially moderated mediation, best explains the association of psychological variables such as exercise dependence and amount of exercise with ED. Models such as the Exercise and ED Model, that examine potential protective factors are needed to help alleviate the severe negative health impact of ED and guide prevention and treatment research. Finally, my dissertation only examined the Exercise and ED Model with female participants. Future research should examine this model with both males and females.

In summary, ED's serious health consequences, chronic course, expensive treatment, added healthcare burden, and impaired health-related quality of life (QOL; Crow & Nyman, 2004; Harris & Baraclough, 1998; Hay & Mond, 2005; Mitchell, Myers,

Crosby, O'Neill, Carlisle, & Gerlach, 2009; Smolak & Striegel-Moore, 2004; Stice, Marti, Shaw, & Jaconis, 2009) show the need for theoretically driven models that explain the relationship between ED and the psychological motivation as well as the physical affect of exercise (Jansen, 2001; Thome & Espelage, 2007). The results of my dissertation provide initial support for the Exercise and ED Model (Hausenblas et al., 2008) and support the only other study to date that has examined the Exercise and ED Model (Cook et al., under review). Finally, my dissertation also examined the mediation relationship of exercise dependence on exercise and ED in greater detail than has previously been reported. My results suggest that psychological criteria of exercise dependence explain more variance in this mediation relationship than did the physical criteria. However, both psychological and physical criteria of exercise dependence exhibit a mediation relationship on exercise and ED. Future research is needed to continue to examine all relationships proposed in the Exercise and ED Model with longitudinal and experimental designs.

APPENDIX A  
DEMOGRAPHIC QUESTIONS

What is your age? _____	What is your gender?	<input type="radio"/> Male	<input type="radio"/> Female
Are you a member of a sorority or fraternity?		<input type="radio"/> Sorority	<input type="radio"/> Fraternity
		<input type="radio"/> Neither	
How tall you are? _____ Ft _____ Inches			
What is your year school?		<input type="radio"/> Freshman	<input type="radio"/> Sophomore
		<input type="radio"/> Junior	<input type="radio"/> Senior
		<input type="radio"/> Graduate/ professional	
What is your major? _____			<input type="radio"/> Undecided
How much do you weigh? If uncertain, please give your best estimate?		_____ lbs	What is your ideal weight? _____ lbs
Have you ever been diagnosed with an eating disorder?		<input type="radio"/> Yes	<input type="radio"/> No
Do you currently have an eating disorder?		<input type="radio"/> Yes	<input type="radio"/> No
What is your ethnic background?			
<input type="radio"/> African-American/Black			
<input type="radio"/> American Indian			
<input type="radio"/> Asian			
<input type="radio"/> Caucasian			
<input type="radio"/> Hispanic			
<input type="radio"/> Other, Please specify _____			
During the past 30 days, on how many days did you smoke cigarettes?			
<input type="radio"/> 0 days			
<input type="radio"/> 1 or 2 days			
<input type="radio"/> 3 to 5 days			
<input type="radio"/> 6 to 9 days			
<input type="radio"/> 10 to 19 days			
<input type="radio"/> 20 to 29 days			
<input type="radio"/> All 30 days			
During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?			
<input type="radio"/> I did not smoke cigarettes during the past 30 days			
<input type="radio"/> Less than 1 cigarette per day			
<input type="radio"/> 1 cigarette per day			
<input type="radio"/> 2 to 5 cigarettes per day			
<input type="radio"/> 6 to 10 cigarettes per day			
<input type="radio"/> 11 to 20 cigarettes per day			
<input type="radio"/> More than 20 cigarettes per day			
During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?			

