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# Factors predicting weight loss and weight gain in bariatric surgery patients

Deborah Potisek Simpson

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**FACTORS PREDICTING WEIGHT LOSS AND WEIGHT  
GAIN IN BARIATRIC SURGERY PATIENTS**

By

Deborah Potisek Simpson, B.A., M.A.

A Dissertation Presented in Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Philosophy

COLLEGE OF EDUCATION  
LOUISIANA TECH UNIVERSITY

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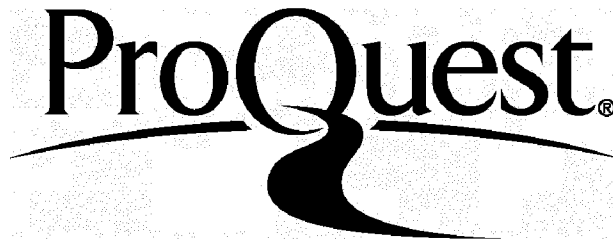
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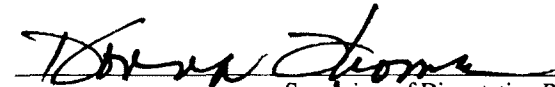
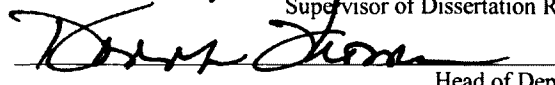
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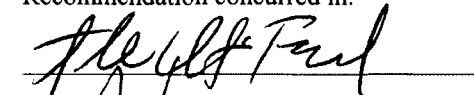
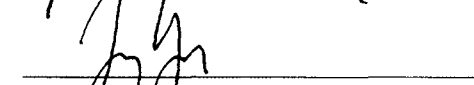
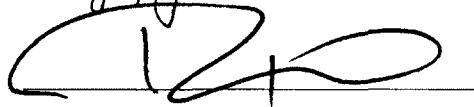
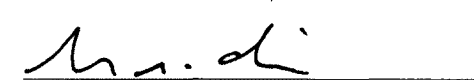
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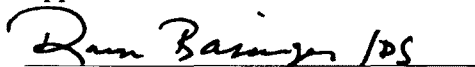
  
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## ABSTRACT

Obesity has become an epidemic in the United States that can result in problems in multiple areas of an individual's life. Bariatric surgery has been shown to be an effective weight loss treatment for obese and morbidly obese individuals; however, although many individuals obtain long-term weight loss success after surgery, there is a percentage of patients who do not obtain the expected weight loss or end up regaining the weight they had initially lost. In an attempt to identify those who may be at risk for poorer results after bariatric surgery, most surgeons require that an individual undergo a psychological evaluation before they are approved for surgery. Previous research has attempted to identify specific factors assessed in the psychological evaluation that may be used to identify those patients who are at risk for poorer surgery outcomes; however, results have been contradictory. This study examined whether specific psychological variables obtained during the psychological evaluation for gastric bypass surgery, specifically, scores on measures of disordered eating behavior, anxiety, and depression, could be used to predict short and long-term success post-surgery, as measured by the percentage of excess weight loss (EWL). This study also examined the role that behaviors engaged in after surgery: binge eating, night eating, grazing, and alcohol use play in longer term bariatric surgery success. The results of the present study did not support the majority of the hypotheses. Anxiety and depression was not found to be a predictor of EWL in the majority of hypotheses; however, anxiety post-surgery was found to predict EWL at two points post-surgery. There were some interesting significant findings when examining the

variables measuring disordered eating and health. Results showed that the Binge Eating Scale and the Night Eating Questionnaire were negatively correlated with the percentage of excess weight loss at various points post-surgery. The results also showed that excess weight loss was correlated with physical and mental health. Additionally, the Grazing Questionnaire was found to be positively correlated with the Binge Eating Scale.

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# CHAPTER 1

## INTRODUCTION

Obesity, defined as a body mass index (BMI) greater than 30, and morbid obesity, defined as a BMI greater than 40, are growing health problems in the United States (U.S.) and in other countries around the world. Since the 1960s, obesity rates have more than doubled in U.S. adults, increasing from 13.4 to 35.7% (United States Department of Health and Human Services (USDHHS, n.d.). More than two-thirds of adults are considered overweight or obese with one-third considered obese. Morbid obesity is found in more than 1 in 20 U.S. adults (USDHHS, n.d.). Rates of obesity are similar among males and females, about 36%, with 8% of women and 4% of men considered morbidly obese.

The main cause of obesity and morbid obesity in the U.S. is an energy imbalance; this means that the person is consuming more calories than they are using throughout the day (USDHHS, n.d.). As an individual consumes more calories than he/she uses, the body will store energy as fat, resulting in an increase in weight. There are numerous factors that can lead to an energy imbalance and weight gain. These factors include: a person's genetics, their environment, socioeconomic status, and physical activity level (USDHHS, n.d.; van Hout, Verschure, & van Heck, 2005).

The consequences of obesity are many (medical, psychological, social, and economic) and can be devastating. Medical risks of obesity include: high blood pressure, type 2 diabetes, nonalcoholic fatty liver disease, osteoarthritis, certain types of cancer, and stroke (O'Brien, 2010; Paeratakul, Lovejoy, Ryan, & Bray, 2002; Rajeswaran & Woodward, 2011; USDHHS, n.d.). The good news for individuals who struggle with obesity is that these consequences can be reversed or diminished when the person is able to lose weight to achieve a healthier Body Mass Index (BMI) through weight loss. BMI is calculated by dividing weight in pounds by height in inches squared and multiplied by a conversion factor of 703 (Centers for Disease Control [CDC], 2015). BMI is not used along to make a determination of someone's health; however, it can be used to obtain an estimate of body fatness (CDC, 2015).

There are not only physical consequences to obesity but also psychological consequences. Some of the psychological disorders associated with obesity include: mood disorders including bipolar disorder and dysthymia; anxiety disorders including panic disorder, agoraphobia, specific phobia, generalized anxiety disorder, and personality disorders (Petry, Barry, Pietrzak, & Wagner, 2008; Simon et al., 2006; Tuthill, Slawik, O'Rahilly, & Finer, 2006; van Hout, van Oudheusden, & van Heck, 2004).

The treatment options for obesity and morbid obesity include non-surgical treatments such as pharmacological, behavioral, and cognitive techniques, and various surgical interventions (Bean, Stewart, & Olbrisch, 2008). Although there are numerous treatments for obesity, the most effective treatment in terms of long-term weight loss and weight loss maintenance has been bariatric weight loss surgery (Shekelle et al., 2004).

Bariatric surgery is a term used to describe various surgeries. These surgeries include Roux-en-Y gastric bypass, biliopancreatic diversion with duodenal switch, laparoscopic gastric banding, and sleeve gastrectomy. All of these surgeries have the goal of dramatically decreasing the amount of caloric intake the individual is able to consume. This drastic cut in calorie intake usually results in substantial weight loss for an individual who has undergone the surgery. Bariatric surgery, like all surgeries, has risks and benefits and is considered a major surgery which may significantly change a person's life. Although the change is hopefully good in terms of weight loss, it can also be a difficult time as the person adjusts to new ways of eating behavior and to the physical changes that they are going through.

Because this is a serious surgery, many surgeons and insurance companies may require the bariatric surgery candidate to undergo a psychological evaluation. Not only is there the possibility of medical complications in bariatric surgery but the patient, after surgery, has to adjust to dietary restriction, has permanent changes in eating and dietary habits, has altered body sensations and experiences, has changes in body image, and experiences new cognitions and feeling (Lemont, Moorehead, Parish, Reto, & Ritz, 2004). The purpose of this evaluation is to identify any problems that can be addressed before and after the individual has surgery to increase the likelihood that their surgery will be a success.

### **Statement of the Problem**

Although bariatric weight loss surgery is successful for a large percentage of individuals who undergo it, there is a percentage of individuals who do not have successful long-term weight loss after bariatric surgery (Elder & Wolf, 2007). Elkins et



al. (2005) state that weight loss is usually guaranteed for the first three months after someone undergoes bariatric surgery but weight loss after this three month period can vary greatly. Not only can weight loss vary after a certain point, but some individuals begin to regain lost weight. This brings about the questions of: What factors may be able to predict who will have success with bariatric surgery and who may need additional pre- and post-surgery support in order to obtain the same success? Research has found that several factors are contraindications for surgery such as, suicidal ideation, self-injury, active psychosis, and severe cognitive impairments (Elder & Wolf, 2007). Research has also found that in obese individuals, factors that may be a risk for regaining weight after surgery include binge eating, depression, weight cycling, perceived barriers to weight control, eating triggered by emotions or stress, psychosocial stress, lack of social support, and poor coping (Elfhag & Rossner, 2005). It also appears that although individuals may be successful for some time in following the diet modifications required by the bariatric surgery, research shows that as time passes, some individuals may slowly start to eat more, experiment with what they eat, and lose control over eating as early as six months following surgery (van Hout, Verschure, & van Heck, 2005). Although research has found that these more severe problems are contraindications, research has been inconsistent when examining other pre- and post-operative factors such as pathological eating behaviors, post-operative alcohol use, depression, and anxiety as predictors of successful weight loss following bariatric surgery and of weight gain after surgery (Canetti, Berry, & Elizur, 2009; Dixon, Dixon, & O'Brien, 2001a; Kinzel et al 2006; Niego, Kofman, Weiss, & Geliebter, 2007; Odom et al., 2010; White, Masheb, Ruthchild, Burke-Martindale, & Grilo, 2006).

The primary purpose of this study was two-fold. Part One of the study involved reviewing the psychological evaluations and surgeon medical records of individuals who had bariatric surgery at least one year ago. This examination of the pre-surgical evaluations included obtaining information from self-report scales given during the evaluation which explored for disordered eating behaviors, health problems, anxiety and depression. The surgeon medical records were reviewed to obtain the one month, three month, six month, nine month, and twelve month surgery follow-up. The goal of this part of the study was to determine what, if any, factors may be predictive of success in the bariatric surgery patients as measured by initial weight loss. Part Two of the study was a follow-up study that provided more information on the success of the subjects of the study in terms of long-term weight loss and other success indicators. This part of the study included mailing out questionnaires for the bariatric surgery patients to complete.

### **Justification**

In regard to predictors of success in bariatric surgery patients, the results are mixed with some studies finding that factors such as depression, anxiety, and disordered eating do impact the success of surgery (Canetti et al., 2009; Crowley, Budak, Byrne, & Thomas, 2011; Niego et al., 2007; Sallet et al., 2007); and other studies concluding these factors do not predict weight loss success post-surgery (Bocchieri-Ricciardi et al., 2006; Kinzel et al., 2006; White et al., 2006). Research has also been limited in exploring the role of certain eating behaviors after surgery and alcohol use in predicting success. Having a clearer picture on what variables predict poorer outcomes in bariatric surgery patients would be valuable to the psychologists who perform the pre-surgery psychological evaluations and the surgeons and surgical staff who may see the patient

before and after the surgery for follow-up appointments. This information will also benefit the patients who may receive better care before surgery and have the opportunity for better aftercare if these variables can be identified.

The present study was unique in two ways. First, it gathered information from bariatric surgery patients before surgery, through examination of psychological evaluation records, as well as post-surgery, through review of surgeon follow-up records and by mailing out questionnaires to gather information. This resulted in post-surgery weight loss information from one month, three months, six months, nine months, twelve months, and after the one year mark. It also gathered information on factors such as eating behavior after one year post surgery. Secondly, the study was unique because it explored factors that have limited research in the current literature. These factors are post-surgery eating behaviors of grazing, night eating, and post-surgery alcohol use.

## **Literature Review**

### **Obesity**

Obesity is a growing health epidemic in the U.S. and worldwide. In the U.S., it is the second leading cause of preventable death (Bean et al., 2008). Since 1980, the worldwide rate of obesity has doubled, with one in three adults currently classified as obese (Bean et al., 2008; World Health Organization (WHO), 2006). A study completed by Finucane et al. (2011) found that 20% of the world population is overweight and approximately 10% are obese. In the U.S., in the year of 2013-2014, 37.9% of adults were considered obese and 70.7% were considered overweight or obese (CDC, 2016). Sturm and Hattori (2013) estimated that in 2010, 6.6% of adults in the U.S. were morbidly obese, with a BMI >40. In 2010, nearly 41 million women and 37 million men

over the age of 20 were considered obese in the U.S. (Ogden, Carroll, Kit, & Flegal, 2012). The highest rates of obesity are seen in non-Hispanic Blacks (49.5%) (CDC, 2012a). Other ethnic groups have the following rates of obesity: Mexican Americans, 40.4%; Hispanics, 39.1%; non-Hispanic Whites, 34.3%; American Indians and Alaska Natives, 39.9%; Native Hawaiians or other Pacific Islanders, 43.5%; and Asian Americans, 11.6% (CDC, 2012a; USDHHS, n.d.). The highest rates of extreme obesity are seen in African Americans, with 1 in 10 Blacks (13.1%) being considered morbidly obese (USDHHS, n.d.). In Caucasians and Hispanics the rates of morbid obesity is about 1 in 20.

Socioeconomic status is also associated with obesity. In non-Hispanic Black and Mexican American men, those who have a higher income are more likely to be obese than those with a low income (CDC, 2012a). In contrast, women who have a higher SES are less likely to be obese than those with a lower SES (CDC, 2012a).

There are no significant differences in obesity rates between women and men but differences in age have been found, with individuals 60 and over being more likely to be obese than younger adults (Ogden et al., 2012). Obesity rates also differ by region of the U.S., although it is important to note that no state in the U.S. has an obesity rate lower than 15%, which is the national goal (CDC, 2010). As of 2009 only Colorado and Washington D.C. had obesity rates lower than 20% with the majority of states having an obesity rate of 20%-29.9% (CDC, 2010).

**Causes of obesity.** The causes of obesity are many. Factors that are related to obesity include poor nutrition, physical inactivity, heredity, socioeconomic status, medication side effects, hormonal variability or imbalance, biological makeup, and

somatic factors (van Hout et al., 2005). When family history of obesity and twin studies are conducted, the evidence shows that being overweight or obese tends to run in families (National Institutes of Health [NIH], 2012). It is suggested that because the rate of obesity has increased so rapidly in recent years, genes cannot be the sole reason (NIH, 2012). Rather, cultural and sociological changes such as the availability of high calorie food and a sedentary lifestyle might be the reason we have seen such a large increase in the obesity rates. Our environments can be examined to see how much cultural and sociological changes may have an influence in the obesity rates in the U.S. For example, neighborhoods may not have sidewalks, access to affordable gyms, or area parks that could be used for exercise (NIH, 2012). Areas with limited access to healthy, affordable foods, commonly referred to as “food deserts” (CDC, 2012b), and the large amount of food advertisements for high fat unhealthy foods that individuals are exposed to may also influence unhealthy food choices. Individuals who get food at restaurants, convenience stores, or vending machines are also more likely to get higher fat and calorie food than food that would be made at home (CDC, 2010). Not only are high fat foods and high calorie foods associated with higher BMI but individuals may also ingest too much sugar which can affect weight. Sixty percent of adults drink at least one sugary drink a day (CDC, 2010). Not only are high fat, calorie, and sugary foods convenient, but they also tend to be the foods that are advertised through various media outlets. This exposure to advertisements and marketing may influence the food choices that individuals make. Just as genes can influence obesity, what eating habits children are exposed to in their families can influence their future eating habits, and if these habits are unhealthy, the possibility of being overweight or obese may increase.

**Physical consequences of obesity.** The physical consequences of obesity are numerous. When examining the rates of mortality associated with obesity, the World Health Organization (2006) states that 2.8 million adults worldwide die each year as a result of being obese or overweight and that obesity is the 5<sup>th</sup> leading of cause of death globally. Whitlock et al. (2009) found that each five point increase in BMI over a BMI of 25 kg/m<sup>2</sup> is associated with about a 30% higher overall mortality rate. With this increase in BMI, the researchers also found a 40% increase for vascular mortality, a 60-120% increase in diabetic, renal, and hepatic mortality, a 10% increase in neoplastic mortality, and a 20% increase in respiratory and all other mortalities. Obesity increases the risk of health conditions such as: heart disease, diabetes, stroke, hypertension, sleep apnea, cancer, cholesterol, gallstones, various abdominal and gastric problems, and osteoarthritis, as well as overall mortality (O'Brien, 2010; Rajeswaran & Woodward, 2011).

When examining mortality rates of the obese and morbidly obese, Abdullah and colleagues (2011) found that how long a person has been obese is directly related to mortality. Their results found that individuals who had lived with obesity between 5 and 14.9 years had a mortality risk double that of individuals who had never been obese. The risk of mortality tripled for those that had been obese for 15 or more years.

As a person's BMI increases, risks for diabetes, hypertension, heart disease, and high serum cholesterol also increase (Paeratakul et al., 2002). Being obese can also be damaging to an individual's bones. Obesity accelerates the wear on the joints and spine that occur in everyone over time. Osteoarthritis in the knees is especially increased, with obese individuals experiencing difficulty squatting, running and climbing stairs (Makk,

2007). Severe arthritis can lead to the obese patient needing knee or hip replacements or having to use a motorized scooter to be mobile.

When examining these health problems, some studies have looked at differences in race. Paeratakul et al., (2002) found that Black obese individuals had higher rates of hypertension than the Caucasian and Hispanic individuals used in their sample. When examining the overall health, obese individuals tend to have poorer health habits than individuals who are not obese. This includes less physical activity, more overeating, and more emotional eating (van Hout et al., 2004). The health consequences of obesity are so great that the effects on morbidity and poorer health-related quality of life are greater than smoking, problem drinking, or poverty, when examined individually. (Sturm & Wells, 2001).

**Psychiatric disorders in obese individuals.** Although we cannot say that obesity causes psychiatric disorders, research shows that there is a high rate of psychiatric disorders found in obese and morbidly obese individuals who present for bariatric surgery. Some research has found the rate of psychiatric disorders in these individuals to be higher than in the general population. Duarte-Guerra, Coelho, Santo, and Wang (2014) examined psychiatric disorders in individuals seeking bariatric surgery and found that their sample had a twelve month prevalence rate of psychiatric disorders twice that found in the general population. Simon et al. (2006) found that individuals with BMI >30 had higher lifetime and twelve month prevalence rates of various psychiatric disorders compared to those who had a BMI <30. Davin and Taylor (2009) reviewed research on psychiatric disorders found in morbidly obese individuals presenting for bariatric surgery. Their results showed that specific psychiatric disorders found in these

individuals include: anxiety, depression, eating disorders, substance abuse, and personality disorders. Lifetime history of psychiatric disorders range from 50-84% and personality disorder diagnoses range from 39.5-72%. Other studies have reported lifetime prevalence rates of depression in obese individuals from 29% to 56% (van Hout et al., 2004). The authors note that this range is well above the lifetime prevalence rate of approximately 17% seen in the general population. In their review of the literature, van Hout et al. (2004) found that the most frequent type of psychiatric disorder in obese patients are depressive disorders and the second most frequent are anxiety disorders. In their sample of 253 obese individuals seeking treatment at a weight management clinic, Tuthill et al. (2006) found that 48% had elevated scores for depression and 56% had elevated scores for anxiety. Heo, Pretrobelli, Fontaine, Sirey, & Faith (2006) found that obese women were more likely to report having a sustained depressed mood over a 14-day period than nonobese women. Kinzel et al. (2006) evaluated morbidly obese individuals presenting for evaluation for bariatric surgery. Thirty-two percent of their sample met criteria for one mental disorder and 7% met criteria for two or more. Research has also found that up to 40% of individuals seeking bariatric surgery were engaged in some form of mental health treatment at the time of their evaluation for surgery and that 50% had a history of mental health treatment (Sarwer & Dilks, 2011). Glinski, Wetzler, & Goodman (2001) found in their sample of 115 gastric bypass surgery candidates that 70% met the criteria for a current psychiatric disorder with an additional 50% having a past psychiatric diagnosis. The researchers also found that 56% of their sample had a lifetime prevalence of depression. A current anxiety disorders was found in 17% of the sample. An additional 12% of the sample reported a past anxiety disorder.



Along with psychiatric disorders, studies have also examined problematic personality characteristics or traits in obese individuals. According to van Hout et al. (2004) when examining personality and obesity, we can look at the relationship in three ways. First, it is possible that there are certain personality characteristics that predispose a person to overeat and gain weight. Second, it is possible that being obese influences personality. The third possibility is that it is a combination of personality predisposing a person to be obese and that obesity influences personality. van Hout et al. (2004) reviewed literature on personality traits found in morbidly obese patients and found that studies have identified immaturity, poor impulse control, and personality features related to the eccentric cluster (paranoid, schizoid, schizotypal) and dramatic cluster (histrionic, narcissistic, borderline, antisocial) of personality. They also found that morbidly obese individuals scored higher in self-doubt, insecurity, sensitivity, dependence, compliance, and emotional instability.

Although research many times looks at general groupings of psychiatric disorders when examining the prevalence of psychopathology in obese individuals, research has also focused on the rates of specific disorders. Of particular interest in the present study are the rates of depression and anxiety in obese individuals. Chen, Jiang, and Mao (2009) investigated the association between obesity and depression in a sample of 59,652 Canadians age 18 and over. The results of their study showed that being overweight was associated with a 40% increase in depression. This association was strongest in women aged 18-39 years. Anderson and colleagues (2010) also examined the rates of depression and anxiety in individuals with morbid obesity; however, their study focused on obese individuals who were undergoing gastric bypass surgery. Their sample size was

relatively small ( $N = 50$ ) but they found significant results indicating that before surgery the obese individuals had higher rates of depression and anxiety. Interestingly, they also found that after surgery at a one year and two year follow-up, the surgery patients had decreases in both depression and anxiety but that the rate of receiving psychological treatment did not change. Oyekcin, Yildiz, Sahin, & Gur (2011) had similar findings in their study examining rates of depression and anxiety in obese and average weight individuals receiving treatment at an endocrinology outpatient clinic. The results of their study showed that both depression and anxiety were higher in the obese individuals.

**Obesity prejudice and discrimination.** Obese individuals also face prejudice and discrimination that can influence their psychological and physical well-being. Obese individuals are faced with negative stereotypes such as being perceived as lazy, weak-willed, unsuccessful, unintelligent, lacking self-discipline, lacking will-power, and being noncompliant with weight loss treatment (Puhl & Heuer, 2010). With the increase of obesity in the U.S., discrimination toward obese individuals has also risen. The increase of weight discrimination has risen 66% in the last decade (Puhl & Heuer, 2010). That increase brings weight discrimination near the level seen in rates of racial discrimination. To make the issue even more difficult for those experiencing this type of discrimination, it is not often openly challenged in our society (Puhl & Heuer, 2010). Puhl and Brownell (2006) examined the experience of weight stigma, sources of stigma, coping strategies, psychological functioning, and eating behaviors in 2,671 overweight and obese adults. The results of their research found common experiences of stigma reported included: others making negative assumptions, receiving nasty comments from children, encountering physical barriers and obstacles, encountering inappropriate comments from

doctors, and receiving negative comments from family members. The individuals in the study reported that these sources of stigma came from their family members, doctors, classmates, sales clerks, friends, and coworkers. The researchers also examined the coping strategies used by these individuals when faced with stigma. Multiple positive coping strategies were used such as positive self-talk. However, 79% of the sample reported coping by eating more food.