- 0 days
- 1 day
- 2 days
- 3 to 5 days
- 6 to 9 days
- 10 to 19 days

APPENDIX B  
DRIVE FOR THINNESS SUBSCALE OF THE EATING DISORDER INVENTORY 2

This is a scale which measures a variety of attitudes, feelings, and behaviors. Read each question carefully and fill in the circle to the right of the question which applied best to you.	Never	Rarely	Sometimes	Often	Usually	Always
I eat sweets and carbohydrates without feeling nervous.	<input type="radio"/>					
I think about dieting.	<input type="radio"/>					
I am terrified of gaining weight.	<input type="radio"/>					
I exaggerate or magnify the importance of weight.	<input type="radio"/>					
I am preoccupied with the desire to be thinner.	<input type="radio"/>					
If I gain a pound, I worry that I will keep gaining.	<input type="radio"/>					
I feel extremely guilty after overeating.	<input type="radio"/>					

APPENDIX C  
EXERCISE DEPENDENCE SCALE

Using the scale to the right, please complete the following questions as honestly as possible. The questions refer to current exercise beliefs and behaviors that have occurred in the **past 3 months**. Please answer by filling in the appropriate circle next to each statement.

	Never		Rarely		Sometimes		Often		Usually		Always
1. I exercise to avoid feeling irritable.	<input type="radio"/>										
2. I exercise despite recurring physical problems.	<input type="radio"/>										
3. I continually increase my exercise intensity to achieve the desired effects/benefits.	<input type="radio"/>										
4. I am unable to reduce how long I exercise.	<input type="radio"/>										
5. I would rather exercise than spend time with my family/friends.	<input type="radio"/>										
6. I spend a lot of time exercising.	<input type="radio"/>										
7. I exercise longer than I intend.	<input type="radio"/>										
8. I exercise to avoid feeling anxious.	<input type="radio"/>										
9. I exercise when injured.	<input type="radio"/>										
10. I continually increase my exercise frequency to achieve the desired effects/benefits.	<input type="radio"/>										
11. I am unable to reduce how often I exercise.	<input type="radio"/>										
12. I think about exercise when I should be concentrating on school/work.	<input type="radio"/>										
13. I spend most of my free time exercising.	<input type="radio"/>										
14. I exercise longer than I expect.	<input type="radio"/>										
15. I exercise to avoid feeling tense.	<input type="radio"/>										
16. I exercise despite persistent physical problems.	<input type="radio"/>										
17. I continually increase my exercise duration to achieve the desired effects/benefits.	<input type="radio"/>										
18. I am unable to reduce how intense I exercise.	<input type="radio"/>										
19. I choose to exercise so I can get out of spending time with family/friends.	<input type="radio"/>										

20 A great deal of my time is spent exercising.

21 I exercise longer than I plan.

APPENDIX D  
LEISURE-TIME EXERCISE QUESTIONNAIRE

The following is a scale which measures your leisure-time exercise (i.e., exercise that was done during your free time such as intramural sports—NOT your physical education class). Considering a typical week, please indicate how often (on average) you have engaged in strenuous, moderate, and mild exercise more than 20 minutes during your free time?

1. Strenuous exercise: heart beats rapidly (running, basketball, jogging, hockey, squash, judo, roller skating, vigorous swimming, vigorous long distance bicycling, vigorous aerobic dance classes, heavy weight training)

How many times per typical week do you perform strenuous exercise for 20 minutes or longer? \_\_\_\_\_

2. Moderate exercise: not exhausting, light sweating (fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, popular and folk dancing)

How many times per typical week do you perform moderate exercise for 20 minutes or longer? \_\_\_\_\_

3. Mild exercise: minimal effort, no sweating (easy walking, yoga, archery, fishing, bowling, lawn bowling, shuffleboard, horseshoes, golf)

How many times per typical week do you perform mild exercise for 20 minutes or longer? \_\_\_\_\_

APPENDIX E  
EATING DISORDER QUALITY OF LIFE INSTRUMENT

Please answer the following statements according to how well they describe you in the last 30 days. Please be as open as possible. There are no right or wrong answers. Fill in the circle in the appropriate column. For those items that do not apply to you, please leave them blank.