Discrimination toward those with obesity is seen in many areas. Studies in the workplace have shown that individuals are less likely to hire an obese individual than they are a thin individual (Puhl & Brownell, 2001). Negative attitudes toward obese individuals in the workplace include beliefs that obese individuals are lazy, less competent, and lack self-discipline. Studies have also shown evidence for individuals being passed up for promotions because of their weight and overweight women tend to make less money compared to their thin counterparts (Puhl & Brownell, 2001). Weight bias in the workplace may manifest as obese individuals being the target of derogatory humor or pejorative comments and differential treatment such as disadvantages in hiring, wages, promotions, and job termination (Puhl & Heuer, 2009).

Discrimination against obese individuals is also seen in the medical and educational settings. Experiencing discrimination in medical settings can result in an individual not seeking out the health care that they need for fear of being shamed or embarrassed by the medical staff. Research has shown that this tendency to delay or not seek out medical services includes obese individuals being less likely to undergo preventive screeners for breast, cervical, and colorectal cancer (Puhl & Heuer, 2009). When asked what specific factors contribute to delaying or not seeking out services,

obese women have stated such reasons as: feeling disrespected, experiencing negative attitudes from providers, being embarrassed about getting weighed, exam equipment being too small for them, or receiving unwanted advice on how they can lose weight (Amy, Aalborg, Lyons & Keranen, 2006). Although discrimination, prejudice, and stigma can occur in many settings and come from many people in the obese individual's life, Puhl, Moss-Racusin, Schwartz, and Brownell (2008) found that individuals in their study cited that their worst stigma experiences were experiences they had with their friends and family.

Unfortunately, many obese individuals face discrimination from the very health professionals whose purpose is to help them find a way to overcome their struggle with obesity. Schwartz, Chambliss, Brownell, Blair, and Billington (2003) investigated weight bias in health care professionals who specialize in the treatment of obesity. The researchers asked participants to complete the Implicit Associations Test and a self-report questionnaire that assessed such areas as explicit attitudes and personal experiences with obesity. Even among this group of professionals, who have an understanding of the genetic and environmental factors that can impact obesity, weight bias was still present. The investigators found that the health care professionals in their study held significant weight bias including indicating negative stereotypes such as obese individuals being lazy, stupid, or worthless. This is a very troubling finding as obese individuals may count on these health professionals to be the ones who can understand the struggles they go through in their weight loss and the frustration of failure. Puhl and Heuer (2009) reviewed a large amount of literature investigating weight bias reported by various health care professionals. When examining the research on weight bias held by physicians the

investigators found that a significant number of the physicians viewed obese patients as awkward, unattractive, ugly, noncompliant, weak-willed, sloppy, and lazy. They also found that a study by Hebl and Xu (2001) showed that as the weight of a patient increased the physician was more likely to view them as less healthy, worse at taking care of themselves, and having less self-discipline. Nurses have also expressed weight bias reflecting views common to those that are expressed by physicians including viewing obese individuals as lazy, lacking will power, and being noncompliant (Brown, 2006).

The discrimination and stigma that obese individuals are faced with can impact many areas of their lives, including having a negative influence on their weight. Schvey, Puhl, and Brownell (2011) examined the impact that being faced with weight stigma has on an individual's calorie intake. The researchers exposed average weight and overweight women to one of two conditions; they either viewed a video depicting weight stigmatizing material or a video depicting neutral material. After watching the video, the researchers measured the amount of calories the women consumed. The results of the study showed that there was a significant relationship in overweight women between being exposed to weight stigmatizing material and the amount of calories consumed. When compared to the overweight women who watched the neutral video, the overweight women who watched the video depicting weight stigma consumed three times the calories; this finding was significant even when BMI was held constant. Puhl, Moss-Racusin, and Schwartz (2007) also examined the role that weight bias plays on disordered eating. Participants in the study completed self-report questionnaires that measured the frequency of weight stigmatization the individual encountered and ways they coped with this bias. The results of the study suggest that individuals who coped

with the stigma by internalizing stereotypes may be more likely to binge eat and to respond to the stigma by being less likely to diet. Weight bias, stigma, and stereotyping has also been associated with depression in obese individuals, lower self-esteem, and poorer body image (Puhl & Heuer, 2009).

**Quality of life and obesity.** As reviewed, research has shown that obesity leads to increased rates of multiple health problems, psychological problems, and that obese individuals are subject to stigma and discrimination based on weight. There is also the question of quality of life in obese individuals and how bariatric surgery changes quality of life.

When investigating this construct, researchers usually refer to quality of life or health related quality of life. Health related quality of life is defined as a person's own subjective evaluation and reaction to their health or an illness they have (Fontaine & Barlett, 1998). Health related quality of life can include ratings in the areas of emotional, physical, social, and subjective well-being (Fontaine & Barlett, 1998). Stewart and Brook (1983) examined health related quality of life in a large sample of obese individuals between the ages of 14 to 61 years old. They found that being overweight was associated with poorer functional status. Poorer functional status included inability to perform various activities such as walking, climbing stairs, working, or engaging in sports. Fontaine, Cheskin, and Barofsky (1996) also examined health related quality of life in obese individuals. Their sample consisted of 312 obese adults. The results of their research showed that their sample scored significantly lower than the general population norms on the Short Form Health Survey-36 (SF-36) domains of physical functioning, role limitations due to physical problems, bodily pain, general health perception, vitality,

social functioning, role limitations due to emotional problems, and mental health.

Cameron et al. (2012) found similar results in their study, which found that having a higher BMI at the beginning of the study was related to a deterioration in health related quality of life over a period of five years for seven of eight health related domains for women and six of eight for men. Interestingly, they also found that health related quality of life was a predictor of weight gain over five years. Wedin et al. (2012) also examined the role of BMI on quality of life. The results showed that higher pre-surgical weight was associated with higher pain-on-average ratings, higher functional impairment due to pain across domains of physical activity, mood, walking ability, relationships, and enjoyment of life. Seidell et al. (1986) found that obesity was associated with complaints such as shortness of breath or musculoskeletal problems, among others.

**Economic costs of obesity.** Obesity not only has psychological and physical costs, but also economic. Cawley and Meyerhoefer (2010) reported that it is estimated that the annual cost of treating obesity in the non-institutionalized population is \$168.4 billion. The annual medical spending for an obese individual is \$3,271 and \$512 for a non-obese individual (Ungar, 2012). The increased cost for obese individuals elevates insurance premiums for all other individuals. When insurance costs are compared, research has found that Medicare pays \$1,723 more for obese individuals; Medicaid \$1,021 more; and private insurance \$1,140 more (Ungar, 2012). There are also indirect costs of obesity that harm the individual and society. Indirect costs of obesity include absenteeism and presenteeism, disability, premature mortality, and increased life insurance premiums (Jeffords, n.d.). The cost of obesity in the workplace is so high that in 2010 obesity cost employers \$73.1 billion (Jeffords, n.d.).

## **Treatment of obesity**

As has been shown, obesity is related to numerous serious health problems, is associated with a higher incidence of psychiatric disorders, is a heavy economic burden, and, on a societal level, exposing individuals to discrimination and prejudice. With this knowledge comes the responsibility and urgency to research effective treatment to assist those individuals who are obese or morbidly obese.

Weight loss in obese individuals usually results in improved health, both physical and psychological. O'Brien (2010) found that after weight loss, overall health improved, including improved blood sugar, hypertension, sleep apnea, and asthma. Buchwald et al. (2004) conducted a meta-analysis of 136 studies reporting health improvements after weight loss in bariatric surgery. Their review found that diabetes improved in 86% of the sample and the condition completely disappeared in 76.8% of the bariatric surgery patients. They also found that hypertension improved in 78.5% and completely resolved in 61.7% of individuals. Improvements were also seen in sleep apnea with this condition resolving in 85.7% of individuals and improved or resolved in 83.6% of individuals. Christou et al. (2004) followed a group of obese individuals for five years; the group consisted of individuals who had undergone bariatric surgery and those that who had not. The results of their study found that the surgical group had long-term maintenance of weight loss, reduced mortality, decrease in diagnosis of new comorbid medical conditions, and decrease in the utilization of health care. The 5-year mortality rate of the bariatric surgery patients in this study was reduced by 89% after the surgery. The patients who participated in this study had a significantly reduced risk of multiple health conditions, such as cancer, cardiovascular disease, endocrine disorders, infectious



diseases, musculoskeletal disorders, and respiratory conditions. Although there was a reduction in multiple disorders and diseases in the researchers' sample, they also found an increase in gastrointestinal disorders. Some of the gastric surgery patients experienced stomal ulcers, small bowel obstructions, incisional hernias, dumping syndrome, and diarrhea. Dumping syndrome is a condition that can occur after bariatric surgery when food moves too quickly through the stomach into the first section of the small intestines (National Institute of Diabetes and Digestive and Kidney Diseases, 2013). There are many symptoms of dumping syndrome including vomiting, nausea, diarrhea, and abdominal pain and cramping, among others.

Patients themselves also have multiple reasons for undergoing treatment such as improving their current medical condition, enhancing mobility and energy, and health and longevity (Snyder, 2009). The ability to provide this to patients starts with providing effective treatment for their obesity.

There are multiple treatments available for those suffering from obesity; however, some have been shown to be more effective than others. These treatments include non-surgical treatments, such as pharmacological and behavioral, as well as surgical treatments, which include various forms of bariatric weight loss surgeries.

**Behavioral treatments.** Behavioral treatments for obesity usually include a combination of diet, exercise, and behavioral support (Bean et al., 2008). Dietary interventions for obesity include calorie restriction. These interventions, when used as the only course of treatment, can result in short-term weight loss but the long-term maintenance of weight loss is more difficult (Xiao & Yang, 2012). Low calorie diets can be defined as the individual consuming 800-1500 calories per day. A very low calorie

diet would restrict the individual's calorie intake to less than 800 calories per day. When using dietary interventions with severely obese individuals, 500-1000 calories a day is suggested. Other dietary interventions include diets low in fat or carbohydrates. Ayyad and Anderson (2000) conducted a meta-analysis examining the long-term effectiveness of diet and behavior modification on weight loss. The follow-up period in their study was greater or equal to three years and success was defined as maintaining all initial weight loss or a certain amount of initial weight loss. They found that the median success rate for diet alone was 15% and the rate for diet and behavior modification was 14%.

Douketis, Macie, Thabane, and Williamson (2005) conducted a meta-analysis examining the effectiveness of various weight loss methods and found that diet and lifestyle changes resulted in 2-5kg after two to four years. This was much lower than the 25-75 kg weight loss found two to four years in those who had surgical treatment.

**Cognitive treatments.** Cognitive approaches are often combined with behavioral approaches. Components of this treatment may include self-monitoring, problem solving, education about nutrition, stimulus control, cognitive restructuring, slowing down the rate at which a person eats, and increasing the amount of exercise the person engages in (Bean et al., 2008). Cooper et al. (2010) examined the effectiveness of a CBT treatment for obesity and found that at three-year follow-up, the majority of the participants had regained the weight initially lost. Agras and colleagues (1997) looked at the effectiveness of a CBT group treatment for binge eating in obese women and found that at one year follow-up the majority of the participants had regained the weight that was lost during treatment.

**Pharmacological treatment.** Pharmacological treatment of obesity is used in combination with behavioral approaches. Patients may view pharmacological treatment as a standalone approach to their obesity problem but research has shown that medication alone has not been effective in substantial weight loss (Bean et al., 2008). Li et al. (2005) conducted a meta-analysis examining the effectiveness of pharmacological treatments of obesity when combined with recommended dietary changes. Their study found that medications such as sibutramine, orlistat, phentermine, diethylpropion, bupropion, fluoxetine, and topiramate promoted weight loss when combined with diet but that the extra weight loss these medications contributed was modest (<5kg at 1yr). Douketis et al. (2005) conducted a meta-analysis examining various weight loss techniques and found that pharmacologic treatments resulted in 5-10kg of weight loss after one to two years.

**Surgical treatments.** There are multiple forms of bariatric weight loss surgery and individuals from all genders and races may decide to undergo surgery. These procedures include Roux-en-Y gastric bypass, biliopancreatic diversion with duodenal switch, laparoscopic gastric banding, and sleeve gastrectomy.

The first bariatric weight loss surgeries were performed approximately 50 years ago. These surgeries were called jejunoileal bypass (JIB) procedures. The procedures had the desired effect of significant weight loss but this weight loss was achieved through extreme malabsorption resulting in significant problems including chronic diarrhea and vitamin and mineral deficiencies (Mitchell, Garcia, de Zwaan, & Horbach, 2012). These deficiencies included: bile salt loss, protein calorie malnutrition, loss of vitamin B12, vitamin K, vitamin A, and magnesium. Because of the problems with diarrhea and

vitamin and mineral deficiencies, this type of surgery was discontinued as an option and many of the procedures were reversed.

The second generation of bariatric surgeries were gastroplasties. These surgeries did not have the problems with malabsorption that were seen in the JIB procedure; however, the weight loss with this procedure was not as great as would be desired.

The third generation of bariatric surgeries were introduced in 1969 by Mason and Ito (Mason & Ito, 1969). These surgeries were referred to as gastric bypass and now are usually referred to as Roux-en-Y gastric bypass. Roux-en-Y gastric bypass is the most commonly performed surgery in the United States (Mitchell et al., 2012). In the Roux-en-Y procedure, the surgeon sections off the stomach to create a small pouch and then connects the small intestines to this small pouch allowing food to bypass a large portion of the stomach and digestive tract (Cleveland Clinic, n.d.; John Hopkins, n.d.). Bypassing sections of the digestive tract allows for less calories and fat to be absorbed. The smaller size of the stomach also allows for less food to be consumed by the individual. Although this is a very popular bariatric surgery, other types of surgeries came along that were less invasive than the gastric bypass.

Laparoscopic surgeries tend to have a lower risk of infections, less pain, and require less time in the hospital after the surgery is performed (Mitchell et al., 2012). Gastric banding followed laparoscopic surgery. This type of bariatric surgery requires the surgeon to place a band around the upper portion of the stomach resulting in the creation of a small pouch. The band is then adjusted by the surgeon at follow-up visits so that optimal weight loss can be achieved by the patient. The Laparoscopic banding generally results in less weight loss than the Roux-en-Y gastric bypass procedure but it

does not have the malabsorption problems that are commonly seen in the gastric bypass procedure.

A more recent bariatric surgery procedure is the gastric sleeve. In this procedure a large portion of the stomach is removed, with a smaller portion left. Another bariatric surgery procedure is the biliopancreatic diversion with duodenal switch (BPD/DS). The BPD/DS results in greater weight loss than laparoscopic banding, sleeve gastrectomy, or the Roux-en-Y gastric bypass, reduces fat absorption by 70% or more, and eventually allows individuals to eat “normal” meals (American Society for Metabolic & Bariatric Surgery (ASMBS), n.d.). Although the procedure has benefits over other surgical procedures, it also has significant disadvantages including higher rates of complications, protein, vitamin, and mineral deficiencies, and longer hospital stays (ASMBS, n.d.). Since this procedure has the risk of significant malabsorption problems it is generally only used for the most obese patients.

There are numerous physiological effects of bariatric surgeries that result in lost weight. These include reduced appetite, inducing satiety, altering the taste of food, restricting intake, diverting nutrients, malabsorption of nutrients, increased energy expenditure, and creating an aversion effect through dumping, steatorrhea, and vomiting (O'Brien, 2010).

***Complications of bariatric surgery.*** All of these treatments have risks associated with them and when deciding on a course of treatment, the risks for each individual should be taken into account. When examining the different treatments, O'Brien (2010) rated them according to degree of risk. Starting with weight loss approaches that have the least risk, side effects, invasiveness, and costs, O'Brien (2010) ranked them as

follows: lifestyle changes, drugs and low energy diets, endoscopic approaches, gastric banding, sleeve gastrectomy, Roux en Y gastric bypass, open biliopancreatic diversion, and laparoscopic biliopancreatic diversion. Complications of these surgeries can happen during the surgery and after the surgery. Complications that can occur during bariatric surgery or shortly after include: the possibility of intestinal leaks, bowel obstructions, pulmonary embolus, infection, or persistent vomiting or nausea (Mitchell, Garcia, de Zwaan, & Horbach, 2012). Later complications can include: gallbladder disease, internal hernias, vitamin and mineral deficiencies, or dumping syndrome. Common vitamin deficiencies include: thiamine, B12, folic acid, vitamin D, calcium, iron, and protein (Jacques, 2013).

Although bariatric surgery treatments have greater risks associated with them than nonsurgical treatments, for many moderately obese and morbidly obese individuals, surgery is the most effective option available and results in greater weight loss than other obesity treatments (Buchwald et al., 2004; Colquitt, Picot, Loveman, & Clegg, 2009; Picot et al., 2009). Stunkard, Stinnet, and Smoller (1986) found that treatments, such as diets restricting calorie intake, which are effective for mild or moderate obesity are usually ineffective for those who struggle with morbid obesity. The success of bariatric surgery is usually measured by the amount of excess weight an individual loses. Reinhold (1982) developed criteria to categorize excess weight loss. According to this criteria, losing more than 75% of excess weight (EWL) is categorized as excellent, 50%-75% EWL is categorized as good, and 25%-50% is categorized as fair. Excess weight is generally defined as the amount of weight that is in excess of a person's ideal body weight (IBW) (Cleveland Clinic, 2013). Ideal body weight is typically calculated using

the Metropolitan Life Insurance height and weight tables which take into account a person's height and body frame and offers a weight range that is ideal for that person (Metropolitan Life Insurance, 1959; Metropolitan Life Insurance, 1983).

The National Institutes of Health (American Society for Clinical Nutrition, 1992) recommend surgical treatment for an individual with a BMI of  $\geq 40$  or if an individual has a BMI of  $\geq 35$  along with serious co-occurring problems. Shekelle et al. (2004) found surgical treatment to be more effective than nonsurgical treatment in individuals who are morbidly obese (BMI  $> 40$ ). With the increase of individuals who have BMIs of 35 and greater, has come the increased popularity of bariatric surgery. According to the Cleveland Clinic and Metabolic Institute (2008) other indications for bariatric surgery include: acceptable operative risk, failure of non-surgical weight loss programs, being psychologically stable and having realistic expectations, well informed and motivated patient, having a supportive family and social environment, the absence of active alcohol or substance abuse, and the absence of an uncontrolled psychotic or depressive disorder. Bariatric surgery procedures increased 804% from 1994 to 2004, with the total number of surgeries increasing from 13,386 to 121,055 (Zhao & Encinosa, 2007). Although the numbers have increased dramatically, only about 1% of morbidly obese individuals who qualify for the surgery utilize it (Elder & Wolf, 2007). Bariatric surgery has consistently shown to result in weight loss (Folope et al, 2008; Picot et al, 2009; Sovik et al, 2011).

### **Quality of life after bariatric surgery**

Naturally, researchers have been interested not only in the quality of life in obese individuals but also how quality of life changes after the individual loses weight through treatment, such as, after undergoing gastric bypass surgery. Klingemann, Pataky, Iliescu,

and Golay (2009) gave quality of life questionnaires to females before and after gastric bypass surgery. Sixty-two of the original 139 completed the questionnaire at one year post surgery. The investigators found that health related quality of life improved in all 62 of the patients who completed the questionnaire and there was highly significant improvement in energy, pain, physical mobility, and emotional reactions. There was no significant improvement in the areas of sleep and social isolation. Mathus-Vliegen and de Wit (2007) also examined health related quality of life in obese individuals before and after surgery and found similar improvements. The researchers gave 50 morbidly obese bariatric surgery patients the Health Related Quality of Life (HRQL) questionnaire (Mathias et al., 1997) before surgery and then at 1, 2.5, and 5 years post-surgery. In the first year after surgery the researchers found that the participants had improvements in general well-being, health distress, depression, perceived attractiveness, and self-worth. There were also increases in physical activity and work productiveness. After the first year the changes in general well-being leveled off but improvements in health distress, depression, physical appearance, and self-regard continued to improve.

### **Pre-surgical evaluation**

Because research has shown that there is a risk of psychiatric disorders in obese individuals presenting for bariatric surgery, a pre-surgery psychological evaluation has become a standard procedure as a way to evaluate the person's appropriateness for surgery as well as to decrease the risk of psychological problems after the surgery has been completed (Aubert et al., 2010). The psychological evaluation can also help determine if additional support or services are needed before the person undergoes the surgery, can identify problem behaviors to address before and after surgery, and can also



help with treatment planning for the entire surgery process (Peterson, Berg, & Mitchell, 2012). Recommendations made after a psychological evaluation for bariatric surgery may include pharmacological interventions, psycho-education, psychotherapy, nutritional consultation, close aftercare monitoring, and bariatric surgery support group attendance (Lemont et al., 2004). Walfish, Vance, and Fabricatore (2007) surveyed psychologists who perform pre-surgery evaluations and found that approximately 15% of individuals seeking bariatric surgery are denied surgery or their surgery is delayed. The most common reasons for the denial or delay of surgery was significant psychopathology, undertreated or untreated depression, or lack of understanding of the surgery risks or the post-surgery requirements.

These evaluations usually include structured and unstructured clinical interviews and various self-report questionnaires. These interviews and questionnaires assess reasons for seeking surgery, dietary intake, weight and diet history, physical activity, eating disorders, substance abuse, trauma history, mental health treatment, stressors and coping skills, social support, knowledge about the weight loss surgery itself and the lifestyle changes that will need to occur following surgery, psychopathology, psychosocial variables, and outcome expectations (Peterson et al., 2012; Snyder, 2009; Sogg, 2012). Categories commonly assessed in this pre-surgery evaluation through a clinical interview are: behavioral, cognitive/emotional, developmental, current life situation, motivation, and expectations. Areas assessed in the behavioral category include previous attempts at weight management, eating and dietary style (e.g., binge eating, overeating, grazing, night eating syndrome), physical activity and inactivity, substance use, and health related risk-taking behavior (e.g., impulsive behavior,

compulsive behavior, and legal history; Lemont et al., 2004). The cognitive and emotional category should assess cognitive functioning, knowledge of morbid obesity and surgical interventions, coping skills, emotional modulation, boundaries, and psychopathology (Lemont et al, 2004). Stressors and utilization of social support can be assessed when examining the patients' current life situation. When examining motivations and expectations, the examiner should be careful to question the person's private motivations and not just any medical reasons they cite (Lemont et al., 2004). Information should be gathered on the patients' psychosocial expectations, emotional and lifestyle expectations, and their expectations adjustments post-surgery (Lemont et al., 2004). Questionnaires can also be used at follow-up of bariatric surgery patients. These questionnaires may assess the same areas that explored the pre-surgery evaluation but are given additional information on how the areas have changed since surgery.