		Never				
		Rarely		Sometimes		
				Often		Always
<b>In the last 30 days...</b>						
1.	How often has your eating/weight resulted in you feeling embarrassed or "different"?	<input type="radio"/>				
2.	How often has your eating/weight made you feel worse about yourself?	<input type="radio"/>				
3.	How often has your eating/weight made you not want to be with people?	<input type="radio"/>				
4.	How often has your eating/weight resulted in you believing that you will never get better?	<input type="radio"/>				
5.	How often has your eating/weight made you feel lonely?	<input type="radio"/>				
6.	How often has your eating/weight resulted in less interest or pleasure in activities?	<input type="radio"/>				
7.	How often has your eating/weight led you to not care about yourself?	<input type="radio"/>				
8.	How often has your eating/weight made you feel odd, weird, or unusual?	<input type="radio"/>				
9.	How often has your eating/weight resulted in avoiding eating in front of others?	<input type="radio"/>				
10.	How often has your eating/weight caused cold hands or feet?	<input type="radio"/>				
11.	How often has your eating/weight caused frequent headaches?	<input type="radio"/>				
12.	How often has your eating/weight caused weakness?	<input type="radio"/>				
13.	How often has your eating/weight affected your ability to pay attention when you wanted to?	<input type="radio"/>				
14.	How often has your eating/weight affected your ability to comprehend some verbal and written information?	<input type="radio"/>				
15.	How often has your eating/weight reduced your ability to concentrate?	<input type="radio"/>				
16.	How often has your eating/weight led to problems with treatment provider(s) regarding cost of treatment?	<input type="radio"/>				
17.	How often has your eating/weight led to you having difficulty paying monthly bills?	<input type="radio"/>				
18.	How often has your eating/weight resulted in significant financial debt?	<input type="radio"/>				
19.	How often has your eating/weight led to the need to spend money from savings or use your credit card frequently?	<input type="radio"/>				

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20.	How often has your eating/weight resulted in the need to borrow money?	<input type="radio"/>				
21.	How often has your eating/weight led to a leave of absence from work or classes/school obligations	<input type="radio"/>				
22.	How often has your eating/weight led to low grades?	<input type="radio"/>				
23.	How often has your eating/weight resulted in reduced hours at work or classes/school obligations	<input type="radio"/>				
24.	How often has your eating/weight resulted in you losing a job or dropping out of school?	<input type="radio"/>				
25.	How often has your eating/weight led to failure in a class or classes?	<input type="radio"/>				

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APPENDIX F  
THE EATING DISORDER DIAGNOSTIC SCALE

Please complete all of the following questions by filling in the appropriate circle or circling your answer.

	Not at all		Slightly		Moderately		Extremely
<b>Over the past 3 months:</b>	0	1	2	3	4	5	6
1. Have you felt fat?	<input type="radio"/>						
2. Have you had a definite fear that you might gain weight or become fat?	<input type="radio"/>						
3. Has your weight influenced how you think about (judge) yourself as a person?	<input type="radio"/>						
4. Has your shape influenced how you think about (judge) yourself as a person?	<input type="radio"/>						

5. During the past **6 months** have there been times when you felt you have eaten what other people would regard as an unusually large amount of food (e.g., a quart of ice cream) given the circumstances?

YES NO

6. During the times when you ate an unusually large amount of food, did you experience a loss of control (feel you couldn't stop eating or control what or how much you were eating)?

YES NO

7. How many **DAYS** per week on an average over the past **6 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control?

0 1 2 3 4 5 6 7

8. How many **TIMES** per week on an average over the past **3 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control?