### **Pre-and post-eating behaviors**

Many times when individuals think of eating disorders or disordered eating behaviors, they tend to think of the disorders of anorexia nervosa or bulimia nervosa. Although these are serious disorders that deserve the attention of clinicians and researchers, there are other eating disorders and disordered eating behaviors that deserve attention, especially when studying individuals with obesity and those presenting for bariatric surgery. These behaviors include binge eating, night eating, and grazing.

Research has examined the prevalence of eating disorders and disordered eating behavior in obese and morbidly obese individuals both before and after bariatric surgery (Calugi, Grave, & Marchesini, 2009; Colles, Dixon, & O'Brien, 2008; Gallant, Lundgren, & Drapeau, 2012; Kinzel et al., 2006; Saunders, 1999; Saunders, Johnson, & Teschner,

1998; Tutill et al., 2006; van Hout et al., 2004). The research that has been conducted has sought to understand how disordered eating behaviors can affect weight loss and the connections between eating patterns and weight loss patterns after surgery (Crowley et al., 2011; Mitchell & Steffen, 2009; Niego et al., 2007; Pekkarinen, Koskela, Huikuri, & Mustajoki, 1994; Sallet et al., 2007; Sarwer et al., 2008). Even with the research that has been done it is difficult to predict which bariatric surgery patients will be successful in losing and maintaining weight after surgery.

**Prevalence of binge eating disorder.** van Hout et al., (2004) found that Binge Eating Disorder (BED) rates in obese individuals seeking bariatric treatment was about 30-50%. Glinski et al. (2001) only found BED in 10% of their sample; however, others were diagnosed with Eating Disorder, Not Otherwise Specified (American Psychiatric Association, 2010). Kinzel et al. (2006) found in their sample of morbidly obese bariatric surgery candidates that 38% showed some symptoms consistent with BED, 27% were chronic overeaters, and 9% showed symptoms of an atypical eating disorder. When examining psychiatric comorbidities in obese individuals seeking treatment, Tutill et al. (2006) found that up to 74% of individuals in their sample had body image dissatisfaction and distortion. When compared to other eating disorders, such as bulimia nervosa, individuals with BED tend to consume less calories in a binge episode and binge less frequently (de Zwaan, 2001). According to a review of the literature by van Hout et al. (2004) between one-third and one-half of individuals who seek treatment for obesity meet criteria for Binge Eating Disorder. de Zwaan (2001) states that BED tends to be similar across genders than other eating disorders such as bulimia nervosa, and is more common

in overweight women who are seeking treatment than those who are not seeking treatment.

**Binge eating disorder diagnostic criteria.** The DSM-5 added Binge Eating Disorder (BED) as a diagnosable condition. Criterion A of BED is an individual exhibiting recurrent binge eating episodes (American Psychiatric Association, 2013). A binge eating episode is characterized by “eating, in a discrete period of time, an amount of food that is definitely larger than what most people would eat in a similar period of time under similar circumstances” and by the individual having a sense of not having control during the binge eating episode (American Psychiatric Association, 2013, p. 350). Criterion B of the BED diagnosis states that during the binge episode the person experiences three or more of the following: (a) rapidly eating at a pace faster than normal, (b) eating until the person feels uncomfortably full, (c) eating large amounts of food without the sensation of being hungry, (d) hiding eating episodes because of embarrassment regarding the amount of food being eaten, and (e) feeling disgusted, depressed, or guilty after the binge episode (American Psychiatric Association, 2013). Criteria C, D, and E of the Binge Eating Disorder diagnosis state that the individual feels significant distress, the binge eating episodes occur at least once a week for three months, the individual does not use compensatory behaviors after the binge episode and the episode does not occur exclusively during bulimia nervosa or anorexia nervosa (American Psychiatric Association, 2013). The American Psychiatric Association (2013) also provides specifiers for the severity of the disorder and if the disorder is in remission. Triggers for binge eating have been found to be negative emotional states which include: anger, frustration, depression, anxiety, and tension (de Zwaan, 2001).

**Night eating syndrome.** Along with binge eating syndrome, Night Eating Syndrome (NES) has also been associated with obesity. This syndrome was first formulated in 1955 by Stunkard, Grace, & Wolff. Night Eating syndrome is mentioned in the DSM-5 under the diagnostic category: Other Specified Feeding or Eating Disorder (American Psychiatric Association, 2013). In the DSM-5 Night Eating Syndrome is described as presenting as recurrent episodes of night eating. This recurrent night eating is manifested as eating after awakening from sleep or by the individual consuming excessive amounts of food after their evening meal. The individual is aware of the night eating and is able to recall it. Allison et al. (2010) proposed a more detailed diagnostic criteria for Night Eating Syndrome. The proposed criterion A for this disorder is that an individual's intake of food increases significantly in the evening or nighttime and is evidenced by the consumption of 25% of food intake after the person's evening meal and/or there are at least two incidences of nocturnal eating per week. An awareness of these evening or nocturnal eating episodes is required. Also proposed by the authors, the person must have at least three of the following: lack of desire to eat in the morning or the person's breakfast meal is omitted for at least four days out of the week, a strong desire to eat during the hours between dinner and bedtime or during the night hours, sleep onset or sleep maintenance insomnia is present for at least four evenings per week, the person believes that they need to eat in order to fall asleep or to fall back asleep, and the person has a frequently depressed mood or mood worsens at night. The proposed criteria also requires that the symptoms be present for at least three months, the symptoms cause significant distress and/or impairment, and the symptoms are not better accounted for by another disorder.

*Prevalence of night eating syndrome.* Night Eating Syndrome is seen in obese individuals including those who are presenting for bariatric surgery (Gallant et al., 2012). Night Eating Syndrome is not exclusive to obese individuals; however, it is most prevalent in populations who have problems with weight (Gallant et al., 2012). Not only is this syndrome found in obese individuals research has shown that night eating leads to weight gain (Anderson, Stunkard, Sorensen, Peterson, & Heitmann, 2004; Gluck, Venti, Salbe, & Krakoff, 2008). Individuals diagnosed with NES usually were obese at an earlier age than obese individuals who do not have this diagnosis (Napolitano, Head, Babyak, & Blumenthal, 2001). The co-occurrence of NES and obesity has been given support with obesity being present in 57.1% of individuals with night eating syndrome and 28.6% of outpatient individuals with night eating also meeting criteria to be considered overweight (Calugi et al., 2009). Calugi et al. (2009) state that the prevalence among obese individuals who seek weight loss treatment in medical centers ranges from 6 to 14%. The prevalence is greater in those who are presenting for bariatric surgery with prevalence rates ranging from 8 to 42%. The rate is even higher in those resistant to weight loss treatments with the prevalence rate in that obese population ranging from 51 to 64%.

Napolitano et al. (2001) examined the psychological and behavioral characteristics of night eating syndrome in a sample of males and females seeking treatment at a university based weight loss center. They found that 43% of the population in their study meet criteria for NES. Rand, Macgregor & Stuckard (1997) found that 27% of their bariatric surgery population had night eating syndrome post-surgery compared to 1.5% in their general population sample. More recent research has shown

that obese individuals presenting for treatment in medical weight reduction programs had a night eating syndrome prevalence rate ranging from 6 to 14% (Cerv-Bjork, Anderson, & Rossner, 2001; Gluck, Geliebter, & Satov, 2001). In individuals presenting for bariatric surgery the prevalence rate increased to 8-42% (Allison et al., 2006; Hsu, Betancourt, & Sullivan, 1996). Although limited, there is research that has examined the role that night eating syndrome plays in weight loss in bariatric surgery patients. Blacke (2005) compared individuals who had undergone bariatric surgery and those who had not on variables they hypothesized could be associated with weight loss and weight regain. The results of the study showed that there was greater weight regain in bariatric surgery patients who exhibited night eating. Colles & Dixon (2006) also found night eating syndrome to be associated with obesity and to be negatively associated with weight loss efficacy.

**Disordered eating as a predictor of success.** The research examining the role of eating behaviors and eating disorders as pre-and post-operative predictors of weight loss has been inconsistent and inconclusive. When reviewing the literature on the eating behavior of obese bariatric surgery candidates, research has found that eating behaviors such as disinhibition, rigid control, hunger, and binge eating differ from normal subjects (van Hout et al., 2004). van Hout et al. (2004) also found that the severity of binge eating is positively related to the severity of obesity. Since research has found that bariatric surgery candidates have these patterns of behavior, numerous studies have examined the role that Binge Eating Disorder, Night Eating Syndrome, binge eating behaviors, and compensatory behaviors have played in predicting success after bariatric surgery (Crowley et al., 2011; Hsu, Sullivan, & Benotti, 1997; Kalarchian et al., 2002; Mitchell &

Steffen, 2009; Niego et al., 2007; Pekkarinen et al., 1994; Sallet et al., 2007; Sarwer et al., 2008; White, Kalarchian, Masheb, Marcus, & Grilo, 2010).

Mitchell and Steffen (2009) reviewed literature examining Binge Eating Disorder and binge eating as a pre-operative predictor of weight loss after bariatric surgery. They found that only 2 out of 9 studies showed BED and binge eating as predictors of weight loss. However, their review found binge eating and BED that emerged or re-emerged after bariatric surgery was predictive of losing less weight and subsequently regaining weight. They suggest that more research on this relationship and examining predictors is needed so that interventions may be implemented early. Pekkarinen et al. (1994) examined 27 bariatric surgery patients who had surgery, on average, 5.4 years before the study. The researchers found that although patients had good initial weight loss, binge eating was predictive of poor long-term weight loss.

Niego et al. (2007) also reviewed the literature on binge eating in the bariatric surgery patient population and found that individuals who have pre and post-surgery binge eating, have poorer weight loss outcomes, and that this re-emergence of binge eating tends to occur 18-24 months after surgery. They suggest that pre-surgical binge eating should be a warning indicator of a patient having poor long-term weight loss success. Sarwer et al. (2008) examined pre-operative eating behavior and post-operative dietary adherence in 200 bariatric surgery patients. These individuals were assessed pre-operatively and at 20-, 40-, 66-, and 92-weeks post-operatively. The authors found that an individual's ability to limit their food intake after surgery was predictive of weight loss. The authors suggest that a person's ability to limit food intake prior to surgery predicts this ability to do the same after surgery. When reviewing these eating behaviors,



they found that following the prescribed diet post-operatively was also predictive of weight loss. Pre-operative binge eating scores and weight loss at six months following bariatric surgery were assessed by Crowley et al. (2011) in 48 individuals seeking bariatric surgery. They found a negative correlation between binge eating scores and loss of excess weight at six months following bariatric surgery. Sallet et al. (2007) also examined the role of pre-surgery binge eating and found similar results to the research cited so far. The researchers assessed 216 obese bariatric surgery candidates for a history of binge eating disorder. The participants were divided into three groups: no binge eating (NBE), sub-threshold binge eating (SBE), and binge eating disorder (BED). These individual's weights were taken at 1-year, 2-year, and 3-years after their bariatric surgery. The researchers found that at one year post-surgery the no binge eating group showed a higher percentage of excess BMI loss than the sub-threshold binge eating group. There was no significant difference between the sub-threshold and the binge eating disorder group. At two years post-surgery, the results showed that the no binge eating group showed a higher percentage of excess BMI loss than the sub-threshold and the binge eating disorder group. Consistent with the one year follow-up, there was no difference at two years between the sub-threshold and binge eating disorder groups. White et al. (2010) examined loss of control over eating before and after surgery in 361 gastric bypass surgery patients. This variable was measured before surgery, and post-surgery at six months, twelve months, and 24-months. They found that pre-operative loss of control of eating was not a predictor of negative bariatric surgery outcomes, measured by examining weight loss at follow-up. Even though pre-operative loss of control was not a predictor of weight loss, it was associated with significantly elevated eating disorder

pathology. Post-operative loss of control when eating was a predictor of less weight loss at twelve months and at 24-months follow-up. Based on these findings, the authors suggest that post-operative loss of control when eating be addressed and monitored after surgery to increase the chances of post-surgery weight loss success.

Canetti et al. (2009) examined emotional eating as a predictor of weight loss in a surgical treatment (bariatric surgery) and a non-surgical (diet) group. They found that individuals in the surgical group who reported higher rates of emotional eating had less weight loss after surgery. Hsu et al. (1997) assessed 27 female bariatric surgery patients who had their surgery in the 36 months preceding the research. The results of this study found that pre-surgical disordered eating behavior was not necessarily predictive of weight loss immediately after surgery but was predictive of patient's regaining weight two-plus years after surgery. Pekkarinen et al. (1994) also found that although binge eating was not predictive of weight loss initially following surgery, it was predictive of poor long-term maintenance of weight loss. Similarly, Kalarchian et al. (2002) found that although binge eating was not associated with immediate weight loss, binge eating at follow-up was associated with greater weight regain at long-term follow-up.

Not all research on this issue has found evidence supporting binge eating or other disordered eating behaviors as predictive of negative bariatric surgery outcomes. Kinzel et al (2006) found that individuals in their study who did not report pre-operative disordered eating behaviors lost less weight than those who did report such behaviors. Powers, Perez, Boyd, and Rosemurgy (1999) found that pre-surgery eating disorders were not predictive of weight outcome after bariatric surgery. In another study, 139 obese individuals seeking gastric bypass surgery were assessed on binge eating and

eating disorders (White et al., 2006). Binge eating and eating disorders were then compared to weight loss after bariatric surgery. The researchers found that pre-operative binge eating was not predictive of negative bariatric surgery outcome, as defined by less weight loss. Bocchieri-Ricciardi et al. (2006) also compared 72 gastric bypass surgery patients on disordered eating pathology in binge eaters and non-binge eaters. These researchers also found that binge eating did not predict a negative outcome in bariatric surgery when examining weight loss after bariatric surgery. Gorin and Raftopoulos (2009) examined bariatric surgery patients categorized as having a history of a mood and eating disorder (MED), mood disorder (MD), eating disorder (ED), and no history of mood or eating disorder (ND) in treatment compliance and weight loss. Although they found that the MED group had poorer treatment compliance, they did not differ significantly from the other groups in weight loss in the six months following surgery. Powers et al. (1999) found that preoperatively, 52% of patients in their sample reported binge eating, 16% meet criteria for binge eating disorder, and 10% had night eating syndrome. Even though such a large percentage of their sample had disordered eating, this pre-surgery disordered eating was not associated with weight outcome after surgery. The authors suggest that, after surgery, the individuals were no longer physically able to engage in binge eating. If so, the disappearance of these disordered eating behaviors post-surgery may have influenced the finding of no relationship between pre-surgery disordered eating and weight outcome.

The ability to limit food intake is only one aspect of eating behavior that can be assessed during bariatric surgery evaluations. Other research has looked at pre-operative compensatory eating disorder behavior, these behaviors include: fasting, vomiting,

laxative use, diuretic use, diet pill abuse, and excessive exercise. Chen, Roehrig et al (2009) examined those behaviors in 199 gastric bypass surgery patients and then measured BMI at six and twelve-months. The researchers found that pre-surgery compensatory behaviors were a small, significant predictor of individuals having a lower BMI at six months but not at twelve months. The researchers conclude that pre-surgery compensatory behaviors do not contribute to long-term weight loss after bariatric surgery.

Even less research has been conducted on the role of grazing as a predictor of weight gain in bariatric surgery patients, however, it does appear to be a common behavior in obese individuals and those presenting for bariatric surgery. It also appears that individuals who report binge eating before surgery sometimes transition to eating small amounts of food over time (Zunker, Karr, Saunders, & Mitchell, 2012). Research has found that individuals who graze are more likely to engage in other forms of disordered eating behavior and that there is a strong connection between grazing and binge eating (Lane & Szabo, 2013). There have been multiple definitions of grazing suggested by researchers. Grazing has been defined as an individual eating smaller amounts of food and more than what the person thinks is good for them over an extended period of time (Colles et al., 2008).

Prior to surgery the investigators found that 26.4% of the individuals in the study reported grazing behavior (Colles et al., 2008). Saunders (1999) found that over half of pre-surgery candidates surveyed reported bingeing or grazing and commonly reported the frequency of these behaviors as two or more times a week. Saunders, Johnson, & Teschner (1998) found a similar frequency with the bariatric surgery patients they surveyed reporting grazing two or more times per week. Although the research is

limited, it has shown that grazing can be a predictor of weight regain after bariatric surgery. Colles et al. (2008) surveyed 129 bariatric surgery patients before surgery and twelve months post-surgery on various eating behaviors. When examining grazing behavior post-surgery the researchers found that grazers lost a lower percentage of excess weight loss, reported less dietary restraint, greater hunger and disinhibition, and a higher number of daily eating episodes. Saunders, Johnson, & Teschner (1998) also found that severe binge eating is associated with grazing behavior. Saunders (2004) found that individuals who were grazers before bariatric surgery saw their pattern of grazing return after surgery. Patients who reported a return of these eating behaviors noticed the behaviors beginning around six months post-surgery.

It is not unusual for individuals who meet criteria for one eating disorder to also meet criteria for another eating disorder. Allison et al (2010) state that research has found that among individuals who meet criteria for night eating syndrome, 7 to 25% also meet the criteria for BED. In individuals who have binge eating disorder, the prevalence of night eating syndrome ranges from 0 to 24%. When examining night eating in individuals with binge eating disorder, Green, Wing, and Marcus (1995) found that 15% of the BED patients in their study reported at least one episode of night eating during a period of time that averaged to be a little over one week. Colles, Dixon, and O'Brien (2007) also found associations between these disorders, finding that binge eaters were nearly seven times more likely than non-binge eaters to manifest night eating syndrome. Forty percent of the NES group reported binge eating and 37% of the binge eating group also reported NES. The researchers also found that there was a 4% co-morbidity between NES and BE (Colles et al., 2007).

Research has also examined the occurrence of eating disorders or eating problems after bariatric surgery. Conceicao et al., (2013) examined the charts of 12 post-surgery bariatric surgery patients who were later hospitalized in inpatient eating disorder units. The authors found that six of the individuals met criteria for anorexia nervosa with three meeting criteria for the binge/purge type and three meeting criteria for the restrictive type. They also found two of the individuals met criteria for bulimia nervosa and four for atypical anorexia nervosa. Kruseman, Leimgruber, Zumbach, & Golay (2009) did a follow-up of bariatric surgery patients eight years post-surgery. They found frequent disordered eating behavior with 51% of their sample describing binge eating episodes or night eating syndrome.

### **Psychiatric variables**

Although research has established that individuals presenting for bariatric surgery have a high incidence of psychiatric disorders, the research is unclear in what way or how much these disorders impact weight loss after bariatric surgery. This is mainly because research does not consistently show that bariatric surgery patients who have a preoperative psychiatric disorder have poorer surgery outcomes (Simon & Arterburn, 2009).

Kinzel et al. (2006) examined 140 patients undergoing bariatric surgery, including assessing for psychiatric disorders, and then mailed follow-up questionnaires 30 months after surgery to assess satisfaction with weight loss. The results of their study found that individuals who had one or more psychiatric disorders at the time of their surgery lost less weight than obese individuals who did not have a psychiatric diagnosis at the time of their surgery. Rutledge, Groesz, and Savu (2011) also examined psychiatric factors in a

bariatric surgery population and the relationship to weight loss. They found that individuals who had two or more psychiatric diagnoses before surgery were more likely than those without these disorders to stop losing weight after one year or to begin regaining weight after the first year.

Aubert et al. (2010) conducted a study similar to the present study. The researchers examined the charts of 92 patients who had undergone bariatric surgery. From the chart review, they gathered information from the psychological assessment and created categories based on the semi-structured interview conducted by the psychologists. These categories were: psychological disturbances (e.g., impulsive behavior, unstable psychiatric disorders, uncontrolled eating disorders), socio-relational difficulties (e.g., traumatic life events, stressful psychosocial situations, impaired social integration), and problematic attitudes toward surgery (e.g., ambivalence, unrealistic expectations, difficulties with compliance). The results of their study found that the presence of a psychological risk factor predicted less excess weight loss at 24 month follow up.

As with other factors examined when trying to establish pre and post-operative concerns, researchers have also found evidence showing that psychiatric variables do not play a role in success after surgery. Black, Goldstein, and Mason (2003) examined 44 bariatric surgery patients who had a psychiatric diagnosis and weight loss at six months following surgery. They found no association between psychiatric diagnosis and weight loss.

**Depression and anxiety.** Studies have also examined the role that specific disorders play in bariatric surgery success. Herpertz, Kielmann, Wolf, Hebebrand, & Senf (2012) performed a meta-analysis on articles exploring depression and anxiety as

predictors of success after bariatric surgery between the years of 1980-2002. Through this meta-analysis the researchers found that both depression and anxiety were positive predictors of weight loss after surgery. The authors suggest that it may not be the symptoms themselves that are predictive but rather the severity of the symptoms that are more important in predicting weight loss. Averbukh et al. (2003) found similar results when they examined the Eating Disorder Inventory (EDI) scores of bariatric surgery candidates and weight loss post-surgery. They found that Beck Depression Inventory (BDI) scores before surgery were significantly related to weight loss at one year and the individual's initial BMI before surgery. In contrast, Alger-Mayer, Rosati, Polimeni, & Malone (2008) followed 157 patients after bariatric surgery and assessed depressive symptoms based on BDI scores. They found that depressive symptoms were not predictive of weight loss after 6-years post bariatric surgery.

As stated before, obesity is related to an increase in rates of specific disorders such as depression and anxiety. Interestingly, anxiety and depression are also associated with other disorders commonly seen in obese individuals and individuals seeking bariatric surgery, specifically, eating disorders. Napolitano et al. (2001) examined rates of anxiety in individuals with night eating syndrome and binge eating disorder. They found that individuals diagnosed with only NES scored significantly lower on anxiety than patients with BED and individuals who had overlapping disorders. They suggest that a combination of night eating and bingeing is related to greater levels of state anxiety than either of the disorders on their own. They also suggest that the presence of anxiety in these individuals may be due to the fact that they have had weight struggles for long



periods of time, experience more psychological distress, and may use food as a way to cope with problems.

Calugi et al. (2009) also examined the association between night eating and psychopathology and stated, based on the findings of their research, that there is a positive association between depressed mood and night eating syndrome. Lundgren et al. (2006) also found an association between night eating syndrome and life stress and depression. Likewise, Gallant et al. (2012) found NES to be associated with depression. Gluck et al. (2001) had 76 overweight men and women in a weight loss program complete the Night Eating Questionnaire, the Zung Depression Inventory, and the Rosenberg Self-Esteem Scale and found that night eaters had higher scores on depression and lower scores on self-esteem. As with night eating syndrome, binge eating disorder has also been found to be associated with various psychiatric disorders. Grilo, White, & Masheb (2008) found that in their sample of individuals with BED 37.1% had an anxiety disorder and 54.2% had a mood disorder at some point in their lives.

### **Alcohol use/abuse**

Research has also examined the abuse of substances before and after bariatric surgery and the role that it plays in weight loss and weight loss maintenance. This literature review will look specifically at alcohol use and dependence in obese individuals before and after bariatric surgery. The literature will also examine the role that alcohol use plays in unhealthy eating behavior.

**Alcohol use and obesity.** Nelson, Lust, Story, and Ehlinger (2009) examined the correlation between alcohol use and eating patterns in a sample of 3,206 undergraduate students. The results of their study found that binge drinking was associated with

unhealthy dietary patterns and weight control behaviors, body dissatisfaction and sedentary behavior. The investigators also found that eating before and/or during drinking was associated with a nearly 25% increase in being overweight.

Research has examined the correlation between obesity and alcohol use and has found mixed results. Lourenco, Oliveira, and Lopes (2012) examined the current and lifetime rates of alcohol consumption in a sample of Portuguese adults and the correlation between this alcohol consumption and obesity. The results of the study showed that current and lifetime rates of alcohol consumption was positively related to obesity. Specifically, they found that levels of alcohol intake >30 g/day in women and >60 g/day in men was correlated with a higher likelihood of obesity. Rohrer, Rohland, Denison, and Way (2005) found results conflicting with Lourenco et al. The results of their study looking at the frequency of alcohol use and obesity in community medicine clinics found that binge drinkers, daily drinkers, and those who consumed alcohol three or more days per month were less likely to be obese. Arif and Rohrer (2005) found mixed results, indicating that certain types of drinking were associated with obesity while other drinking behaviors were not. The researchers analyzed the data from 8,236 individuals who participated in the Third National Health and Nutrition Examination Survey. They found that individuals who engaged in binge drinking had a significantly greater likelihood of being overweight or obese. Individuals who drank four or more drinks per day also had greater odds of being overweight or obese. However, individuals who reported drinking one or two drinks per day had significantly lower odds of being obese.

**Alcohol use in the bariatric surgery population.** Previous research in this area has reported on the prevalence of alcohol abuse and dependence in the bariatric surgery

population without much research examining the role that these factors play as a predictor of success in this population. Saules et al. (2010) examined the charts of 7,199 patients admitted to a substance abuse rehabilitation program in a three year period. Through the review of these charts, the researchers identified those who had a history of bariatric surgery resulting in a final sample of 54 post bariatric surgery patients and 54 controls. The researchers found that 35.8% of their bariatric surgery sample had engaged in the heavy use of drugs and/or alcohol before they had surgery; 43.4% had begun heavy use of drug and/or alcohol after surgery and 20.8% had used alcohol and/or drugs before and after bariatric surgery. When looking specifically at alcohol, 61.9% of the bariatric surgery sample reported heavy use of alcohol during their lifetime, prior to surgery. The researchers state that their findings suggest that psychologists, surgeons, and other members of the treatment team need to be vigilant in assessing for substance use and abuse both before and after bariatric surgery. Suzuki, Haimovici, and Chang (2010) also examined the incidence of alcohol use disorders in bariatric surgery patients. The researchers found that losing weight with bariatric surgery was not associated with the development of an alcohol use disorder. However, they did find that in their sample, there was a higher level of alcohol use disorders in individuals who had a lifetime history of alcohol use disorders and in those patients who were undergoing Roux-en-Y gastric bypass compared to those undergoing laparoscopic adjustable gastric banding surgery. Ertelt et al. (2008) followed-up with 70 Roux-en-Y bariatric surgery patients 6-10 years after their surgery. The researchers not only examined changes in alcohol use after surgery but also changes in the response individuals had to alcohol after surgery. Over half of their sample (54.3%) said they had some kind of change in the way they

responded to alcohol. A very small percentage of the sample (2.9%) indicated they began drinking alcohol after surgery or felt that their alcohol use had increased after surgery (2.9%). In contrast, a much larger percentage of the sample said they had stopped using after surgery (7.1%) or that their alcohol use had decreased after surgery (15.7%).

Besides just looking at the prevalence of alcohol or substance abuse in a bariatric population, Clark et al. (2003) looked at weight loss at two year follow-up in bariatric surgery patients who had treatment for substance abuse before surgery. Interestingly, the researchers found that the individuals who had received substance abuse treatment before surgery had more weight loss at two years post-surgery than those who did not have this treatment history. Similarly, Dixon, Dixon, & O'Brien (2001a) found that patients who consumed alcohol regularly had a better rate of weight loss. King et al. (2012) examined the responses of 1,945 bariatric surgery patients who completed the Alcohol Use Disorders Identification Test (AUDIT) before surgery and one year and two years after surgery. The researchers found that there were higher rates of alcohol use disorders at the second post-operative year than the first post-operative year. The researchers also found that post-operative alcohol use disorder was not related to the percentage of weight loss. Odom et al. (2010) also examined the role of alcohol use in weight loss after surgery. The researchers examined predictors of weight gain in 203 bariatric surgery patients who had Roux-en-Y surgery within the last year at the time of the study. They found that concerns over alcohol or drug use at the time of follow-up were predictive of significant weight regain.

Research has suggested possible reasons why there are changes in alcohol use or response to alcohol in bariatric surgery patients. Some of these reasons include

physiological changes in the body as a result of bariatric weight loss surgery. These physiological changes include: weight loss results in a greater concentration of alcohol in the system for each drink an individual consumes; changes in the structure of the stomach result in changes in how the enzyme alcohol dehydrogenase metabolizes alcohol, and the diminishment in bariatric surgery patients of the ability of the liver to reduce the concentration of alcohol in the body (Brady & DeMatteo, 2011)

### **The Present Study**

Years of research on predictors of bariatric surgery success have yielded conflicting findings. The majority of studies on this issue use weight loss as the only outcome variable when measuring success and often times do not follow patients longer than the one year follow-up appointment that is recommended by many surgeons. This means that success is very narrowly defined. Additionally, it is important to consider that although at one year individuals may appear to be successful in their weight loss outcome, it is possible that they are unable to maintain that weight loss after one year. This study examined predictor variables that have been researched before but yielded conflicting results. These predictor variables were: eating disordered behavior before surgery, history of depression or anxiety, and history of substance abuse. The study defined success by percentage of excess weight lost after bariatric surgery and also looked at weight regain after bariatric surgery. Excess weight is the number of pounds above the patient's ideal body weight. Ideal body weight (IBW) is typically calculated using the Metropolitan Life Insurance (1959) height and weight tables using a person's height and body frame. An ideal body weight range is then given based on this information. However, because the body frame of the participants in this study was not

known and because an exact ideal body weight was needed, an estimation of IBW was calculated using the person's height and gender (Sierra Bariatric News, 2006).

The second part of the study examined longer-term weight loss after surgery by following up with patients one year or more post-surgery. Follow up questionnaires were used in an attempt by the researcher to measure success in terms of maintenance of weight loss. The questionnaires also gave information on disordered eating behavior and depressive and anxiety symptoms. These questionnaires assessed areas that have limited study in this field of research, including post-surgery alcohol use and various disordered eating behaviors such as night eating syndrome and grazing.

## **Hypotheses**

### **Hypothesis 1**

Higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict less excess weight loss at one month, three month, six month, nine month, twelve month, and beyond twelve months.

### **Justification for hypothesis 1**

Several studies over the last 20 years have found that pre-surgery eating disordered behavior, such as binge eating or emotional eating, is associated with less weight loss post-surgery (Canetti et al., 2009; Crowley et al., 2011; Niego et al., 2007; Pekkarinen et al., 1994; Sallet et al., 2007). It was predicted that the same results would be found in the present study. It was predicted that the individuals who indicated having disordered eating in the pre-surgery psychological evaluation will have less weight loss at the one month, three month, six month, nine month, and twelve month follow-up with the

surgeon as well as reporting less weight loss in follow-up questionnaires mailed after the twelve month surgeon follow-up.

### **Hypothesis 2**

Higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict more weight regain at part two follow-up.

### **Hypothesis 3**

Higher scores on the Binge Eating Scale at follow-up would be associated with more weight regain and less initial weight loss.

### **Justification for hypothesis 2 and hypothesis 3**

Even when research has shown that binge eating is not associated with weight loss or weight regain immediately following surgery, research as shown that pre-surgical disordered eating behavior is predictive of weight regain at longer term follow-up and that emerging or re-emerging binge eating after surgery is associated with losing less weight or regaining weight after surgery (Hsu et al., 1997; Kalarchian et al., 2002; Mitchell & Steffen, 2009; Niego et al., 2007). Additionally, Meany, Conceicao, and Mitchell (2013) reviewed 15 studies that examined binge eating, binge eating disorder (BED), and loss of control (LOC) during eating in bariatric surgery patients and found that binge eating, BED, and LOC was predictive of less weight loss and/or more weight regain after surgery. Pacanowski, Senso, Griogun, Crain, & Sherwood (2014) examined a non-surgery population and found that binge eating behavior was associated with greater weight regain. It was predicted that similar results would be found in the present study. Weight loss and weight regain was gathered from post-surgeon follow-up at

three months, six months, nine months, and twelve months post-surgery as well as being assessed as part of the follow-up questionnaires in individuals who had bariatric surgery more than one year previously. Information on pre-surgical eating behavior was gathered from the pre-surgery psychological evaluation. Information on post-surgery eating behavior was gathered by scores on the Binge Eating Scale.

#### **Hypothesis 4**

Higher scores on the Night Eating Questionnaire given at follow-up would be associated with less initial weight loss and more weight regain.

#### **Justification for hypothesis 4**

Although there has not been much research done in the area of night eating syndrome in bariatric surgery patients, the research that has been conducted shows that night eating syndrome is associated with more weight regain after bariatric surgery and less weight loss efficacy (Blacke, 2005; Colles & Dixon, 2006). Information on night eating syndrome symptoms was gathered through questionnaires mailed to individuals who had received bariatric surgery within the last five years.

#### **Hypothesis 5**

Higher scores on the BDI-II and BAI in the pre-surgery psychological evaluation would predict less initial weight loss and more weight regain at part two follow-up.

#### **Hypothesis 6**

Higher scores on the BDI-II and BAI at follow-up would be associated with less initial weight loss and more weight regain at part two follow-up.



**Justification for hypothesis 5 and hypothesis 6**

Research has been inconclusive but a large amount of research has shown that psychiatric disorders have been associated with less weight loss or more weight regain after bariatric surgery (Aubert et al., 2010; Kinzel et al., 2006; Rutledge et al., 2011). Studies looking specifically at anxiety and depression have found those disorders to be related to weight loss after surgery (Averbukh, 2003; Herpertz et al., 2012). Information on anxiety and depression was gathered pre-surgery from the psychological pre-evaluation and the BDI-II and BAI. Post-surgery information on anxiety and depression was gathered from the BDI-II and BAI.

**Hypothesis 7**

Higher scores on the AUDIT after surgery would be associated with weight regain at part two follow-up.

**Justification for hypothesis 7**

Limited research has been conducted examining the role of alcohol as a predictor of success in bariatric surgery. Of the research that has been conducted, alcohol use does not seem to predict a lower percentage of weight loss (Dixon et al., 2001a; King et al., 2012). There is some evidence that alcohol use is a predictor of weight gain after surgery (Odom et al., 2010). It was predicted that this study would find similar results to Odom et al. (2010). Alcohol abuse was measured after surgery by the Alcohol Use Disorder Identification Test (AUDIT).

**Hypothesis 8a**

Greater weight loss would be associated with greater improvement in health as evaluated by the social, mental, and physical health areas of the Duke Health Profile.

**Hypothesis 8b**

Greater weight loss would be associated with greater improvements in health as evaluated by objective measures of health indicators (e.g., blood pressure, decrease in medications needed) gathered at follow-up.

**Justification for hypothesis 8a, hypothesis 8b**

Research has shown that obesity is related to multiple negative health consequences and poorer quality of life (Cameron et al., 2012; Fontaine et al., 1996; Fontaine & Barlett, 1998; O'Brien, 2010; Paeratakul et al., 2002; Rajeswaran & Woodward, 2011; Wedin et al., 2012). Research has also shown that weight loss can improve quality of life and improve health (Buchwald et al., 2004; Christou et al., 2004; Klingemann et al., 2009; Mathus-Vliegen & de Wit, 2007; O'Brien, 2010). It was predicted that this study would be consistent with previous research. Improvement in health was measured by comparing the social, mental, and physical health subscales of the Duke Health Profile before surgery to the scores after surgery as well as health indicators gathered by the nurse during the surgeon follow-ups after surgery.

**Hypothesis 9**

Higher scores on the Grazing Questionnaire would be associated with more weight regain and part two follow-up and less initial excess weight loss.

**Hypothesis 10**

Higher scores on the Grazing Questionnaire would be associated with higher scores on the BES.

**Hypothesis 11**

Higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict greater amounts of grazing behavior after surgery.

**Justification for hypothesis 9, hypothesis 10, and hypothesis 11**

Limited available research on the grazing behavior in a bariatric surgery population indicates evidence that it may be a predictor of lower percentage of excess weight loss, greater weight regain, and is associated with binge eating (Colles et al., 2008; Nicolau et al., 2015; Saunders, 1999; Saunders, Johnson, & Teschner, 1998). It was predicted that similar results would be found in the present study.

## **CHAPTER 2**

### **METHOD**

#### **Participants**

Participants for the first part of this study were 374 adult male and female bariatric surgery patients, from which archival data was obtained from pre-surgery psychological evaluations and from surgeon follow-up post-surgery. Of the 374 patients only 272 were used in the final sample. Participants were removed from the data set because of not having surgery after the initial pre-surgery evaluation ( $n = 33$ ), having surgery reversed ( $n = 3$ ), not having post-surgery follow-up data ( $n = 7$ ), not having day of surgery weight information ( $n = 1$ ), not having height information ( $n = 2$ ), and patient being deceased ( $n = 3$ ). Finally, 53 individuals could not be used in the data set because of technical difficulties preventing this investigator from obtaining post-surgery information. In the second part of the study, which involved sending out packets for the 374 bariatric surgery patients to complete, 54 packets were returned. However, only 50 of these packets were able to be used as four of the participants who returned packets did not have surgery follow-up data.

## **Instruments**

### **Eating Attitudes Test-26 (EAT-26)**

This screening instrument for symptoms of eating disorders includes 26 items that measure behaviors and attitudes related to desire to be thin, satisfaction with body, and bulimia (Garner, Olmsted, Bohr, & Garfinkel, 1982). The EAT-26 provides an overall score and contains three subscales: dieting, bulimia and food preoccupation, and oral control. This study only examined the total score on the EAT-26. A total score of 20 or higher denotes concerns regarding body weight, body shape, and eating. Individuals answer each question on the EAT-26 using a six point measure with 1 = never and 6 = always. Garner et al. (1982), when developing the EAT-26, compared the measure between females who had been diagnosed with anorexia nervosa and a control group (females) who had not been diagnosed with the disorder. The researchers found the EAT-26 to be a reliable (.90) and valid measure and that it correlates highly with the original EAT-40 ( $r = .98$ ). Garner et al. (1982) also found that 83.6% of individuals were correctly classified either as anorexic or non-anorexic using the EAT-26. The follow-up sample produced a Cronbach's alpha of .81. Cronbach's alpha was unable to be computed on the pre-surgery EAT-26 scale as this researcher only had access to the total score on the pre-surgery measure and not the individual item scores.

### **Binge Eating Scale (BES)**

The BES (Gormally, Black, Daston, & Rardin, 1982) was developed as a scale to measure binge eating in obese individuals. The BES contains 16 multiple choice items. The 16 items are divided into two symptom areas. Eight of the items examine behaviors related to binge eating and the other eight examine the thoughts and feelings that are

associated with the binge eating. For each time the participant indicates what statement best describes how they feel. A response of zero indicates the person is endorsing no binge eating problems on that item whereas a three response would indicate that they are endorsing severe binge eating problems on that item. To obtain a total score of the BES, the scores for each item are added together. Possible scores on the BES range from 0 to 46. Scores are divided into three interpretive ranges: non-binge eating is defined as a score of 17 or below, scores of 18-26 indicates moderate binge eating, and 27 and greater is indicative of severe binge eating. The follow-up sample in the present study produced a Cronbach's alpha on the binge eating scale of .89. This is similar to previous research which has found the Cronbach's alpha of the BES to be .89 and .85 (Freitas, Lopez, Appolinario, & Coutinho, 2006; Gormally et al., 1982).

#### **Night Eating Questionnaire (NEQ)**

The Night Eating Questionnaire (Allison et al., 2008) is a 14 item self-report questionnaire that assesses the behavioral and psychological symptoms of night eating syndrome and the severity of these symptoms. The NEQ is answered using a 4-point Likert scale with the exception of item seven. Items 1, 4, and 14 are reverse scored. Questions 1-9 are answered by all participants. Items 10-12 are answered by participants who wake up in the middle of the night and score greater than zero on item nine. Questions 13-14 are answered by participants who eat upon awakening and score greater than zero on item 12. All items except item 13 are summed to obtain a total score. Total scores on the NEQ range from 0 to 52 with higher scores indicate more severe night eating syndrome symptomatology. The NEQ questions assess morning hunger and timing of first food consumption; food craving and control over eating behavior before

bedtime; and during nighttime awakenings, percentage of food consumed after dinner, initial insomnia, frequency of nocturnal awakenings and ingestion of food, mood disturbance, and awareness of nocturnal eating episodes. Principle components analysis conducted by Allison et al. (2008) showed four symptom subtypes: nocturnal ingestions, evening hyperphagia, morning anorexia, and mood/sleep. Cronbach's alpha for the total scale was found to be .70. In this study, the follow-up sample produced a Cronbach's alpha of .58 for the total scale. The Cronbach's alpha for the four factors are as follows: nocturnal ingestions, .94; evening hyperphagia, .65; morning anorexia, .57; and mood/sleep, .30. This study did not examine the four individual factors of the Night Eating Questionnaire so the Cronbach's alphas for the factors were not calculated. Discriminate validity of NEQ showed the scale is able to discriminate between bariatric surgery candidates with and without NES (Allison et al., 2008).

### **The Grazing Questionnaire (GQ)**

The Grazing Questionnaire was developed by Lane and Szabo (2013) to evaluate 'grazing' behavior. The Grazing Questionnaire is made up of eight items to measure behaviors and cognitions specific to grazing. Five items assess eating behaviors and three items assess cognitions. Items are rated on a 5-point Likert-type rating scale, from never (0) to all of the time (4). The scores on each item are summed to obtain a total score which can range from 0 to 32. Higher scores indicate more grazing behaviors and cognitions. Grazing behavior has not been studied as extensively as other disordered eating behaviors and The Grazing Questionnaire is the first measure to assess grazing behavior. As such, very little research has been conducted to examine the reliability and validity of this measure. Lane and Szabo (2013) calculated a Cronbach's alpha

coefficient to estimate the internal consistency of the measure. They also calculated a Pearson correlation coefficient to estimate temporal stability. The Cronbach's alpha of .82 showed very good internal consistency. Test-retest reliability was strong ( $r = .62$  and  $r = .71$ ). The follow-up sample in this study produced a Cronbach's alpha of .85. The Grazing Questionnaire was only gathered for the follow-up sample.

### **Duke Health Profile (DUKE)**

The Duke Health Profile (Parkerson, Broadhead, & Tse, 1990) is a 17-item self-report questionnaire that measures six areas of health (physical, mental, social, general, perceived health, and self-esteem) and four areas of possible dysfunction (anxiety, depression, pain, and disability). Each of the 10 areas of the Duke are scored separately. For physical health, mental health, social health, general health, self-esteem, and perceived health, 100 indicates the best health status, and 0 indicates the worst health status. For anxiety, depression, anxiety-depression, pain, and disability, 100 indicates the worst health status and 0 indicates the best health status. The reliability of the Duke Health Profile has found to have a Cronbach's alpha that ranges from .55 to .78. The test-retest reliability of the Duke ranges from .30 to .78, it exceeded .50 for all the measures except disability and pain. The authors suggest that the test-retest reliability is so variable because health is not stable over time. This study looked at three of the areas of the Duke Health Profile: physical, mental, and social health. Individual item scores were only gathered from the follow-up sample. For the three health areas examined, the follow-up sample produced the following Cronbach's alphas: physical (.72), mental (.85), and social (.76).



## **Beck Depression Inventory-II (BDI-II)**

The BDI-II (Beck, Steer, & Brown, 1996) is a 21 item self-report instrument that is used to measure depression in adolescents and adults. The items are based on diagnostic criteria in the DSM-IV. The BDI-II can be administered to adolescents as young as 13 and takes approximately 5-10 minutes to complete. Each item on the BDI-II is answered and scored on a 4-point scale ranging from 0 to 3. For each time, participants are asked to choose which statement best reflects how they have felt in the past two weeks. A total score is summed from the score of all items. The total score on the BDI-II can range from 0-63 with higher scores indicating more severe depression. Care should be taken when scoring the items assessing changes in sleep and appetite as each of those items contains seven options to differentiate if there has been an increase or decrease in the behavior. Scores of 0-13 are considered to be in the minimal range, 14-19 mild, 20-28 moderate, and 29-63 severe. Beck et al. (1996) state that the internal consistency of the BDI-II was found to have a Cronbach's alpha of .92 for outpatients and .93 for students. The test-retest reliability correlation has been found to be  $r = .93$ . Studies have also found good convergent and discriminate validity (Beck et al., 1996). This sample produced a Cronbach's alpha of .92. There has been some concern over the use of the BDI-II with the bariatric surgery population because they may report somatic complaints unrelated to depression (Munoz et al., 2007). However, Krukowski, Friedman, & Applegate (2008) found that the BDI-II was a reasonable instrument for differentiating depression in individual's seeking bariatric weight loss surgery from those only experiencing somatic complaints resulting from obesity related physical health problems.