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

<b>During these episodes of overeating and loss of control, did you...</b>	<b>YES</b>	<b>NO</b>
9. Eat much more rapidly than normal?	<input type="radio"/>	<input type="radio"/>
10. Eat until you felt uncomfortably full?	<input type="radio"/>	<input type="radio"/>
11. Eat large amounts of food when you didn't feel physically hungry?	<input type="radio"/>	<input type="radio"/>
12. Eat alone because you were embarrassed by how much you were eating?	<input type="radio"/>	<input type="radio"/>
13. Feel disgusted with yourself, depressed, or very guilty after overeating?	<input type="radio"/>	<input type="radio"/>
14. Feel very upset about your uncontrollable overeating or resulting weight gain?	<input type="radio"/>	<input type="radio"/>
15. How many times per week on a average over the past 3 months have you made yourself vomit to prevent weight gain or counteract the effects of eating?		
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14		
16. How many times per week on an average over the past 3 months have you used laxatives or diuretics to prevent weight gain or counteract the effects of eating?		
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14		
17. How many times per week on average over the past 3 months have you fasted (skipped at least 2 meals in a row) to prevent weight gain or counteract the effects of eating?		
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14		
18. How many times per week on average over the past 3 months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes?		
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14		
19. Over the past 3 months, how many menstrual periods have you missed?	1 2 3 4 NA	
20. Have you been taking birth control pills during the past 3 months?	YES NO	

APPENDIX G  
EXAMINATION OF THE EATING DISORDER QUALITY OF LIFE INSTRUMENT'S  
ITEM WORDING

**Introduction**

The measurement of psychological disorder specific QOL is a recent area of interest (Fallowfield, 1990). Previous measurement of QOL has relied on generic assessments that conceptualize general QOL definitions (Hay & Mond, 2005). The use of such broad measures has led some researchers to argue that generic measures of QOL may overlook disease specific aspects of QOL (Adair et al., 2006; Engel et al., 2009; Jones et al., 2008). Therefore, recent attention has focused on disease specific measurements of QOL that more accurately assess the affected areas of health (Abraham et al., 2006; Adair et al., 2007; Bohne et al., 2008; Engel et al., 2006; Las Hayas et al., 2006).

Currently, five surveys assess QOL in ED populations, yet each survey conceptualizes QOL in varying terms. The conceptualization and subsequent wording of items assessing QOL is of importance when examining the effects a specific disease has on QOL (Clark & Watson, 1995). For example, eating and weight concerns are two separate but related aspects that influence the development of ED (Killen et al., 1996; Richards et al., 1990). Therefore, accurately measuring ED specific QOL in terms of eating and weight concerns should distinguish between these two aspects of the ED (Clark & Watson, 1995). Specifically, all of the items in the EDQOL (i.e., the ED specific QOL measure used in this dissertation) are worded beginning with: “How often has your eating/weight...”. Wording that combines eating and weight concerns may be problematic when measuring the ED attitudes and behaviors’ impact on QOL because it is asking the participant to respond in reference to two constructs (i.e. eating and

weight). This is referred to as a double-barrel item because the question combined 2 issues in a single question (i.e., the items ask more than one thing). This presents a challenge for both the researcher and the participant because it is difficult (if not impossible) to know which part of the question the participant was thinking of when responding. Thus, it is recommended that researchers check to verify whether it is a double-barreled question (<http://knowledge-base.supersurvey.com/response-bias.htm>).

Thus, the purpose of this brief study was to examine the double-barreled wording of each item of the EDQOL (Engel et al., 2006) and determine if complex wording affected participants' responses. Previous research has validated the EDQOL using the combined "eating/weight" worded items (Engel et al., 2006). Therefore, I hypothesized that the wording will not affect the way in which participants responded to this scale's items.

## **Method**

### **Participants**

Participants were 43 female college students (age range = 19-23, *M* age = 20.77, *SD* = 0.92). Women in this age group were chosen because this cohort is at greater risk for ED compared to men of the same age, and incidences of ED typically peak during adolescence to early adulthood (Jacobi et al., 2004; Stice, 2002). Most of this sample was Caucasian (51.2%), followed by African American (27.9%), Asian (9.3%), and Hispanic (2.3%). About half of the participants were in their junior year of school (51.2%), followed by seniors (41.9%), sophomores (4.7%), and freshman (2.3%; Table A1).