**Beck Anxiety Inventory (BAI)**

The BAI (Beck & Steer, 1990) is a measure of anxiety for adolescents and adults. The BAI contains 21 items that are rated on a scale from 0 to 3. The measure requires approximately 5-10 minutes to administer. Each item describes subjective, somatic, or panic-related symptoms of anxiety. When completing the BAI, individuals are asked to assess how much they have been bothered by each of the symptoms in the past week. Each item has four possible answer choices. These choices are: not at all = 0, mildly = 1, moderately = 2, severely = 3. The values for each item are summed together to get a total score for the scale which can range from 0 to 63. A score on the BAI from 0-7 is considered a minimal level of anxiety; 8-15 is considered mild; 16-25 is considered moderate; 26-63 is considered severe. Internal consistency for adults ranges from .92 to .94. Test re-test reliability is  $r = .75$ . The Beck has been compared to other anxiety measures and found to have .51 convergent validity with the Hamilton Anxiety Rating Scale and .47 with the trait scales of the State Trait Anxiety Inventory. (Beck & Steer, 1990). This sample produced a Cronbach's alpha of .85.

**The Alcohol Use Disorders Identification Test (AUDIT)**

The Alcohol Use Disorders Identification Test was developed by the World Health Organization to screen for excessive drinking and assists in identifying alcohol dependence and specific negative consequences the person may have experienced because of alcohol use (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001; Saunders & Aasland, 1987; Saunders, Aasland, Babor, dela Fuente, & Grant, 1993). The AUDIT consists of 10 questions that assess recent alcohol use, alcohol dependence symptoms, and alcohol-related problems. Three of the AUDIT questions are on the amount and

frequency of drinking, three questions on alcohol dependence, and four questions on the problems caused by alcohol. A score of 8 or more on the AUDIT is associated with harmful or hazardous drinking. A score of 13 or more in women, and 15 or more in men is likely to indicate dependence. Internal consistency ranges from .81 to .93. This sample produced a Cronbach's alpha of .57. Test-retest reliability ranges from  $r = .81$  to  $r = .98$ .

### **Demographic questionnaire**

A demographic questionnaire was included in the packet sent to participants in Part 2 of the present study. This demographic questionnaire included basic information on individuals including: age, gender, ethnicity, education level, and marital status. In order to calculate the BMI and excess weight loss since surgery, participants were also asked to provide their current weight and height. BMI was calculated using an online calculator provided by the National Institutes of Health (n.d.). Participants were also asked about health concerns including if they were currently being treated for high blood pressure, diabetes, high cholesterol, or sleep apnea. Last, participants were asked if they were satisfied with the results of their weight loss surgery and were offered space to provide an explanation if they indicated that they were not satisfied with the surgery. See appendix A for information on the demographic questionnaire.

### **Procedures**

This study consisted of two components. First, the medical charts of 374 bariatric surgery patients drawn from a bariatric center of excellence surgery clinic in the southern U.S. were reviewed. These charts included the pre-surgery psychological evaluation and

the follow-up weight information of each patient. These individuals were later contacted via U.S. postal mail to consent to participate in a follow-up study.

The analysis took the form of a regression model. The predictor variables examined were disordered eating (including binge eating, night eating syndrome, bulimia, etc), psychiatric history (anxiety and depression), physical health and alcohol use. The criterion variable were weight loss at one month, three months, six months, nine months and twelve months following surgery. The relationship between these predictor variables and weight loss maintenance and gain after twelve months were also be examined. This information was gathered from those individuals who mailed back the follow-up questionnaires.

In the first part of this study, 374 bariatric surgery patient charts were reviewed. This chart review included the pre-surgery psychological evaluation and the post-surgery follow-up weight at one month, three months, six months, nine months and twelve months after surgery. Information gathered from the psychological evaluation were scores from the Duke Health Profile, the Beck Depression Inventory, the Beck Anxiety Inventory, and the Eating Attitudes Test-26. The patient records chosen for review were individuals evaluated at least one year prior to the present study. This increased the likelihood that their surgical follow-up records contained a full twelve months of follow-up information. The follow-up weight information was gathered from the medical records of a surgeon at the bariatric clinic who performed the surgery and the follow-up appointments. As this information is considered archival, informed consent was not needed from the patients in this part of the study. However, institutional review board approval was obtained before examining the archival records. Consent was given by the

surgeon and psychologist who have ownership of the medical records. To ensure confidentiality in this part of the study, third party individuals were recruited to remove identifying information and code each chart before the investigator examined the information. The individuals were employees from the office of the psychologist who conducted the psychological evaluations and an individual who was an employee from the office of the surgeon who performed the bariatric surgeries. These third parties were the only people who were able to match the patients' names with their code.

In the second part of the study, the individuals whose charts were reviewed were mailed an informed consent and a packet of questionnaires to complete and mail back to the investigator. There were two informed consent documents, one was kept by the participant and the other was mailed back when the packet was returned. The informed consent that was mailed back was removed by the surgeon's office before the packet was given to the primary investigator. This was done to ensure confidentiality. Participants were identified only by a code that was assigned in the first part of the study when charts were being reviewed. The informed consent was the first page of the packet to ensure that the participant saw it and had the opportunity to read it before consenting. Formal scales used consisted of the Binge Eating Scale (BES), the Duke Health Profile, the Beck Depression Inventory, the Beck Anxiety Inventory, the Night Eating Syndrome Questionnaire, the Grazing Questionnaire and the Alcohol Use Disorder Identification Test. Additional questions asked demographic information. Institutional Review Board approval was obtained before conducting the second part of the study.

Participants were also informed that if they choose to participate in the research project, they would be entered to win a \$25 gift card to an area store. This was included

as an incentive for the participants to complete the packet of questionnaires. Participants were given an addressed, stamped envelope to return the questionnaires. Completion of the packet of questionnaires took approximately 40 minutes. This time was determined by the primary investigator completing all of the questionnaires and timing the completion time. Reminder letters were sent to participants. The response period was open for one year. Based on the age at psychological evaluation and age provided at Part 2 follow-up, the average number of years since surgery was 2.3.

### **Hypotheses and data analysis**

First, the frequency and percentages of the demographic variables were calculated. Next, means, standard deviations, and ranges for all study variables were calculated.

Hypothesis 1 stated that higher scores on the EAT-26 would predict less excess weight loss at one month, three month, six month, nine month, twelve months and beyond twelve months. A linear regression analysis was conducted for weights at one month, three month, six month, nine month, twelve months, and beyond twelve months. The predictor variable was scores on the EAT-26 and the criterion variable was percent excess weight loss.

To test Hypothesis 2, which stated that higher scores on the EAT-26 would be associated with more weight regain at follow-up, a Pearson Correlation was conducted. To test Hypothesis 3, which stated that higher scores on the Binge Eating Scale at follow-up would be associated with more weight regain at follow-up and less initial weight loss, a Pearson Correlation was conducted. To test Hypothesis 4, which stated that higher scores on the Night Eating Questionnaire given at follow-up would be associated with

less initial weight loss and more weight regain at follow-up, the Pearson Correlation was conducted.

To test Hypothesis 5, which stated that higher scores on the BDI-II and BAI in the pre-surgery psychological evaluation would predict less initial weight loss and more weight regain at follow-up, a multiple regression analysis was conducted. The predictor variables were scores on BDI-II and BAI. The criterion variables was weight regain and initial weight loss. To test Hypothesis 6, which stated that higher scores on the BDI-II and the BAI at follow-up would predict less initial weight loss and more weight regain at follow-up, the multiple regression analysis was repeated. The predictor variables was scores on the BDI-II and the BAI. The criterion variables was weight regain and initial weight loss.

To test Hypothesis 7, which stated that higher scores on the AUDIT would associated with weight regain at follow-up, the Pearson Correlation was conducted. To test Hypothesis 8a, which stated that greater weight loss would associated with greater improvement in health as evaluated by the Duke Health Profile, the Pearson Correlation was conducted. Hypothesis 8b, stated that greater weight loss would be associated with greater improvements in health as evaluated by objective measures of health indicators gathered at surgeon follow-up. This hypothesis was not tested, as adequate data was not gathered on the objective measures. To test Hypothesis 9, which stated that higher scores on the Grazing Questionnaire would be associated with less initial excess weight loss and more weight regain at follow-up, the Pearson correlation was conducted. To test Hypothesis 10, which stated that higher scores on the Grazing Question would be associated with higher scores on the BES, the Pearson correlation was conducted. To test

Hypothesis 11, which stated that higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict greater amounts of grazing after surgery, the linear regression analysis was conducted. The predictor variable was disordered eating. The criterion variable was grazing behavior.



## CHAPTER 3

### RESULTS

The purpose of this chapter is to present the results of an examination of the relationship between disordered eating, depression, anxiety, alcohol use, and health on success after bariatric surgery. Sample characteristics are presented first, followed by descriptive statistics of the variables. Finally, the results of the research are presented by hypotheses.

#### Participants

The majority of the total sample ( $N = 272$ ) were Non-Hispanic white (96%), followed by African American (4%). Of the 272 participants, 209 (76.8%) were female and 63 (23.2%) were male. The mean age of participants was 45 with ages ranging from 18-75. The most frequent surgery performed was sleeve gastrectomy ( $n = 200$ , 73.5%), followed by laparoscopic gastric banding ( $n = 30$ , 11%), and gastric bypass surgery ( $n = 17$ , 6.3%).

#### Total sample

When examining height and weight of the 272 participants, the mean height of patients was 66 inches. The mean height of males was 70.83 inches and females was 64.46 inches. The mean weight day of surgery for the total sample was 276.9 lbs. The

mean weight day of surgery for males was 330.75 lbs. and for females was 260.78 lbs. The mean body mass index (BMI) was 44.4. The mean BMI for males was 45.99 and for females was 43.96. The mean excess weight the patients needed to lose to reach their ideal body weight was 143.1 lbs. When broken up by gender, males' mean excess weight was 160.94 lbs. and females' was 137.78 lbs. The majority of the patients fell in the morbidly obese weight category ( $n = 186$ , 68.4%) followed by the obese category ( $n = 86$ , 31.6%).

### **Follow-up sample**

The majority of the follow-up sample ( $n = 50$ ) were also Non-Hispanic White ( $n = 47$ , 94%), followed by African American ( $n = 3$ , 6%). Of the 50 participants, 10 (20%) were male and 40 (80%) were female. The mean age of participants in the follow-up portion of the study was 54 with ages ranging from 33-74. The majority of the follow-up participants were married ( $n = 35$ , 70%), followed by divorced ( $n = 7$ , 14%), widowed ( $n = 4$ , 8%), separated ( $n = 3$ , 6%) and unknown ( $n = 1$ , 2%). When looking at education level, the majority of the participants were high school graduates or had the equivalent of a high school diploma ( $n = 13$ , 26%), followed by trade/technical/vocational training ( $n = 10$ , 20%), Bachelor's degree ( $n = 9$ , 18%), Master's degree ( $n = 7$ , 14%), Associate's degree ( $n = 4$ , 8%), Some college credit, no degree ( $n = 4$ , 8%), and some high school, no diploma ( $n = 3$ , 6%). The most frequently performed surgery was sleeve gastrectomy ( $n = 30$ , 63.8%), followed by gastric bypass surgery ( $n = 6$ , 12.8%), and laparoscopic gastric banding ( $n = 3$ , 6.4%). At follow-up the majority of the sample did not report any medical conditions ( $n = 26$ , 52%). The following medical conditions and combination of medical conditions were reported by participants in the follow-up condition: high blood

pressure ( $n = 11$ , 22%), sleep apnea ( $n = 3$ , 6%), diabetes, high blood pressure, high cholesterol, and sleep apnea ( $n = 3$ , 6%), diabetes ( $n = 1$ , 2%), high cholesterol ( $n = 1$ , 2%), diabetes and high blood pressure ( $n = 1$ , 2%), high blood pressure and high cholesterol ( $n = 1$ , 2%), high blood pressure and sleep apnea ( $n = 1$ , 2%), high cholesterol ( $n = 1$ , 2%), and diabetes, high cholesterol, and sleep apnea ( $n = 1$ , 2%).

The average height of the follow-up sample ( $n = 50$ ) was 66 inches. The average height of males was 69.45 inches and females was 64.88 inches. The average weight at day of surgery for the follow-up sample was 270.86, with males having a mean weight of 314.20 and females 260.03. The average BMI day of surgery of 43.6. When examined by gender, the average BMI for males was 44.72 and females was 43.36. The average excess weight day of surgery was 139.08. For males the average excess weight was 151.80 and females was 135.90. The mean BMI at follow-up was 30.14. The mean BMI at follow-up for males was 30 and for females was 30.18. The majority of the sample at follow-up fell into the overweight range according to BMI ( $n = 23$ , 46%), followed by obese ( $n = 14$ , 28%), normal range ( $n = 9$ , 18%), and morbid obesity ( $n = 4$ , 8%). The average amount of excess weight lost by those participants in the follow-up sample was 61.63%, with males losing 69.53% of excess weight and females 59.65%. Seventy-six percent of the sample lost at least 50% of their excess weight. Eight-eight percent ( $n = 44$ ) of the follow-up sample reported being satisfied with the results of the bariatric surgery with 12% ( $n = 6$ ) having reported that they were not satisfied.

Levene's test of homogeneity showed that the follow-up sample did not differ significantly from the sample that did not complete the follow-up packets on gender ( $F(1,270) = 1.50$ ,  $p = .22$ ) or ethnicity ( $F(1,270) = 2.34$ ,  $p = .13$ ). Levene's test of

homogeneity did show that the samples differed significantly on type of surgery ( $F(1,270) = 14.40, p < .001$ ). Levene's test was not performed on marital status or education as this information was only obtained from the follow-up sample. Independent sample t-tests were conducted to compare weight day of surgery, BMI day of surgery, excess weight day of surgery, age at psychological evaluation, and height in the follow-up sample and those who did not complete the follow-up packets. There was not a significant difference in the scores for weight day of surgery,  $t(270) = .819, p = .410$ , BMI day of surgery,  $t(270) = .801, p = .997$ , excess weight day of surgery  $t(270) = .661, p = .827$ , age at time of psychological evaluation  $t(270) = -4.42, p = .124$ , or height,  $t(270) = .349, p = .112$ .

Table 1 shows the mean, median, standard deviation, and range of participant weight information for the entire sample. Sample size varies, as each participant did not have weight information for each month post-surgery.

Table 1

*Participant Weight Information*

	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
Ideal Weight	272	133.39	125.00	23.98	95-205
Excess Weight	272	143.15	134.00	48.08	64-350
*EWL 1-month	247	17.29	15.90	7.37	3.0-49.4
EWL 3-month	196	30.16	29.30	11.84	0-82.4
EWL 6-month	134	43.90	43.05	16.43	9.4-87.3
EWL 9-month	68	50.15	51.15	19.27	8.4-92.5
EWL 12-month	94	55.54	54.83	20.33	0-97.7
EWL follow-up	50	61.63	61.30	22.17	0-100
EWL regained	22	4.26	3.30	3.96	.01-16.00
*BMI pre-surgery	272	44.48	43.50	7.76	31.9-77.5
BMI 1-month	247	40.56	39.30	7.23	27.8-71.0
BMI 3-month	197	38.14	36.70	7.28	25.7-63.7
BMI 6-month	133	34.83	33.60	7.04	23.2-53.2
BMI 9-month	68	33.89	33.20	6.65	21.4-48.4
BMI 12-month	94	31.49	30.70	6.29	21.3-47.4
BMI follow-up	50	30.14	28.75	6.18	20.2-46.5

\**EWL = Excess Weight Loss; BMI = Body Mass Index*

**Descriptive statistics for measures**

**Pre-surgery measures.** Descriptive statistics for the pre-surgery measures of the Beck Depression Inventory-II (BDI-II), Beck Anxiety Inventory (BAI), Duke Health Profile (Duke), and the Eating Attitudes Test-26 (EAT-26); and post-surgery measures of the Beck Depression Inventory-II, Beck Anxiety Inventory, Duke Health Profile, Eating Attitudes Test-26, Alcohol Identification Test (AUDIT), Grazing Questionnaire (GQ),

Night Eating Questionnaire (NEQ), and Binge Eating Scale (BES) were obtained and compared to normative samples. It is important to note that not all 272 participants completed all of the pre-surgery measures. When reporting descriptive statistics the number of participants who completed each measure is reported. Also, there were some follow-up participants who did not complete all scales in the follow-up packet and, this information is provided when reporting descriptive statistics.

When looking at the pre-surgery measures obtained at psychological evaluation, the mean score on the BDI ( $n = 123$ ) was 10.50 (Mdn = 9; SD = 7.15; Range = 0-54). In the pre-surgery participants, the majority of scores indicated participants falling into the minimal range ( $n = 88$ , 71.5%), followed by mild depression ( $n = 25$ , 20.3%), moderate depression ( $n = 8$ , 2.9%), and severe depression ( $n = 2$ , 0.7%). The pre-surgery BAI mean ( $n = 114$ ) was 6.75 (Mdn = 6.75; SD = 7.79; Range = 0-49). The majority of participants in the pre-surgery sample obtained scores on the BAI indicating minimal anxiety ( $n = 81$ , 71.1%), followed by mild anxiety ( $n = 19$ , 16.7%), moderate anxiety ( $n = 11$ , 9.6%), and severe anxiety ( $n = 3$ , 2.65%). Pre-surgery scores on the EAT-26 ( $n = 119$ ) produce a mean of 7.26 (Mdn = 5; SD = 6.55; Range = 0-28). On the EAT-26, a score of 20 or higher indicates concerns regarding body weight, body shape, and eating. On the pre-surgery EAT-26, 6.7% ( $n = 8$ ) scored 20 or higher, while 93.3% ( $n = 111$ ) scored 19 or lower. On the Duke Health Profile the pre-surgery mean on the physical health subscale ( $n = 261$ ) was 35.44 (Mdn = 30; SD = 21.35; Range = 0-100). The mean on the mental health subscale ( $n = 261$ ) was 68.77 (Mdn = 70; SD = 20.59; Range = 0-100) and the mean on the social subscale ( $n = 261$ ) was 72.87 (Mdn = 70; SD = 19.98; Range = 20-80).

**Post-surgery measures.** The post-surgery sample completed the BDI-II, BAI, EAT-26, Duke Health Profile, AUDIT, Grazing Questionnaire, BES, and NES. On the BDI-II ( $n = 49$ ), the follow-up sample obtained a mean score of 6.41 (Mdn = 4; SD = 8.18; Range = 0-37). Of the 49 follow-up participants who completed the BDI-II, 42 (85.7%) fell in the minimal depression range, 4 (2%) fell in the mild depression range, 1 (2%) fell in the moderate depression range, and 2 (4.1%) fell in the severe depression range. The mean for the BAI ( $n = 50$ ) for the follow-up sample was 5.82 (Mdn = 4.50; SD = 5.61; Range = 0-21). Thirty-five (70%) of the follow-up sample fell in the minimal range for anxiety based on their scores, 12 (24%) fell in the mild anxiety range, and three (6%) fell in the severe anxiety range. The follow-up EAT-26 ( $n = 50$ ) resulted in a mean of 14.32 (Mdn = 12; SD = 9.97; Range = 0-39). Thirteen (26%) of the follow-up participants scored above 20 on the EAT-26 while 37 (74%) scored 19 or below. All 50 of the follow-up sample completed the Duke Health Profile. On the Duke Physical scale, the mean score was 58 (Mdn = 60; SD = 26.12; Range = 10-90). The mean score on the Duke Mental Health Scale was 73.60 (Mdn = 80; SD = 26.01; Range = 0-100) and the mean score on the Duke Social Health Scale was 76.80 (Mdn = 80; SD = 24.53; Range = 10-100). The Grazing Questionnaire ranges from 0-32 with higher scores indicating more grazing behaviors and cognitions. The follow-up sample ( $n = 50$ ) received a mean score on the Grazing Questionnaire of 10.94 (Mdn = 10; SD = 5.76; Range = 1-27). The Binge Eating Scale ranges from 0-46 with scores of 27 and above indicating severe binge eating. The mean score on the Binge Eating Scale for the following up sample ( $n = 48$ ) was 7.88 (Mdn = 6; SD = 7.87; Range = 0-32). The majority of the sample fell in the non-binge eating range ( $n = 43$ ; 89.6%), followed by moderate binge eating ( $n = 3$ ; 6.3%)

and severe binge eating ( $n = 2$ ; 4.2%). The Night Eating Questionnaire scores range from 0-52 with higher scores indicating more severe night eating syndrome symptomatology. The entire follow-up sample ( $n = 50$ ) completed the NEQ. The mean score on the NEQ was 13.64 (Mdn = 12.50; SD = 6.85; Range = 1-33). The last measure completed by the follow-up sample was the Alcohol Use Disorders Identification Test (AUDIT). The mean score of the AUDIT was .86 (Mdn = .00; SD = 1.34; Range = 0-7). On the AUDIT, scores of eight or higher are associated with harmful or hazardous drinking. Of the follow-up sample, the majority fell below a score of eight indicating that there are no concerning alcohol use behaviors ( $n = 46$ ; 93.9%). Three (6.1%) fell in the harmful or hazardous drinking range. Table 2 summarizes the means, standard deviations, ranges, and reliabilities for the independent variables discussed above.



Table 2

*Means, Standard Deviations, Range, and Reliabilities For Independent Variables in Total Sample*

Variables	M	Mdn	SD	Range	$\alpha$
<b>EAT-26</b>					
Pre-surgery	7.26	5	6.58	0-28	-
Post-Surgery	14.32	12	9.97	0-39	.81
<b>Grazing Questionnaire</b>					
Post-surgery	10.54	10	5.76	1-27	.85
<b>NEQ</b>					
Post-surgery	13.64	12.50	6.85	1-33	.58
<b>BES</b>					
Post-surgery	7.88	6	7.87	0-32	.89
<b>BDI-II</b>					
Pre-surgery	10.50	9	7.15	0-54	-
Post-surgery	6.41	4	8.18	0-37	.92
<b>BAI</b>					
Pre-surgery	6.75	6.75	7.79	0-49	-
Post-surgery	5.82	4.50	5.61	0-21	.85
<b>AUDIT</b>					
Post-surgery	.86	.00	1.34	0-7	.57
<b>Duke Health Profile</b>					
Physical Pre-surgery	35.44	30	21.35	0-100	-
Physical Post-surgery	58	60	26.12	10-90	.72
Mental Pre-surgery	68.77	70	20.59	0-100	-
Mental Post-surgery	73.60	80	26.01	0-100	.85
Social Pre-surgery	72.87		19.98	20-80	-
Social Post-surgery	76.80	80	24.53	10-100	.76

*Note: EAT-26 = Eating Attitudes Test 26; NEQ = Night Eating Questionnaire; BES = Binge Eating Scale; BDI-II = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory. AUDIT = Alcohol Use Disorder Identification Test. Dash denotes single scale score; no reliability calculated.*

## Data Analysis

### Hypothesis 1

Hypothesis 1 stated that scores on the EAT-26 in the pre-surgery psychological evaluation will predict less excess weight loss at one month, three month, six month, nine month, and twelve month post-surgery, and beyond twelve months. A linear regression was performed to examine this hypothesis. As not all participants had completed the EAT-26 in the pre-surgery psychological evaluation, not all participants had gone to all post-surgery appointments, and not all participants responded to the request for additional follow-up data from the primary investigator, sample size in each analysis was affected. Because of the multiple dependent variables, this hypothesis was broken into multiple analyses. One variable, scores on the EAT-26 pre-surgery was transformed using a square root transformation and all significant outliers associated with this hypothesis were removed. All assumptions for linear regression were met for each part of the hypothesis except for the assumption of a linear relationship when examining excess weight loss at one month post-surgery and at nine months post-surgery. Because of this violation in these two aspects of the hypothesis, the ability to assess the unique effects of these variables is reduced. The linear regression analysis to test if scores on the EAT-26 significantly predicted EWL at one month post-surgery indicated the predictor explained .4% of the variance  $F(1,100) = .36, p = .54, R^2 = .004, R^2_{\text{adjusted}} = -.006$ . It was found that the EAT-26 did not significantly predict EWL at one month post-surgery ( $\beta = -.06, t(100) = -.61, p = .54$ ). The regression analysis examining the EAT-26 scores ability to predict EWL at three months post-surgery found that the predictor explained 2% of the variance ( $F(1,80) = 1.63, p = .21, R^2 = .02, R^2_{\text{adjusted}} = .008$ ). The EAT-26 scores did not

significantly predict EWL at three months post-surgery ( $\beta = -.14$ ,  $t(80) = -1.28$ ,  $p = .21$ ).