Table A-1. Demographics

N	43			
Age	20.77 (.92)			
Body mass index	24.12 (5.16)			
Greek Affiliation	11.6%			
Class recruited from	48.8% Exercise Psychology      51.2% Community & Environmental Health			
Ethnicity	27.9% African American      9.3% Asian      51.2% Caucasian      2.3% Hispanic      9.3% Other			
Eating Disorder - Ever	7.0% Yes			
Eating Disorder - Currently	4.7% Yes			

Note - Mean(Standard Deviation)

## Measures

### Demographic Questionnaire

The Demographic Questionnaire assessed the participant's year in school, major, age, gender, weight, ideal weight, height, self-reported ED history, ethnicity, tobacco usage, binge drinking status, and amphetamine usage (Presley & Vineyard, 2004), acculturation (Chamorro, R., & Flores-Ortiz, 2000a), and sorority membership. (see Appendix A).

### The Eating Disorders Quality of Life Instrument

The Eating Disorders Quality of Life instrument (EDQOL) is an ED specific QOL measure that includes the following subscales: psychological, physical/cognitive, financial, work/school, and a total score (Engel et al., 2006). The EDQOL is 25-item scale and has been found to be more sensitive to ED specific aspects of QOL than generic measures of QOL. This measure was validated on female college students and has good reliability and validity ( $\alpha = .94$ ; Engel et al., 2006). However, the inclusion of "eating/weight" in each item raises concerns about how the participants are responding to each item. Therefore, two modified versions of the EDQOL were used; one worded only with "eating" and an identical version worded only with "weight". I also

corresponded with Dr. Engel about how the wording of these items were developed and obtain permission to examine this wording issue. (see Appendix H)

## **Procedure**

### **Data Collection**

All study procedures were reviewed and approved by the Institutional Review Board at the University of Florida. Participants were recruited through announcements in large lecture style classes. The announcement was for a study examining the relationship among exercise, health, and psychological states. Interested students were directed to complete a pen and paper survey. Interested participants read an informed consent sheet before beginning the survey, kept one copy for their records, and signed and returned another copy with their completed survey. They were also instructed to treat this survey as they would a test, and thus sit spaced apart as much as possible, avoid inspecting other students' responses, return the complete survey to an envelope, and hand the envelope to me immediately after completion. The survey took about 10 minutes to complete. Extra credit was given at the discretion of the course instructors.

### **Data Analysis**

First, means, standard deviations, and alpha values were determined for the overall score of each version of the EDQOL as well as for each item worded as "eating" and items worded as "weight". Alphas for both worded versions were excellent (Table A2). Second, a correlation was performed to examine the relationship between responses to the overall score both survey versions. Results indicated that participant responses were highly correlated,  $r = .86$ ,  $p = .01$ , indicating that the participants responses were very similar for both versions. A paired sample t test was undertaken to examine if differences existed between the participants overall responses to the 2

versions (e.g., if the wording of the items effected their responses). Results revealed that the participants' responses to each survey were not significantly different [ $t = -1.15$  (48),  $p = .26$ ].

Table A-2. Eating Disorder Quality of Life Instrument Alternative Item Wording Means and Standard Deviations

Scale worded EATING Overall Score $\alpha$	Mean (Standard Deviation) 0.28 (0.33) .90	Scale worded WEIGHT Overall Score $\alpha$	Mean (Standard Deviation) 0.22 (0.21) .90
Item		Item	
1	0.62 (0.83)	1	0.90 (0.98)
2	1.14 (0.88)	2	1.06 (0.97)
3	0.34 (0.75)	3	0.45 (0.84)
4	0.38 (0.81)	4	0.47 (0.84)
5	0.28 (0.73)	5	0.43 (0.76)
6	0.38 (0.70)	6	0.59 (0.76)
7	0.22 (0.58)	7	0.31 (0.65)
8	0.34 (0.69)	8	0.41 (0.73)
9	0.36 (0.83)	9	0.35 (0.69)
10	0.24 (0.72)	10	0.22 (0.85)
11	0.24 (0.59)	11	0.12 (0.48)
12	0.40 (0.81)	12	0.14 (0.46)
13	0.42 (0.64)	13	0.20 (0.58)
14	0.20 (0.40)	14	0.06 (0.32)
15	0.44 (0.61)	15	0.18 (0.49)
16	0.02 (0.14)	16	0.00 (0.00)
17	0.22 (0.84)	17	0.16 (0.69)
18	0.08 (0.34)	18	0.04 (0.29)
19	0.44 (0.86)	19	0.18 (0.67)
20	0.14 (0.41)	20	0.08 (0.28)
21	0.00 (0.00)	21	0.02 (0.14)
22	0.02 (0.14)	22	0.00 (0.00)
23	0.08 (0.34)	23	0.04 (0.29)
24	0.00 (0.00)	24	0.00 (0.00)
25	0.00 (0.00)	25	0.00 (0.00)