The analysis examining the EAT-26 ability to predict EWL at six months post-surgery found that the predictor explained 3% of the variance  $F(1,59) = 1.63$ ,  $p = .21$ ,  $R^2 = .03$ ,  $R^2_{\text{adjusted}} = .01$ . The EAT-26 did not significantly predict EWL at six months post-surgery ( $\beta = -.16$ ,  $t(59) = -1.28$ ,  $p = .21$ ). The EAT-26 explained 9.2% of the variance when explaining the predictors ability to predict EWL at nine months post-surgery  $F(1,29) = 2.93$ ,  $p = .09$ ,  $R^2 = .09$ ,  $R^2_{\text{adjusted}} = .06$ . The predictor did not significantly predict EWL at nine months post-surgery ( $\beta = -.30$ ,  $t(29) = -1.71$ ,  $p = .10$ ). This trend continued when examining the predictor variables ability to predict EWL at twelve months post-surgery. EAT-26 explained 2.3% of the variance  $F(1,38) = .88$ ,  $p = .35$ ,  $R^2 = .02$ ,  $R^2_{\text{adjusted}} = -.003$ . The EAT-26 did not significantly predict EWL at twelve months post-surgery ( $\beta = -.15$ ,  $t(38) = -.94$ ,  $p = .35$ ). The ability of the EAT-26 to predict EWL at follow-up was examined. The predictor explained 3.4% of the variance  $F(1,19) = .66$ ,  $p = .43$ ,  $R^2 = .03$ ,  $R^2_{\text{adjusted}} = -.02$ . It did not significantly predict EWL at follow-up ( $\beta = -.18$ ,  $t(19) = -.81$ ,  $p = .43$ ). The results did not support hypothesis 1. See Table 3 for a summary of results for Hypothesis 1.

Table 3

*Results of The Regression Analysis For Hypothesis 1*

Variable	B	SE B	$\beta$
1-month	-.33	.54	-.06
3-month	-1.33	1.04	-.14
6-month	-2.30	1.80	-.16
9-month	-5.10	3.00	-.30
12-month	-2.33	2.50	-.15
*EWL follow-up	-2.77	3.41	-.18
*EW regained	-1.71	1.38	-.42

*EWL = Excess Weight Loss; EW = Excess Weight*

**Hypothesis 2**

Hypothesis two stated that higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict more weight regain at part two follow-up of the study. The results of this hypothesis will not be reported because the sample size was not adequate ( $n = 8$ ).

**Hypothesis 3**

Hypothesis three stated that scores on the Binge Eating Scale (BES) at follow-up would be associated with EWL and that higher scores would be associated with lower EWL and more weight regain. It was expected that there would be a relationship between BES scores and weight loss and weight regain. The predictor variable was scores on the BES and the dependent variables were percent of excess weight loss at one month, three months, six months, nine months, and twelve months after surgery and percent of excess weight loss regained reported at follow-up. See Table 4 for the mean, median, standard deviation, and range BES scores for each month post-surgery.

Table 4

*Mean, Median, Standard Deviation, & Range Scores For BES*

Variable	N	M	Mdn	SD	Range
*BES 1-month post-surgery	40	6.10	5.50	5.10	0-18
BES 3-month post-surgery	39	5.79	5.00	5.20	0-18
BES 6-month post-surgery	26	5.81	5.50	4.88	0-17
BES 9-month post-surgery	15	5.13	4.00	5.03	0-18
BES 12-month post-surgery	12	6.43	6.00	5.88	0-18
BES Part 2 follow-up	40	5.60	5.00	4.78	0-17
% *EWL regained	10	7.00	4.50	6.41	0-17

\*BES = *Binge Eating Scale*; EWL = *Excess Weight Loss*

Because of the multiple dependent variables, this hypothesis was broken into seven different analysis. These hypotheses will be referred to as: hypothesis 3, 3a, 3b, 3c, 3d, 3e and 3f. Fifty individuals were in the total follow-up sample, however, not each individual fully completed the BES and not each individual reported weight regain at follow-up. Additionally, of the 50 individuals, each person did not go to each of their post-surgery follow-up appointments. This affected the sample size in each part of this hypothesis as shown in Table 3. Two variables were transformed using a square root transformation. These variables were excess weight loss at three months and excess weight loss at six months. After the square root transformation, each variable used in this analysis had a normal distribution as indicated by the Kolmogorov-Smirnov test for normality. Significant outliers associated with these hypotheses were removed from the data set. Additionally, regression plots of the variables indicated that the assumption of homogeneity of various was not violated. The scatterplots associated with these hypotheses showed a linear relationship between variables. Pearson's correlation

coefficient was used on each analysis to examine the relationship between variables.

When examining hypothesis 3, the relationship between BES and percentage of excess weight loss at one month, the Pearson correlation coefficient did not show a significant relationship ( $n = 40$ ,  $r = -.02$ ,  $p = .46$ ). Hypothesis 3a, the relationship between BES and percentage of excess weight loss at three months showed a significant relationship between the variables ( $n = 39$ ,  $r = -.32$ ,  $p < .05$ ). There was also a significant relationship when looking at hypothesis 3b, scores on the BES and the percentage of excess weight loss at six months ( $n = 26$ ,  $r = -.43$ ,  $p < .05$ ). There was not a significant relationship found in hypothesis 3c, examining the relationship between BES and the percentage of excess weight loss at nine months ( $n = 15$ ,  $r = -.22$ ,  $p = .22$ ). There was a significant relationship in hypothesis 3d examining between scores on the scores on the BES and the percentage of excess weight loss at twelve months post-surgery,  $n = 23$ ,  $r = -.52$ ,  $p < .01$ . There was a significant relationship in hypothesis 3e examining between scores on the BES and percentage of excess weight loss at Part 2 follow-up,  $n = 40$ ,  $r = -.53$ ,  $p < .001$ . When examining hypothesis 3f, the association between scores on the BES and excess weight regain at follow-up, the results of the Pearson correlation coefficient indicated that there is not significant relationship between these two variables,  $n = 10$ ,  $r = -.47$ ,  $p = .08$ . Table 5 summarizes the results of the correlation analysis.

Table 5

*Results of Correlation Analysis Between BES, Excess Weight Loss, & Weight Regain*

Variable	N	r	p
1-month	40	-.02	.46
3-month	39	-.32	<.05
6-month	26	-.43	<.05
9-month	15	-.22	.22
12-month	23	-.52	<.01
*EW loss	40	-.53	<.001
EW regained	10	-.47	.08

\*EW = excess weight

**Hypothesis 4**

Hypothesis 4 stated that scores on the Night Eating Questionnaire (NEQ) would be associated with initial weight loss after surgery and weight regain at follow-up. The independent variable was scores on the NEQ. The dependent variables were excess weight loss at one month, three months, six months, nine months, twelve months after surgery, excess weight loss reported at Part 2 follow-up and the percentage of excess weight regained at follow-up. Because of the multiple dependent variables, this hypothesis was broken up into multiple analyses. These hypotheses will be referred to as hypothesis 4, 4a, 4b, 4c, 4d, 4e, and 4f. Fifty individuals were in the total follow-up sample, however, not each individual reported weight regain at follow-up. Additionally, of the 50 individuals, each person did not go to each of their post-surgery follow-up appointments. This affected the sample size in each part of this hypothesis as shown in Table 6. Three variables were transformed using a square root transformation. This

variables were: scores on the Night Eating Questionnaire, excess weight loss at three months and excess weight loss at six months. After the square root transformation, each variable used in this analysis had a normal distribution as indicated by the Kolmogorov-Smirnov test for normality except the Night Eating Questionnaire when looking at the relationship between the NEQ and excess weight loss at Part 2 follow-up. A Spearman rho correlation coefficient was used to examine this relationship. Significant outliers associated with the hypotheses were removed from the data set. Additionally, regression plots of the variables indicated that the assumption of homogeneity of variances was not violated. The majority of scatterplots associated with these hypotheses showed a linear relationship; however, hypothesis 4- examining the relationship between the NEQ and excess weight loss at one month and hypothesis 4a- examining the relationship between the NEQ and excess weight loss at three months did not. A Spearman's rho analysis was conducted on these hypotheses. Pearson's correlation coefficient was used on the other analyses to examine the relationship between variables. When examining hypothesis 4, the relationship between NEQ and percentage of excess weight loss at one month, the Spearman rho correlation coefficient did not show a significant relationship ( $n = 41, r = .02, p = .45$ ). Hypothesis 4a, the relationship between NEQ and percentage of excess weight loss at three months also did not show a significant relationship between the variables ( $n = 38, r = .10, p = .29$ ). Additionally, Hypothesis 4b, which examined the relationship between NEQ and percentage of excess weight loss at six months did not show a significant relationship ( $n = 23, r = -.22, p = .15$ ). Hypothesis 4c and 4d did show a significant relationship between variables. Hypothesis 4c examined the relationship between the NEQ and excess weight loss at nine months which the Pearson correlation



coefficient found to be significant ( $n = 14, r = .50, p < .05$ ). Hypothesis 4d, the relationship between the NEQ and excess weight loss at twelve months also showed a significant relationship ( $n = 22, r = -.41, p < .05$ ). The Spearman rho analysis on hypothesis 4e, the relationship between NEQ and excess weight loss at Part 2 follow-up, did not show a significant relationship ( $n = 39, r = -.16, p = .17$ ). Lastly, hypothesis 4f, which examined the relationship between the NEQ and excess weight loss that was regained at follow-up did not show a significant relationship ( $n = 11, r = -.27, p = .22$ ). Table 6 summarizes the statistical analysis for this hypothesis.

Table 6

*Results of Correlation Analysis between NEQ, Excess Weight Loss, & Weight Regain*

Variable	N	R	p
1-month	41	.02	.45
3-month	38	.10	.29
6-month	23	-.22	.15
9-month	14	.50	< .05
12-month	22	-.41	< .05
Follow-up	39	-.16	.17
*EW regained	11	-.27	.22

\*EW = Excess Weight

### Hypothesis 5

Hypothesis 5 stated that higher scores on the BDI-II and BAI in the pre-surgery psychological evaluation would predict less initial weight loss and more weight regain at

part two follow-up. The predictor variables were scores on the BDI-II and the BAI. Criterion variables were percentage of excess weight loss at one month, three month, six month, nine month and twelve months post-surgery, as well as the percentage of excess weight loss reported at Part 2 follow-up and the percentage of excess loss weight that was regained at Part 2 follow-up. Because of multiple criterion variables, multiple analyses were performed. Sample size varied in each part of the hypothesis as each individual did not completed the BDI-II and BAI in the pre-surgery evaluation and each individual did not attend each of the follow-up appointments, and, lastly, not all participants responded to request for follow-up data from the primary investigator. See Table 7 and Table 8 for information on sample size and scores obtained on the BAI and BDI-II post-surgery.

Table 7

*Pre-surgery BAI Scores Associated With Each Month Follow-up After Surgery*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*BAI at 1-month	104	6.24	4.50	6.24	0-27
BAI at 3-months	85	6.13	4.00	6.37	0-27
BAI at 6-months	58	7.64	6.00	7.28	0-27
BAI at 9-months	35	5.26	4.00	5.11	0-18
BAI at 12-months	39	4.38	3.00	5.42	0-27
BAI at Part 2 follow-up	21	5.48	4.00	6.74	0-27
BAI *EW regained	9	6.78	5.00	7.92	1-27

\*BAI = Beck Anxiety Inventory; EW = Excess Weight

Table 8

*Pre-surgery BDI-II Scores Associated With Each Month Follow-up After Surgery*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*BDI-II at 1-month	104	9.95	9.50	5.61	0-24
BDI-II at 3-months	85	9.93	10.00	5.62	1-24
BDI-II at 6-months	58	11.28	10.00	5.72	1-24
BDI-II at 9-months	35	9.69	10.00	4.99	1-23
BDI-II at 12-months	39	9.77	9.00	5.94	0-23
BDI-II at follow-up	21	8.76	8.00	4.91	1-20
BDI-II *EW regained	9	9.00	7.00	6.19	1-23

\*BDI-II = Beck Depression Inventory-II; EW = Excess Weight

All assumptions of multiple regression were met for each part of the hypothesis; however, scatterplots showed weak linear relationships so results should be interpreted with a caution. A standard regression analysis was used to determine whether the two predictor variables (BDI-II and BAI) significantly contributed to each criterion variable. When examining the BDI-II and BAI ability to predict percentage of EWL at one month post-surgery, the predictor variables did not explain a significant amount of the variance  $F(2,101) = .30, p = .75, R^2 = .006, R^2_{\text{adjusted}} = -.02$ . The regression analysis examining the ability of the BDI-II and BAI to predict EWL at three months post-surgery, did not explain a significant amount of the variance  $F(2,82) = .13, p = .88, R^2 = .003, R^2_{\text{adjusted}} = -.02$ . The BDI-II and BAI also did not explain a significant amount of the variance when examining the criterion variable EWL at six months post-surgery  $F(2,55) = .97, p = .38, R^2 = .03, R^2_{\text{adjusted}} = -.001$ . In line with the trend seen so far in this hypothesis, the BDI-II

and BAI did not explain a significant amount of the variance when examining the criterion variable EWL at nine months post-surgery  $F(2,32) = .25, p = .78, R^2 = .02, R^2_{\text{adjusted}} = -.05$ . When examining the EWL at twelve months post-surgery variable, the BDI-II and BAI did not explain a significant amount of the variance  $F(2,36) = .60, p = .56, R^2 = .03, R^2_{\text{adjusted}} = -.02$ . The last two criterion variables, percentage of EWL at follow-up and percentage of EWL regained at follow-up, were gathered from participants who completed the packets sent by the primary investigator. When examining the BDI-II and BAI ability to predict EWL at follow-up, the predictor variables did not predict a significant amount of the variance  $F(2,18) = 1.51, p = .25, R^2 = .14, R^2_{\text{adjusted}} = .05$ . The last criterion variable was percentage of EWL regained at follow-up. The predictor variables, BDI-II and BAI did not predict a significant amount of the variance  $F(2,6) = .36, p = .71, R^2 = .11, R^2_{\text{adjusted}} = -.19$ . The results did not support hypothesis 5. See Table 9 for a summary of results for Hypothesis 5.

Table 9

*Results of The Regression Analysis For Hypothesis 5*

Variable	BDI			BAI		
	B	SE B	$\beta$	B	SE B	$\beta$
1-month	-.04	.12	-.04	.08	.11	.09
3-month	-.02	.23	-.01	.10	.20	.06
6-month	-.32	.40	-.12	.44	.32	.20
9-month	-.43	.72	-.11	-.09	.70	-.03
12-month	-.27	.51	-.09	.58	.55	.18
*EWL follow-up	1.22	.82	.36	.08	.60	.03
*EW regained	-.21	.30	-.28	-.08	.23	-.13

EWL = Excess Weight Loss; EW = Excess Weight

## Hypothesis 6

Hypothesis 6 stated that scores on the BDI-II and the BAI post-surgery follow-up would predict less weight loss and weight regain at Part 2 follow-up. The predictor variables were scores on the BDI-II and the BAI. Criterion variables were percentage of EWL at one month, three months, six months, nine months, and twelve months post-surgery, as well as percentage of EWL reported at part two follow-up and the percentage of EWL that was regained at part two follow-up. Because of the multiple criterion variables, multiple analyses were performed. Sample size varied in each analyses as each individual did not complete the BDI-II and BAI in the pre-surgery evaluation and each individual did not attend each of the post-surgery follow-up appointments. Lastly, sample size varied because not all participants responded to request for follow-up data from the primary investigator. See Tables 10 and 11 for information on sample size and BAI and BDI-II scores obtained post-surgery.

Table 10

### *Post-surgery BAI Scores Associated With Each Month Follow-up After Surgery*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*BAI at 1-month	35	4.60	4.00	4.39	0-15
BAI at 3-months	34	4.26	3.50	4.14	0-15
BAI at 6-months	22	4.09	2.00	5.00	0-15
BAI at 9-months	13	4.54	4.00	3.57	0-12
BAI at 12-months	21	5.62	4.00	4.98	0-15
BAI at Part 2 follow-up	37	4.49	4.00	4.29	0-15
BAI EW* regained	8	3.75	3.00	4.71	0-14

*\*BAI = Beck Anxiety Inventory; EW = Excess Weight*

Table 11

*Post-surgery BDI-II Scores Associated With Each Month Follow-up After Surgery*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*BDI-II at 1-month	35	5.11	4.00	5.32	0-18
BDI-II at 3-months	34	4.50	3.50	5.10	0-18
BDI-II at 6-months	22	4.09	2.00	5.05	0-17
BDI-II at 9-months	13	5.23	4.00	5.85	0-18
BDI-II at 12-months	21	6.14	4.00	6.04	0-18
BDI-II at follow-up	37	4.89	4.00	5.26	0-18
BDI-II EW regained	8	4.25	2.00	5.89	0-17

\*BDI-II = Beck Depression Inventory-II; EW = Excess Weight

When checking the assumptions for multiple regression, dependent and independent variables were continuous. Results of the Durbin-Watson statistic showed that all the hypotheses showed independence of variance except the analysis examining the BDI-II and BAI's ability to predict excess weight regained which had a Durbin Watson statistic of 3.06. Tolerance and VIF values showed no multicollinearity. Significant outliers were removed. After a square root transformation of the BDI-II and BAI, the data showed homoscedasticity and scatterplots showed linear relationships. A standard regression analysis was used to determine whether the two predictor variables (BDI-II and BAI) significantly contributed to each criterion variable. When examining the BDI-II and BAI ability to predict percentage of EWL at one month post-surgery, the predictor variables did not explain a significant amount of the variance  $F(2,32) = 2.7$ ,  $p = .08$ ,  $R^2 = .14$ ,  $R^2_{\text{adjusted}} = .09$ . When examining the BDI-II and BAI ability to predict

percentage of EWL at three month post-surgery the predictor variables did not predict a significant amount of the variance  $F(2,31) = 1.60, p = .22, R^2 = .09, R^2_{\text{adjusted}} = .31$ . When examining the percentage of EWL at six month post-surgery, the BDI-II and BAI did not predict a significant amount of the variance  $F(2,19) = 2.60, p = .10, R^2 = .21, R^2_{\text{adjusted}} = .14$ . The BDI-II and BAI did not predict a significant amount of the variance when looking at percentage of EWL at nine months post-surgery  $F(2,10) = .29, p = .75, R^2 = .06, R^2_{\text{adjusted}} = -.13$ . The combination of the BDI-II and the BAI explained a significant amount of variance in EWL at twelve months post-surgery  $F(2,18) = 5.40, p = .02, R^2 = .37, R^2_{\text{adjusted}} = .31$ . The analysis revealed that only the BAI significantly predicted EWL at twelve months post-surgery ( $\beta = -.50, t(18) = -2.31, p = .03$ ) whereas the BDI-II was not a significant predictor ( $\beta = -.18, t(18) = -.85, p = .41$ ). The combination of the BDI-II and BAI also explained a significant amount of the variance in EWL at follow-up,  $F(2,34) = 3.80, p = .03, R^2 = .18, R^2_{\text{adjusted}} = .13$ . The analysis revealed that only the BAI significantly predicted EWL at follow-up ( $\beta = -.45, t(34) = -2.56, p = .02$ ) whereas the BDI-II was not a significant predictor ( $\beta = .37, t(34) = .37, p = .71$ ). The predictors variables did not predict a significant amount of variance when examining the last criterion variable, percentage of EWL regained at Part 2 follow-up  $F(2,5) = 1.92, p = .24, R^2 = .43, R^2_{\text{adjusted}} = .21$ . The partially supported hypothesis 6. See Table 12 for a summary of the standard regression analysis for hypothesis 6.

Table 12

*Results of The Regression Analysis For Hypothesis 6*

Variable	BDI-II			BAI		
	B	SE B	$\beta$	B	SE B	$\beta$
1-month	-.04	.12	-.04	.08	.11	.09
3-month	-.02	.23	-.01	.10	.20	.06
6-month	-.32	.40	-.12	.44	.32	.20
9-month	-.43	.72	-.11	-.09	.70	-.03
12-month	-.27	.51	-.09	.58	.55	.18
*EWL follow-up	1.22	.83	.36	.08	.60	.03
*EW regained	-.21	.30	-.28	-.08	.23	-.13

*\*EWL = Excess Weight Loss; EW = Excess Weight*



### **Hypothesis 7**

Hypothesis 7 stated that scores on the Alcohol Use Disorder Identification Test (AUDIT) would be associated with weight regain at part two follow-up. The results of this hypothesis will not be reported because of inadequate sample size ( $n = 9$ ).