## Discussion

The purpose of this study was to further examine the psychometric properties of a new measure of ED specific QOL, and to determine if complex item wording (i.e., double-barreled items) affected participants' responses. The results of this study indicated that the complex item wording that includes two aspects related to ED

development (i.e., eating concerns and weight concerns) did not have an effect on participants' responses. That is, no significant difference was found for EDQOL scores from the version worded "eating" and the version worded "weight".

Scale item development must be guided by a theoretical foundation related to the specific construct, informed by the existent literature, and measure theoretical constructs as hypothesized by the psychological construct being assessed (Clark & Watson, 1995). Engel et al. (2006) described the development of the EDQOL, and they adhered to scale development guidelines (Clark & Watson, 1995) concerning initial item development, wording, testing, rejection of inaccurately worded or inappropriate items, and final scale validity. Furthermore, eating and weight concerns are related concerns that gradually worsen simultaneously during the development of ED (see Levine & Smolak, 2006 for review). Therefore, it appears to be theoretically relevant to measure eating/weight concerns together. Furthermore, the scale development (Engel et al., 2006) and analyses in this study suggested that items worded as "eating/weight" do not appear to influence participants' responses as opposed to measuring eating and weight concerns separately. Because the EDQOL is a new measure, researchers are encouraged to further examine its psychometric properties in a variety of populations.

APPENDIX H  
EATING DISORDER QUALITY OF LIFE INSTRUMENT ALTERNATIVE WORKING

Please answer the following statements according to how well they describe you in the last 30 days. Please be as open as possible. There are no right or wrong answers. Fill in the circle in the appropriate column. For those items that do not apply to you, please leave them blank.

		Never				
		Rarely		Sometimes		
				Often		Always
<b>In the last 30 days...</b>						
1.	How often has your eating resulted in you feeling embarrassed or "different"?	<input type="radio"/>				
2.	How often has your eating made you feel worse about yourself?	<input type="radio"/>				
3.	How often has your eating made you not want to be with people?	<input type="radio"/>				
4.	How often has your eating resulted in you believing that you will never get better?	<input type="radio"/>				
5.	How often has your eating made you feel lonely?	<input type="radio"/>				
6.	How often has your eating resulted in less interest or pleasure in activities?	<input type="radio"/>				
7.	How often has your eating led you to not care about yourself?	<input type="radio"/>				
8.	How often has your eating made you feel odd, weird, or unusual?	<input type="radio"/>				
9.	How often has your eating resulted in avoiding eating in front of others?	<input type="radio"/>				
10.	How often has your eating caused cold hands or feet?	<input type="radio"/>				
11.	How often has your eating caused frequent headaches?	<input type="radio"/>				
12.	How often has your eating caused weakness?	<input type="radio"/>				
13.	How often has your eating affected your ability to pay attention when you wanted to?	<input type="radio"/>				
14.	How often has your eating affected your ability to comprehend some verbal and written information?	<input type="radio"/>				
15.	How often has your eating reduced your ability to concentrate?	<input type="radio"/>				
16.	How often has your eating led to problems with treatment provider(s) regarding cost of treatment?	<input type="radio"/>				
17.	How often has your eating led to you having difficulty paying monthly bills?	<input type="radio"/>				
18.	How often has your eating resulted in significant financial debt?	<input type="radio"/>				
19.	How often has your eating led to the need to spend money from savings or use your credit card frequently?	<input type="radio"/>				
20.	How often has your eating resulted in the need to borrow money?	<input type="radio"/>				