### **Hypothesis 8**

Hypothesis 8 originally was broken into two hypotheses. Hypothesis 8a stated that greater weight loss would be associated with greater improvement in health as evaluated by the social, mental, and physical health areas of the Duke Health Profile. Hypothesis 8b stated that greater weight loss would be associated with greater improvements in health as evaluated by objective measures of health indicators such as blood pressure, and decrease in medications. However, after data was gathered, there was not enough complete information, as determined by the primary investigator, to test Hypothesis 8b. Therefore, only Hypothesis 8a was analyzed. To determine if greater weight loss was associated with these improvements, participants were divided into two groups. One group was those who had lost greater than 50% of excess weight loss. The other group was those who had lost less than 50% percent of excess weight loss. For each group, excess weight loss at twelve months post-surgery and excess weight loss at follow-up was examined. Correlation analysis was used for each of these groups so see if percentage of excess weight loss was associated with scores on the Duke Health Profile reported at follow-up at twelve months post-surgery and at Part 2 follow-up. Sample size varies across analyses as each individual did not attend each follow-up appointment with the surgeon after surgery and each individual in the total data set did not respond to requested follow-up data from the primary investigator. See Table 13 and Table 14 for

information on sample size and scores obtained on the subscales of the Duke Health Profile.

Table 13

*Scores on Duke Health Profile Subscales 12-Months Post-surgery For Individuals Who Lost Greater Than 50% EWL and Those Who Lost Less Than 50%*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*EWL $\geq$ 50% *DHP Physical	17	65.29	70.00	19.72	20-90
EWL $\geq$ 50% DHP Mental	17	77.06	80.00	23.39	20-100
EWL $\geq$ 50% DHP Social	17	79.41	80.00	21.35	40-100
EWL $\leq$ 50% DHP Physical	10	31.00	25.00	23.78	10-80
EWL $\leq$ 50% DHP Mental	10	57.00	55.00	19.46	30-80
EWL $\leq$ 50% DHP Social	10	62.00	60.00	30.11	20-100

*\*DHP = Duke Health Profile; EWL = Excess Weight Loss*

Table 14

*Scores on Duke Health Profile Subscales at Part 2 Follow-up For Individuals Who Lost Greater Than 50% EWL and Those Who Lost Less Than 50%*

Variable	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>	<i>Range</i>
*EWL $\geq$ 50% *DHP Physical	38	63.68	70.00	24.54	10-100
EWL $\geq$ 50% DHP Mental	38	77.63	85.00	26.14	0-100
EWL $\geq$ 50% DHP Social	38	79.21	85.00	24.43	10-100
EWL $\leq$ 50% DHP Physical	12	40.00	45.00	23.35	10-80
EWL $\leq$ 50% DHP Mental	12	60.83	60.00	21.93	30-100
EWL $\leq$ 50% DHP Social	12	69.17	70.00	24.29	30-100

*\*EWL = Excess Weight Loss; DHP = Duke Health Profile*

When examining the data of those individuals who lost 50 percent or more of excess weight loss at twelve months post-surgery ( $n = 17$ ) and the association with their scores on the Duke Health Profile subscales of Mental Health, Physical Health, and Social Health, the assumption of normality was not met for Social Health scales was not met. This was evidenced by the Kolmogorov-Smirnov test for normality ( $D(17) = .244$ ,  $p = .008$ ). A Spearman's rho analysis was used to test this part of the hypothesis. There was also not a linear relationship when examining EWL of 50% or more at twelve months post-surgery and the Duke Mental Health scale. Because this assumption was not met, a Spearman's rho analysis was conducted and the results should be interpreted with caution. All other assumptions for correlational analysis were met. The Pearson correlation coefficient between EWL of 50% or more at twelve months post-surgery and the Duke Physical Health subscale did not show a significant relationship ( $n = 17$ ,  $r = .110$ ,  $p = .337$ ). The Spearman rho analysis did not show a significant relationship between the EWL of 50% or more at twelve months post-surgery and the Duke Mental Health subscale ( $n = 17$ ,  $r = .150$ ,  $p = .283$ ) or the Duke Social subscale ( $n = 17$ ,  $r = -.010$ ,  $p = .485$ ).

When examining the data for those individuals who lost 50 percent or less of excess weight loss at twelve months post-surgery ( $n = 10$ ) and the association with the scores on the Duke Health Profile subscales of Mental Health, Physical Health, and Social Health, all assumptions for correlation were met. A Pearson correlation coefficient was used to conduct the analyses for this part of hypothesis 8. The Pearson correlation coefficient between EWL of 50% or less at twelve months post-surgery and the Duke Physical Subscale did not show a significant relationship ( $n = 10$ ,  $r = .101$ ,  $p =$

.390). The relationship between EWL of 50% or less at twelve months post-surgery and the Duke Social subscale also did not show a significant relationship ( $n = 10$ ,  $r = .486$ ,  $p = .077$ ). The Pearson correlation coefficient between EWL of 50% or less at twelve months post-surgery and Duke Mental Health Subscale showed a significant relationship ( $n = 10$ ,  $r = .667$ ,  $p < .05$ ). To examine if greater weight loss was associated with greater scores on the Duke Health Profiles of Mental, Physical, and Social, the primary investigator also looked at the relationship between these scores and percentage of EWL at part two follow-up ( $n = 38$ ).

EWL at part two follow-up was broken into more than 50% of EWL and less than 50% of EWL. When examining the data for those individuals who reported 50% or more of EWL at Part 2 follow-up ( $n = 38$ ), the Kolmogorov-Smirnov test of normality showed that the Duke Mental subscale ( $D(38) = .247$ ,  $p < .001$ ) and the Duke Social subscale ( $D(38) = .250$ ,  $p < .001$ ) showed that this assumption was violated. Because of this violation, a Spearman rho correlation coefficient was used in the analysis of this part of hypothesis 8. All other assumptions for correlation were met. The Spearman rho between EWL of 50% or more at Part 2 follow-up and the Duke Physical Health subscale showed a significant relationship ( $n = 38$ ,  $r = .351$ ,  $p < .05$ ). The Spearman rho did not show a significant relationship between EWL of 50% or more at Part 2 follow-up and the Duke Social subscale ( $n = 38$ ,  $r = -.021$ ,  $p = .449$ ) or the Duke Mental Subscale ( $n = 38$ ,  $r = .058$ ,  $p = .364$ ).

When examining the data for those individuals who reported 50 percent or less of EWL at Part 2 follow-up ( $n = 12$ ), all assumptions for correlation were met. The Pearson correlation coefficient examining EWL of 50% or less at Part 2 follow-up and the Duke

Physical Health subscale showed a significant relationship ( $n = 12, r = .516, p < .05$ ).

There was also a significant relationship between EWL of 50% or less at Part 2 follow-up and the Duke Mental Health subscale ( $n = 12, r = .552, p < .05$ ). The Pearson correlation coefficient did not show a significant relationship between EWL of 50% or less at Part 2 follow-up and the Duke Social Health subscale ( $n = 12, r = .476, p = .059$ ).

### **Hypothesis 9**

Hypothesis 9 stated that scores on the Grazing Questionnaire (GQ) would be associated with EWL and that higher scores would be associated with lower EWL or higher weight regain. The independent variable was scores on the GQ. The dependent variables were excess weight loss at one month, three month, six months, nine months, twelve months after surgery, excess weight loss at Part 2 follow-up and the percentage of excess weight loss regained at follow-up. Because of the multiple dependent variables, this hypothesis was broken up into multiple analyses. These hypotheses will be referred to as 9, 9a, 9b, 9c, 9d, 9e and 9f. Fifty individuals were in the total follow-up sample, however, not each individual reported weight regain at follow-up. Additionally, of the 50 individuals, each person did not go to each of their post-surgery follow-up appointments. This affected the sample size in each part of this hypothesis as shown in Table 15 and Table 16. See Table 15 for information on the post-surgery GQ scores for each month follow-up after surgery.

Table 15

*Post-surgery GQ Scores Associated With Each Month Follow-up After Surgery*

Variable	N	M	Mdn	SD	Range
*GQ 1-month	45	11.24	11.00	5.85	1-27
GQ 3-month	42	10.69	10.50	5.60	1-22
GQ 6-month	29	11.14	11.00	5.67	20-27
GQ 9-month	15	9.53	9.00	5.10	2-20
GQ 12-month	25	11.32	12.00	6.32	2-27
GQ follow-up	47	10.96	10.00	5.90	1-27
GQ *EW regained	11	12.45	12.00	7.17	3-27

\*GQ = Grazing Questionnaire; EW = Excess Weight

One variable, excess weight loss at three months, was transformed using a square root transformation. After the square root transformation, each variable used in this analysis had a normal distribution as indicated by the Kolmogorov-Smirnov test for normality. Significant outliers associated with the hypotheses were removed from the data set. Additionally, regression plots of the variables indicated that the assumption of homogeneity of variance was not violated. The majority of scatterplots associated with these hypotheses showed a linear relationship. However, hypothesis 9, examining the relationship between GQ and excess weight loss at one month and hypothesis 9a examining the relationship between GQ and excess weight loss at three months did not. A Spearman's rho analysis was conducted on these hypotheses. Pearson's correlation coefficient was used on the other analyses to examine the relationship between variables. When examining hypothesis 9, the relationship between GQ and percentage of excess

weight loss at one month, the Spearman rho correlation coefficient did not show a significant relationship ( $n = 45, r = .01, p = .48$ ). Hypothesis 9a, the relationship between GQ and excess weight loss at three months, also did not show a significant relationship ( $n = 42, r = -.01, p = .47$ ). This trend continued when examining the other hypotheses. The analysis of 9b, the relationship between GQ and excess weight loss at six months, did not find a significant relationship ( $n = 29, r = -.12, p = .27$ ). An analysis of hypothesis 9c, examining the GQ and excess weight loss at nine months also did not find significance ( $n = 15, r = .24, p = .19$ ). An analysis of the relationship between the GQ and excess weight at twelve months (hypothesis 9d) did not show a significant relationship ( $n = 25, r = -.12, p = .28$ ). Hypothesis 9e, examining the relationship between the relationship between the GQ and excess weight loss at Part 2 follow-up showed a significant relationship ( $n = 47, r = -.30, p < .05$ ). Lastly, hypothesis 9f, examining the relationship between the GQ and excess weight loss regained did not show a significant relationship ( $n = 11, r = -.15, p = .33$ ). The results did not support hypothesis 9. Table 16 summaries the results of the correlational analyses for hypothesis 9.

Table 16

*Results of The Correlation Analysis Between Grazing Behavior, EWL, and Weight Regain.*

Variable	<i>N</i>	<i>r</i>	<i>p</i>
1-month	45	.01	.48
3-month	42	-.01	.47
6-month	29	-.12	.27
9-month	15	.24	.19
12-month	25	-.12	.28
*EWL follow-up	47	.30	<.05
*EW regained	11	-.15	.33

EWL = Excess Weight loss; EW = Excess Weight

### **Hypothesis 10**

Hypothesis 10 stated that higher scores on the Grazing Questionnaire (GQ) would be associated with higher scores on the Binge Eating Scale (BES). The independent variable was scores on the GQ and the dependent variable was scores on the BES. Fifty individuals were in the follow-up sample; however, because not all participants completed the GQ and BES and because of significant outliers being removed, the sample size of this hypothesis was 44. See Table 17 for information on GQ and BES scores obtained in this sample.



Table 17

*Scores on The BES & GQ in Part 2 Follow-up Sample*

Variable	<i>N</i>	M	Mdn	SD	Range
*GQ	44	10.5	10	5.01	1-22
*BES	44	6.07	5.50	5.19	0-18

\*GQ = Grazing Behavior Question; BES = Binge Eating Scale

The variables used in this analysis had a normal distribution as indicated by the Kolmogorov-Smirnov test for normality. Significant outliers associated with the hypothesis were removed from the data set and scatterplots showed a linear relationship between variables. The results of the Pearson correlation coefficient showed a significant positive correlation between scores on the GQ and scores on the BES ( $n = 44$ ,  $r = .700$ ,  $p < .001$ ). These results supported hypothesis 10.

### **Hypothesis 11**

Hypothesis 11 stated that scores on the EAT-26 in the pre-surgery psychological evaluation would predict greater amounts of grazing behavior on after surgery, as indicated by higher scores on the Grazing Questionnaire (GQ). The sample size for this hypothesis was 21. The size of the sample was diminished because not all individuals completed the EAT-26 in the pre-surgery psychological evaluation. See Table 18 for mean EAT-26 and GQ scores obtained in this sample.

Table 18

*Mean Scores on The EAT-26 and GQ*

Variable	<i>N</i>	M	Mdn	SD	Range
*EAT-26	21	4.43	4.00	3.14	0-11
*GQ	21	10.52	9.00	5.45	3-22

\*EAT-26 = Eating Attitudes Test-26; GQ = Grazing Questionnaire

Significant outliers associated with this hypothesis were also removed, which also impacted the final sample size for this hypothesis. All assumptions for linear regression were met. The linear regression analysis to test if the EAT-26 significantly predicted scores on the GQ indicated the predictor explained 2.1% of the variance ( $R^2 = .02$ ,  $F(1,19) = .41$ ,  $p = .530$ ,  $R^2 = .21$ ,  $R^2_{\text{adjusted}} = -.03$ ). The EAT-26 scores did not significantly predict scores on the GQ ( $\beta = -.15$ ,  $t(19) = -.64$ ,  $p = .53$ ). The results did not support hypothesis 11.

## **CHAPTER 4**

### **DISCUSSION**

#### **General Overview of Results**

The focus of this study was to examine variables that may be associated with or predict excess weight loss and weight regain after bariatric surgery. Although not a primary purpose of this study, this study also gathered information on variables that have been rarely studied in the bariatric surgery population. The predictor variables examined measures of disordered eating behaviors, alcohol use, depression, anxiety, and reported health in the areas of social, mental, and physical health. The criterion variable was percentage of excess weight loss at various points post-surgery and percentage of excess weight regained post-surgery. Bariatric surgery, in this sample, resulted in weight loss, but participants varied in the amount of weight loss. At twelve months post-surgery, 40.4% lost less than 50% of EW. The majority of the sample, 59.6%, lost more than 50% of EW. A smaller amount, 17%, lost 75% or more of EW. At follow-up, there was also significant weight loss in the sample with 76% of the sample having lost 50% or more of EW, 24% losing 50% or more of EW, and 24% losing more than 75% of EW. A large percentage (44%) of the follow-up sample reported weight regain; however, the amount of weight regain; however, even with weight regain, the majority of the follow-up sample (>99%) still reported loss of EW. Disordered eating, based on the measures used, was

not at a pathological level in the sample at pre-surgery or at follow-up. Anxiety and depression, based on the BAI and BDI-II, did not indicate significant depressive or anxiety symptomatology in the sample. Additionally, reported alcohol use at follow-up indicated no difficulties with substance abuse or dependence, in the samples as a whole. Although there were some significant findings, there was a lack of significance found for the majority of the hypotheses. The potential explanations for the general lack of significance in the present study are elaborated on below.

### **Hypothesis 1**

Hypothesis 1 stated that higher scores on the EAT-26 in the pre-surgery psychological evaluation would predict less excess weight loss post-surgery. There was low reported disordered eating behavior measured by the EAT-26 in the pre-surgery and post-surgery portions of the study. Because of the low scores on the EAT-26, it was not a predictor of any kind of change in weight. The low reported disordered eating and the resulting inability to predict change is inconsistent with previous research that has shown disordered eating behavior is associated with less weight loss after bariatric surgery (Canetti et al., 2009; Crowley et al., 2011; Niego et al., 2007; Pekkarinen et al., 1994; Sallet et al., 2007). One possible explanation for the low reported disordered eating behavior and nonsignificant findings is the measure used in the present study to assess eating disordered behavior, the EAT-26. The previous cited research noted, that disordered eating behavior influences weight loss after bariatric surgery, was measuring binge eating behavior, which is not the primary disordered eating behavior measured by the EAT-26. The EAT-26 was originally designed to assess the symptoms of anorexia nervosa (Garner & Garfinkel, 1979). Garner and Garfinkel (1979), when assessing the

usefulness of the EAT-26 in the screening of symptoms of anorexia nervosa, found that obese individuals scored lower on the EAT-26 than individuals who were diagnosed with anorexia nervosa. Another possible explanation is the sample sizes used in each part of the hypothesis. Although the analysis of EAT-26 and EWL at one month post-surgery was over 100, this sample size went down with each month post-surgery and when examining the EAT-26 and percentage of EWL regained at follow-up, the sample size was only nine participants. Previous research that has found higher rates of disordered eating based on the EAT-26 in bariatric surgery populations had larger sample sizes (Lasagni, 2012; Osei-Assibey, Kyrou, Kumar, Saravanan, & Matyka, 2010). The last possible explanation for this finding, is the low scores on the EAT-26 in the sample used for this study. The mean for participants in this analysis was well below the score of 20 that the EAT-26 suggests is indicative of concerning disordered eating behavior. It is possible that this sample did not have disordered eating behavior, as measured by the EAT-26. It is also possible that there was under-reporting in the pre-surgery psychological evaluation over concern of having the recommendation that surgery be delayed.

### **Hypothesis 3**

Hypothesis 3 examined the relationship between the follow-up scores on the Binge Eating Scale (BES) and excess weight regain at follow-up and initial weight loss at twelve months. There was not a significant relationship between the BES and weight regain. This is inconsistent with research which has shown disordered eating behavior to be associated with weight regain after surgery (Hsu et al., 1997; Kalarchian et al., 2002; Meany et al., 2013; Mitchell & Steffen, 2009; Niego et al., 2007). It is also inconsistent

with research that has shown binge eating behavior to be associated with greater weight regain in nonsurgery populations (Pacanowski et al., 2014). One possible explanation in the difference between the findings of the present study and previous research is the small sample size of the present study. Previous research that has found disordered eating to be associated with weight regain had larger samples (Kalarchian et al., 2002; Pacanowski et al., 2014) or were a meta-analysis (Meany et al., 2013; Mitchell & Steffen, 2009). In the present study there was also post-surgery low levels of binge eating behavior reported which likely impacted the ability of this variable to be a predictor of weight change post-surgery. Although this low score may have influenced the nonsignificant results, a lower score on this measure of disordered eating may be expected after surgery. Latner, Wetzler, Goodman, and Glinski (2004) found that in their sample the prevalence of Binge Eating Disorder fell from 48% pre-surgery to 0% post-surgery. It is also possible that the BES was not significantly related to weight regain because binge eating was not a significant problem for this study's sample before surgery, so it did not influence the post-surgery outcome. However, this is not known as the present study did not have a pre-surgery measure of binge eating behavior.

The present study also examined the relationship between scores on the BES and excess weight loss post-surgery. It was found there was a negative correlation on BES and post-surgery EWL at six months and twelve months, and EWL at follow-up; however, this relationship was not seen at one month, three months, or nine months post-surgery. This finding may suggest that BES scores are associated with EWL at various points post-surgery, but not at all times post-surgery. One possible explanation for this finding is individuals may struggle more at various points to adapt to the eating and diet

changes required after bariatric surgery which could result in a return to disordered eating and less weight loss. Although the bariatric surgery procedures limit the amount of food that can be eaten at one time, frequent snacking, nibbling, consumption of high calorie liquids can interfere with weight loss (Kalarchian, Marcus, & Courcoulas, 2008).

#### **Hypothesis 4**

Hypothesis 4 stated that scores on the Night Eating Questionnaire (NEQ) would be associated with less initial excess weight loss after bariatric surgery and with excess weight regain at follow-up. The majority of the results in this hypothesis were non-significant; however, the results showed that greater scores on the NEQ was associated with greater EWL at nine months post-surgery and less EWL at twelve months post-surgery. The positive correlation between NEQ and EWL at nine months was not expected. One possible explanation of this finding is that although the individuals may be eating more calories in the evening, their caloric intake is still low enough to result in EWL. Although not expected, this result is not in complete conflict with previous research. Powers et al. (1999) found that Night Eating Syndrome (NES) was not associated with less weight loss. However, it should be noted that Powers et al. (1999) were examining pre-surgery night eating behaviors and not post-surgery. The finding that higher NEQ scores was associated with less EWL at twelve months post-surgery is consistent with previous research that has found night eating to be associated with less weight loss or a greater BMI (Gluck et al., 2001; Latner et al., 2004). Although consistent with previous research, what needs further explanation is why the change between the direction of EWL from nine months to twelve months post-surgery when examining the scores on the NEQ. One possible explanation is that as time since surgery

increased closer to the one year mark, possible disordered eating behaviors, such as those measured by the NEQ, influenced the amount of EWL. However, if this were true, it would be expected that NEQ would have also been negatively associated with EWL at follow-up, which was not found. One possible explanation for the majority of non-significant findings in this hypothesis is the low scores on the NEQ, which may have impacted the ability to find an association between the variables. Other research that has found night eating to be associated with EWL examined individuals who have been diagnosed with Night Eating Syndrome (Gluck et al., 2001). Individuals in the present study only completed a screening instrument and were not diagnosed with this syndrome by the primary investigator.

#### **Hypothesis 5**

Hypothesis 5 stated that scores on the BDI-II and BAI in the pre-surgery psychological evaluation would predict less initial weight loss and more weight regain at Part 2 follow-up. The results of multiple regression analysis did not support hypothesis 5. The BDI-II and BAI did not predict initial weight loss, EWL at Part 2 follow-up, or EW regained at follow-up. These findings were unexpected, although research in the areas of the role of psychiatric disorders in impacting weight loss and weight regain in bariatric surgery patients has been inconsistent, as there has been a large body of research that has shown an association between these variables (Aubert et al., 2010; Averbukh, 2003; Herpertz et al, 2012; Kinzel, et al., 2006; Rutledge et al., 2011). The present study also found low self-reported scores of depression and anxiety, both pre-surgery and post-surgery. This finding was unexpected based on previous research that found high rates of depression and anxiety in individuals seeking bariatric surgery (Abiles et al., 2010;



Edwards-Hampton, et al., 2014; Greenberg, Perna, Kaplan, & Sullivan, 2005; Kubik, Gill, Laffin, & Karmali, 2013). There are multiple explanations why the present study found results that conflict with previous research. One possible explanation is that the sample used in the present study did not have clinically significant levels of anxiety or depression, both pre-and post-surgery. Herpertz et al (2012) suggest that it is not the presence of depression and anxiety that predict weight loss post-surgery but rather the severity of these symptoms. However, based on research cited above, higher levels would be expected in a bariatric surgery population. A second possibility is that individuals in this sample were under-reporting their anxiety and depressive symptoms both pre-and post-surgery. An examination of previous research on impression management in this population is mixed. Corsica, Azarbad, McGill, Wool, and Hood (2010) suggested, based on their findings, that significant impression management may not be prevalent in obese individuals seeking bariatric surgery. Similarly, Maddi et al. (2001) examined the MMPI-2 profiles on bariatric surgery candidates and did not find evidence of faking good, faking bad, or defensiveness on the validity scales. In contrast, Ambwani et al. (2011) found elevated scores on the PAI impression management scale and the Marlowe-Crowne Social Desirability Scale in their sample of bariatric surgery candidates. They found that the elevated scales negatively correlated with anxiety and depression and that there were significant differences in anxiety and depression scores in those that had high social desirability and those that had low. Rosik (2005) also gave a sample of bariatric surgery candidates the Marlowe-Crown Social Desirability Scale and concluded that there is evidence of impression management in this population. This previous research, although insightful, does not give evidence in the present sample that

under-reporting. Comparing the mean scores in the present sample to samples of bariatric populations in previous research may give information on how the present sample scores compare. The mean score of the BDI-II in the pre-surgery evaluation was compared to pre-surgery BDI-II mean scores from previous research (Averbukh et al., 2003; Dymek, Grange, Neven, & Alverdy, 2002; Sierra-Murguia, Vite-Sierra, Ramos-Barragan, & Lopez-Tamaya, 2012). The results of the independent samples t-test showed a significant difference between the present study BDI-II scores and previous research, with previous research finding higher BDI-II scores in their sample. This finding may lend support for under-reporting in this sample. However, it could also be explained by other factors such as sample size.

A third possible explanation for the findings of low levels of anxiety and depression is the self-report measures used and if said measures were the best assessments to identify these symptoms, if present. However, this is unlikely, as the BAI has been found to have good reliability and convergent validity in the bariatric surgery population and the BDI-II has been found to be an adequate screening instrument for bariatric surgery candidates (Edwards-Hampton et al., 2014; Hayden, Brown, Brennan, & O'Brien, 2012).

### **Hypothesis 6**

Hypothesis 6 stated that scores on the BDI-II and BAI post-surgery would predict less initial weight loss and more weight regain a Part 2 follow-up. This hypothesis was partially supported; however, the majority of findings were nonsignificant. The nonsignificant finding was not expected as a large body of research examining the relationship between psychiatric disorders and weight loss and weight regain have shown

an association (Aubert et al., 2010; Averbukh, 2003; Herpertz et al., 2012; Kinzel et al., 2006; Rutledge et al., 2011). However, research has also shown a decrease in depression and anxiety after surgery which would explain the low scores reported by this sample (Burgmer et al., 2007; de Zwaan et al., 2011; Herpertz et al., 2003 Mathias et al., 1997; van Hout, Boekestein, Fortuin, Pelle, & van Heck, 2006). Additionally, lower post-surgery anxiety and depression scores may be explained by the low scores this sample obtained pre-surgery. It is possible that this sample had no significant struggles with depression or anxiety pre-or post-surgery.

When examining the significant results in this hypothesis, it was found that the BAI was negatively associated with EWL at twelve months. Specifically, for every one point increase in the BAI, there will be a -.50 standardized unit decrease in EWL. It was also found that the BAI was negatively associated with EWL at follow-up. Specifically that for every one point increase in the BAI, there will be a -.45 standardized unit decrease in EWL. What is unknown, is why the BAI was a predictor at these times post-surgery but not others as well as why the BDI was also not a predictor. It is possible that although minimal anxiety was reported both pre- and post-surgery, that this anxiety still influenced EWL.

### **Hypothesis 8**

Hypothesis 8 stated that greater weight loss would be associated with improvements in health as evaluated by the Social, Mental, and Physical Health Subscales of the Duke Health Profile obtained at Part 2 follow-up. This hypothesis was partially supported when examining amount of EWL lost at 12 months post-surgery and scores on the Social, Mental, and Physical Health subscales of the Duke Health Profile.

There was a significant positive correlation between those that lost <50% EW at twelve months post-surgery and the Mental Health subscale of the Duke Health Profile post-surgery. One possible explanation for this finding is that even though there was less EWL (<50%), these individuals may have had greater difficulties with mental health pre-surgery and therefore, even lower amounts of EWL improved mental health.

When examining the amount of EWL lost at follow-up, there was a significant positive correlation between both those who lost >50% of EWL and <50% EWL and physical health. The finding of improved physical health is consistent with research that has found improved physical health and physical functioning after weight loss and bariatric surgery (Buchwald et al., 2004; Dixon, Dixon, & O'Brien, 2001b; Fine et al., 1999; O'Brien, 2010). There was also a significant positive correlation between individuals who lost less than 50% of EW and the Mental Health Subscale. This finding is consistent with research that has shown improved psychological health after surgery (Dixon & O'Brien, 2002; Herpertz et al., 2003; Karlsson, Taft, Ryden, Sjostrum, & Sullivan, 2007; Mathus-Vliegen & de Wit, 2007). One explanation for the different findings when examining EWL at twelve months and at follow-up is that it is possible that at twelve months post-surgery, the individuals were not seeing the physical health improvements that they saw at follow-up. Also unexpected in the results of this hypothesis was the non-significant findings when examining the Social Health subscales. One possible explanation is that the individuals were functioning well in social health prior to surgery so there was not a significant increase related to weight loss. With regard to the Mental Health subscale, it is possible that the individuals who lost more than 50% EWL at follow-up had less psychological symptoms before surgery, and therefore did not

see an increase post-surgery. These two possible explanations are supported by the high mean scores on the Duke Mental and Social Health subscales pre-surgery as well as the low scores on the BDI-II and BAI post-surgery. Another possible explanation for why there were nonsignificant findings was the small sample sizes in this hypothesis which could have negatively affected the ability of the correlational analysis to find significant findings.

### **Hypothesis 9**

Hypothesis 9 stated that scores on the Grazing Questionnaire (GQ) would be associated with initial EWL and weight regain at Part 2 follow-up. It was found that the GQ was negatively correlated with EWL at follow-up but not at other points post-surgery. Although the research on grazing behavior has been limited, this finding that GQ was not associated with EW throughout post-surgery follow-up, is inconsistent with the available research suggesting that grazing behavior is associated with lower percentage of EWL and greater weight regain (Colles et al., 2008; Kofman, Lent, & Swencionis, 2010; Nicolau et al., 2015). One explanation for the present study findings being different from previous studies is the low level of grazing behavior reported by the follow-up sample as measured by the Grazing Questionnaire. It is possible that the follow-up sample did not have grazing behavior; however, it is also possible that the way grazing behavior was measured influenced the reporting of this eating behavior. Previous research that has found grazing behavior after bariatric surgery and a relationship between this behavior and weight regain and EWL, interviewed individuals in-person or on the telephone. This may allow for more follow-up questions to be asked or give the individual the opportunity to elaborate, thereby gaining more detailed information on

grazing behavior than is possible with a questionnaire can gather. The finding that there was a relationship between GQ and EWL at follow-up may suggest that individuals struggle more with disordered eating at some points post-surgery, but not consistently.

### **Hypothesis 10**

Hypothesis 10 stated that scores on the Grazing Questionnaire (GQ) would be associated with scores on the Binge Eating Scale (BES). The results showed a significant positive correlation and supported this hypothesis. This finding is consistent with other research that has examined this relationship between binge eating and grazing behavior (Lane & Szabo, 2013; Saunders, 1999; 2004; Saunders, 1998). This suggests that individuals who exhibit one type of disordered eating behavior, may have additional types of disordered eating behavior. Specifically, it suggests that individuals who exhibit behaviors consistent with binge eating may also exhibit grazing behaviors. Additionally, some research has found that after bariatric surgery there is shift from binge eating behavior to grazing behavior, as an individual is unable to physically binge after bariatric surgery (Colles et al., 2008; Saunders, 2004). This may suggest a commonality in the behaviors seen in grazing and binge eating and may further explain why this relationship is seen between the two scales.

### **Hypothesis 11**

Hypothesis 11 stated that scores on the EAT-26 in the pre-surgery psychological evaluation would predict scores on the Grazing Questionnaire (GQ) after surgery. This hypothesis was not supported. There has been no research this primary investigator could find that compared the relationship between the GQ and the EAT-26; however, research by Lane & Szabo (2013) found that there was a strong relationship between the Grazing

Questionnaire and other measures of disordered eating such as the Binge Eating Scale. Saunders et al. (1998) also found grazing behavior to be associated with binge eating. One explanation for the nonsignificant findings for this hypothesis is that the EAT-26 and GQ are measuring different types of disordered eating, explaining why one of the measures may not predict the other. As mentioned previously Garner & Garfinkel (1979) originally designed the EAT-26 to measure disordered eating typically found in individuals with anorexia nervosa, symptoms which individuals seeking bariatric surgery may not be exhibiting. Additionally, as discussed, grazing behavior is common in those presenting with binge eating disorder and, as found in this study, scores on the GQ are associated with scores on the Binge Eating Scale (Lane & Szabo, 2013; Saunders, 1999, 2004; Saunders et al, 1998). This may suggest that the symptoms measured by the GQ are more likely found in those with binge eating than in those with symptoms consistent with anorexia nervosa, such as restricting, that is measured by the EAT-26. Another possible explanation for the non-significant finding is the small sample in this hypothesis which may have made it difficult to find a significant result even if there is, in fact, a relationship between these variables. As there have not been studies this investigator could find examining the relationship between these two scales, it is not possible to compare the sample sizes in the present study to previous research. Lastly, a third possible explanation for the non-significant findings is the low level of disordered eating reported by this sample. It is possible that these individuals truly did not have disordered eating measured by the EAT-26 pre-surgery or the GQ post-surgery. However, research has shown that disordered eating is high pre-surgery and occurs post-surgery (Beck, Mehlsen, & Stovins, 2012; Kinzel et al., 2008; Meany et al., 2013; Mitchell et al., 2015;

van Hout et al., 2004). It is also possible that the participants were responding in a socially desirable way. Since no measure of social desirability was used in the pre-surgery evaluation or post-surgery, this possibility cannot be supported with evidence but only hypothesized.

### **Limitations and Suggestions for Future Research**

There were several limitations to the present study, including missing data, small sample sizes, low response rate in Part 2 follow-up, and low reports of pathology in the sample. A major limitation of the study was missing data in both the pre-surgery data and missing information from the medical records. In the pre-surgery data only 43.75% of the sample had EAT-26 information, 45.22% had BDI-II information, and 41.91% had BAI information. In contrast, in the pre-surgery data, 95.95% of the participants had data for the Duke Health Profile subscales of Social Health, Mental Health, and Physical Health. Additionally, only total scores were available to the primary investigator for the pre-surgery measures so Cronbach's alphas were not calculated for the pre-surgery measures in this sample. In the post-surgery data gathered by from the surgeon's office, the majority of individuals did not attend all post-surgery follow-up appointments with the surgeon. At one month follow-up appointment, 90.8% of individuals attended. In the three month follow-up 72.1% attended, 49.3% attended the six month follow-up appointment, 25% attended the nine month follow-up appointment, and 34.6% attended the twelve month follow-up appointment. The missing data affected the sample sizes in each hypothesis that was looking at these variables. The small sample sizes may have contributed to the lack of significance on most of the hypotheses.



Another limitation related to the data was only having one measure of disordered eating behavior from the pre-surgery data, the EAT-26. The pre-surgery data did not have measures of disordered eating used in Part 2 of the study including the Binge Eating Scale, the Night Eating Questionnaire, and the Grazing Questionnaire. Pre-surgery did also not have data on alcohol use, which was gathered at Part 2 of the study using the AUDIT. This influenced what variables were able to be explored at using the pre-surgery data.

A second limitation in the present study was the small sample sizes. As noted previously, missing data negatively affected the number of participants that could be used in each hypothesis. The small sample sizes likely affected the statistical power, limiting the ability of the analysis to find significance, if it did in fact exist. Along with the small sample size, there was also a low response rate of 18.4% in Part 2 of the study.

A third limitation of the study, which may have affected the many of the nonsignificant findings in the present study was the low rate of pathology in the sample that was measured by various instruments such as the BDI-II, BAI, EAT-26, Binge Eating Scale, Night Eating Questionnaire, the Grazing Questionnaire, and the AUDIT. It is unknown if the reported low rates of psychological symptoms both pre- and post-surgery are accurate reflections of individuals functioning at the time or if there was an incentive to present oneself in a favorable light. It is possible, as the evaluation was assessing someone's appropriateness for surgery, that individuals may have not been entirely honest when answering questions. With regard to the measures used in the study, a limitation is the lack of research examining the validity and reliability of the Grazing Questionnaire.

A fourth limitation in the present study is the inability to generalize results to the general population. The violations of multiple assumptions in the parametric analyses as well as the lack of diversity based on gender and ethnicity mean the interpretation of these results to the bariatric surgery population as a whole should be done with caution.

Based on the limitations of the present study, there are a few recommendations that future research may consider that may prevent smaller sample sizes. First, it would be beneficial to ensure that all data is present in the medical records that are being used before data is gathered. It would also be beneficial to gather additional pre-surgery data, including data on measures that current research has not examined extensively. This would include gathering information on pre-surgery alcohol use, binge eating, grazing behavior, and night eating. To assess whether individuals are answering in a way to be presented in a favorable light, it could also be beneficial to include a measure that may assess that aspect of participant response. Although sample size and response rate may also be a concern for future studies, it may be helpful for future research to offer a greater incentive for participation. Additionally, although more time consuming, not using archival data and instead gathering new data to better ensure complete response may also protect against the smaller sample sizes seen in the present study.

### **Implications and Summary**

The current study has several implications contributing to the field of examining predictors of success in the bariatric surgery population. First, although not adding a definite answer, it adds to the literature that has examined the role depression and anxiety play in excess weight loss and weight regain after bariatric surgery. The findings suggest that all individuals presenting for bariatric surgery may not have clinically significant

depression or anxiety pre-surgery or post-surgery. It also suggests, that although not clinically significant, anxiety may still be a predictor a EWL at various points post-surgery. The present study also adds to the literature on disordered eating in the bariatric surgery population. First, although there were not significant grazing and night eating behaviors in this population, it adds to the research on those little studied variables. Second, although not stating that certain measures of disordered eating should not be used with this population, it highlights the importance of carefully choosing assessment measures. Third, when examining the findings on disordered eating, the finding of the correlation between the BES and GQ, shows a possible connection between various types of disordered eating. Fourth, the finding that shows the BES scale and GQ to be correlated with EWL at various points post-surgery suggests that individuals may struggle with disordered eating, but they may not struggle consistently with these symptoms. There is also contribution to the literature that examines how health can improve as excess weight is lost after bariatric surgery, adding to the existing literature that shows physical health is correlated with EWL. Lastly, since this sample showed low scores on depression, anxiety, and disordered eating, which was in contrast to previous research, the present study suggests the importance of adding a measure of social desirability when conducting pre-surgery psychological evaluations.

For the psychologists, surgeons, and other professionals who work with bariatric surgery populations, the present study also has implications for professional practice. The current study showed that there is a positive correlation between the Binge Eating Scale and the Grazing Questionnaire, suggesting that an individual may manifest disordered eating in multiple ways. This finding implies the importance of professionals

assessing for multiple types of disordered eating behavior. Additionally, the current study found some measures of disordered eating were negatively correlated with the percent of excess weight loss at various points post-surgery. This finding may suggest that a person's disordered eating behavior may change at various points after surgery. If so, it would be important for professionals working with bariatric surgery patients to assess for disordered eating behavior routinely post-surgery. Lastly, this study found that anxiety post-surgery, as measured by the BAI was a significant predictor of EWL at some points post-surgery. This suggests the importance of ongoing assessment of anxiety in individuals post-surgery.

In the literature on predictors of success in bariatric surgery, findings have been inconsistent regarding which variables are predictive or associated with those patients who lose less excess weight or regain weight after bariatric surgery. Not having conclusive evidence of these factors makes it more difficult to identify those individuals who may struggle after bariatric surgery and who may benefit from additional support both before and after bariatric surgery.

The current study was developed with hopes of adding to the current literature on predictors of success in bariatric surgery such as the role that anxiety and depression play, as well as how health may increase as excess weight is lost. Additionally, the current study examined factors that have not been extensively studied in this population, such as alcohol use and various types of disordered eating behavior.

Pre-surgery psychological evaluation data was gathered from bariatric surgery patients, as well as post-surgery weight loss information. Additionally, the primary investigator mailed out packets of questionnaires to these bariatric surgery patients asking

for additional information on weight and measures of depression, anxiety, health, alcohol use, and disordered eating behavior.

Obtained data was analyzed using Spearman's correlation, Pearson's correlation, and linear and multiple regression. Results did not support the majority of the hypothesis; however, there were significant findings. When examining the ability of the BAI and BDI-II to predict EWL post-surgery, the majority of hypotheses were not supported. However, the results showed that the BAI was predictive of EWL at twelve months post-surgery and at Part 2 follow-up. The results of the presents study showed that certain measures of disordered eating, such as the Binge Eating Scale and Night Eating Questionnaire were negatively correlated with percentage of excess weight loss at various points post-surgery. The study also showed that percentage of excess weight loss was found to be correlated weight physical and mental health. Additionally, this study found that the Grazing Questionnaire was correlated positively with the Binge Eating Scale, suggesting that individuals who struggle with disordered eating, may manifest this disordered eating in multiple ways. Contributions of the present study include adding to the current body of literature examining variables that may be predictive of success in this population. Additionally, this study contributed information on variables that have not been studied extensively such as alcohol use in this population as well as night eating and grazing behavior.

## **APPENDIX A**

### **DEMOGRAPHIC QUESTIONNAIRE**

## Demographics

Age \_\_\_\_\_

**Gender**

Male       Female

**Current Weight** \_\_\_\_\_

**Height** \_\_\_\_\_

**Ethnicity**

African American

White

Asian

Native American nor Alaska Native

Native Hawaiian or Other Pacific Islander

Other

If you choose other, please specify \_\_\_\_\_

**Marital Status: What is your marital status?**

Single, never married

Married or domestic partnership

Widowed

Divorced

Separated

**Education: What is the highest degree or level of school you have completed? If currently enrolled, highest degree received**

No schooling completed

Nursery school to 8<sup>th</sup> grade

Some high school, no diploma

High school graduate, diploma or the equivalent (for example: GED)

Some college credit, no degree

Trade/technical/vocational training

Associates degree

Bachelors degree

Masters degree

Professional degree

Doctorate degree

**Are you currently being treated for:**

Diabetes    High blood pressure    High cholesterol    Sleep apnea

**If you are being treated for one of the above illnesses, what medications are you taking for those illnesses? (use back of page if needed)**

**Are you satisfied with the results of your weight-loss surgery?   yes   no**

**If no, please briefly explain (use back of page if needed):**



## **APPENDIX B**

### **INFORMED CONSENT FORM**

## HUMAN SUBJECTS CONSENT FORM

The following is a brief summary of the project in which you are asked to participate. Please read this information before signing the statement below.

**TITLE OF PROJECT:** Factors predicting weight loss and weight regain in bariatric surgery patients.

**PURPOSE OF STUDY/PROJECT:** The purpose of this study is to look at factors that may predict success in bariatric surgery patients.

**PROCEDURE:** Prior to participating you will be asked to read over an informed consent form and indicate that you understand and agree. You will then be asked to complete a packet of surveys which will take approximately 40 min to complete. Please answer the questions as accurately, honestly, and completely as possible. There are no right or wrong answers. At the end of the surveys you will be given information on how to receive counseling if you feel it would be beneficial and will be given an email address to contact the researcher if you would like a summary of the results of the research. Data will be analyzed to try to identify factors that may be used to predict success after bariatric surgery.

No identifying information will be used in the data analysis and your responses are confidential. Please do not write your name on the questionnaires.

**INSTRUMENTS:** The surveys will ask you to answer demographic information as well as questions regarding your mood, eating habits, health, and alcohol use. Your responses to these questions will not affect your relationship with Dr. Sartor. Dr. Sartor will not have access to your responses.

**RISKS/ALTERNATIVE TREATMENTS:** The participant understands that Louisiana Tech is not able to absorb the costs of medical treatment should you be injured as a result of participating in this research.

The questionnaires that you complete will be confidential. No identifying information will be asked of you on the questionnaires and you will not be identified individually in any part of the research. The results of your questionnaire will not be given to the surgeon or the medical center that performed your surgery and in no way will affect your relationship with that individual or organization.

If you begin to experience any extreme emotional distress, there are national and regional crisis lines available. National crisis lines available include: 1-800-273-8255 and 1-800-784-2433. If you are in the Monroe, LA area a regional crisis line is offered through The Wellspring, which can be contacted at 318.323.1505 or 318.323.4112. If you believe that you are in immediate danger because of extreme emotional distress, call 911 or go to your nearest emergency room.

**BENEFITS/COMPENSATION:** If you choose to participate you will be entered into a raffle to win a twenty five dollar gift certificate.

I, \_\_\_\_\_, attest with my signature that I have read and understood the following description of the study, "Factors predicting weight loss and weight regain in bariatric surgery patients", and its purposes and methods. I understand that my participation in this research is strictly voluntary and my participation or refusal to participate in this study will not affect my relationship with the Louisiana Center for Weight Loss Surgery or my physician in any way. My physician will not have access to individual results and will not see my responses. Further, I understand that I may withdraw at any time or refuse to answer any questions without penalty. Upon completion of the study, I understand that the results will be freely available to me upon request. I understand that the results of my survey will be confidential, accessible only to the principal investigators, myself, or a legally appointed representative. I have not been requested to waive nor do I waive any of my rights related to participating in this study.

\_\_\_\_\_  
Signature of Participant or Guardian

\_\_\_\_\_  
Date

**CONTACT INFORMATION:** The principal experimenters listed below may be reached to

answer questions about the research, subjects' rights, or related matters.

Deborah P. Simpson, M.A.

Donna Thomas, Ph.D.

[dlp027@latech.edu](mailto:dlp027@latech.edu)

[dthomas@latech.edu](mailto:dthomas@latech.edu)

Members of the Human Use Committee of Louisiana Tech University may also be contacted if a problem cannot be discussed with the experimenters:

Dr. Stan Napper (257-3056)

Dr. Mary M. Livingston (257-5066)

## **APPENDIX C**

### **HUMAN USE COMMITTEE FORM**



LOUISIANA TECH  
UNIVERSITY

MEMORANDUM

OFFICE OF UNIVERSITY RESEARCH

TO: Ms. Deborah Simpson and Dr. Donna Thomas  
 FROM: Barbara Talbot, University Research  
 SUBJECT: HUMAN USE COMMITTEE REVIEW  
 DATE: October 29, 2013

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

**“Preoperative Factors Predicting Weight Loss, Satisfaction with Surgery, and Quality of Life after Bariatric Surgery”**

HUC 1135

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. *This approval was finalized on October 29, 2013, and this project will need to receive a continuation review by the IRB if the project, including data analysis, continues beyond October 29, 2014.* Any discrepancies in procedure or changes that have been made including approved changes should be noted in the review application. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of University Research.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Research or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

If you have any questions, please contact Dr. Mary Livingston at 257-2292 or 257-5066.

A MEMBER OF THE UNIVERSITY OF LOUISIANA SYSTEM

P.O. BOX 3092 • RUSTON, LA 71272 • TELEPHONE (318) 257-5075 • FAX (318) 257-5079  
 AN EQUAL OPPORTUNITY UNIVERSITY

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