21.	How often has your eating led to a leave of absence from work or classes/school obligations	<input type="radio"/>				
22.	How often has your eating led to low grades?	<input type="radio"/>				
23.	How often has your eating resulted in reduced hours at work or classes/school obligations	<input type="radio"/>				
24.	How often has your eating resulted in you losing a job or dropping out of school?	<input type="radio"/>				
25.	How often has your eating led to failure in a class or classes?	<input type="radio"/>				

Please answer the following statements according to how well they describe you in the last 30 days. Please be as open as possible. There are no right or wrong answers. Fill in the circle in the appropriate column. For those items that do not apply to you, please leave them blank.

		Never				
		Rarely		Sometimes		
		Often			Always	
<b>In the last 30 days...</b>						
1.	How often has your weight resulted in you feeling embarrassed or "different"?	<input type="radio"/>				
2.	How often has your weight made you feel worse about yourself?	<input type="radio"/>				
3.	How often has your weight made you not want to be with people?	<input type="radio"/>				
4.	How often has your weight resulted in you believing that you will never get better?	<input type="radio"/>				
5.	How often has your weight made you feel lonely?	<input type="radio"/>				
6.	How often has your weight resulted in less interest or pleasure in activities?	<input type="radio"/>				
7.	How often has your weight led you to not care about yourself?	<input type="radio"/>				
8.	How often has your weight made you feel odd, weird, or unusual?	<input type="radio"/>				
9.	How often has your weight resulted in avoiding eating in front of others?	<input type="radio"/>				
10.	How often has your weight caused cold hands or feet?	<input type="radio"/>				
11.	How often has your weight caused frequent headaches?	<input type="radio"/>				
12.	How often has your weight caused weakness?	<input type="radio"/>				
13.	How often has your weight affected your ability to pay attention when you wanted to?	<input type="radio"/>				
14.	How often has your weight affected your ability to comprehend some verbal and written information?	<input type="radio"/>				
15.	How often has your weight reduced your ability to concentrate?	<input type="radio"/>				
16.	How often has your weight led to problems with treatment provider(s) regarding cost of treatment?	<input type="radio"/>				

- |     |   |                       |                       |                       |                       |                       |
|-----|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 17. | How often has your weight led to you having difficulty paying monthly bills?                              | <input type="radio"/> |
| 18. | How often has your weight resulted in significant financial debt?   | <input type="radio"/> |
| 19. | How often has your weight led to the need to spend money from savings or use your credit card frequently? | <input type="radio"/> |
| 20. | How often has your weight resulted in the need to borrow money?   | <input type="radio"/> |
| 21. | How often has your weight led to a leave of absence from work or classes/school obligations               | <input type="radio"/> |
| 22. | How often has your weight led to low grades?  | <input type="radio"/> |
| 23. | How often has your weight resulted in reduced hours at work or classes/school obligations                 | <input type="radio"/> |
| 24. | How often has your weight resulted in you losing a job or dropping out of school?                         | <input type="radio"/> |
| 25. | How often has your weight led to failure in a class or classes?   | <input type="radio"/> |
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## BIOGRAPHICAL SKETCH

Brian was raised in Cumberland, Rhode Island and attended high school at Mount Saint Charles Academy in Woonsocket, Rhode Island. He began his undergraduate education at Johnson State College in Johnson, Vermont, where he majored in psychology and competed on the men's varsity cross country and tennis teams. At the conclusion of his freshman year, he transferred to the University of Rhode Island to focus on his psychology major. After graduating from the University of Rhode Island, he worked as a project assistant at ProChange Behavior Systems, Inc., in West Kingston, Rhode Island. Brian enrolled at the University of Florida in the fall semester of 2003. During his time at the University of Florida, he has worked with Dr. Heather Hausenblas on several projects in the Exercise Psychology Lab. His research focus in Lab has focused on exercise and eating disorders and exercise during pregnancy and the postpartum period.