Are depression, anxiety, body mass index, and types of surgery predictive of weight loss and psychological outcomes after bariatric surgery?

Chia-Hao Damien Hsu

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy under the Executive Committee of the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2012

ABSTRACT

Are depression, anxiety, body mass index, and types of surgery predictive of weight loss and psychological outcomes after bariatric surgery?

Chia-Hao Damien Hsu

Background: The primary goal of bariatric surgery is to not only lose weight but also resolve comorbidities and improve quality of life. It is crucial to identify predictors of surgical outcomes. The current study investigates pre-surgical depression, pre-surgical anxiety, and demographic factors (age, gender, education, race, and baseline body mass index) as predictors of post-surgical outcomes as well as examines difference in the effect of laparoscopic Roux-en-Y gastric bypass versus laparoscopic adjustable gastric banding on post-surgical surgical outcomes. **Methods:** The study is a retrospective one-group pre-test-post-test design study that examined 88 (Females = 81, Males = 7) bariatric surgery participants at St. Luke's-Roosevelt Hospital. Data collected at baseline (three weeks prior to surgery) and 1 year post-surgery from participants administered the Zung Self-rating Depression Scale, the Liebowitz Social Anxiety Scale – Self-Report Version, and Quality of Life – Lite Scale were analyzed. Participants underwent either laparoscopic Roux-en-Y gastric bypass surgery or laparoscopic adjustable gastric banding surgery. **Results:** Age ($F = 4.0$, $p = 0.05$) and baseline body mass index ($F = 5.8$, $p = 0.02$) were significant predictors of % excess weight loss. Age ($F = 4.2$, $p = 0.04$) and baseline body mass index ($F = 33.6$, $p < 0.001$) were significant predictors of absolute weight loss (kg). Baseline body mass index ($F = 4.2$, $p = 0.046$) was also a significant predictor of total quality of life. The effect of laparoscopic Roux-en-Y gastric bypass versus laparoscopic adjustable gastric banding differed in changes in pre- to post-surgical total quality of life ($F =$

12.5, $p = 0.001$), % weight loss (F = 126.3, $p < 0.001$), % excess weight loss (F = 124.8, $p < 0.001$), and absolute weight loss (F = 87.7, $p < 0.001$). Baseline depression and baseline anxiety were not predictive of weight loss (% excess weight loss, % weight loss, or absolute weight loss), but baseline anxiety was predictive of post-surgical depression (F = 13.0, $p = 0.001$), post-surgical anxiety (F = 43.8, $p < 0.001$), and post-surgical total quality of life (F = 8.6, $p = 0.005$).

Conclusion: The data show that younger age and lower baseline body mass index are positive predictors of weight loss, lower baseline body mass index and lower baseline anxiety are positive predictors of quality of life, and lower baseline anxiety is a positive predictor of post-surgical depression and anxiety. The data also show that baseline depression and baseline anxiety are not predictors of post-surgical weight loss. Hence, the data suggest that younger adults have a bigger chance to succeed at greater weight loss after surgery. In addition, treating baseline anxiety disorder might result in better quality of life after surgery. Interventions that are effective in lowering baseline body mass index might help with greater post-surgical weight loss and better post-surgical quality of life. Those with better scores on the baseline depression and anxiety assessment do not necessarily have greater weight loss after surgery, so denial of surgery to those with psychopathology should be further examined. Long-term follow-up is necessary.

Key words: bariatric surgery, Roux-en-Y gastric bypass, adjustable gastric banding, depression, anxiety, quality of life, weight loss

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGMENTS

I am heartily thankful to Dr. Isobel Contento and Dr. Randi Wolf, whose encouragement, guidance, and support from the beginning to the end enabled me to grow as a student and also as a person. I am grateful to have had them in the last six memorable years of my life. I would also like to thank Dr. Allan Geliebter for the opportunity to work at his research lab and use his data for my dissertation. I would also like to show my gratitude to my fellow classmates in the doctoral seminar who have provided me with tremendous help to make this happen. Last but not least, I would like to thank Dr. Marrie-Pierre St-Onge. Although I did not get to meet Dr. St-Onge until the final stage of my dissertation process, she has been a great mentor who has bestowed a great deal of knowledge and wisdom upon me.

DEDICATION

I would like to dedicate my dissertation to my parents, my sister, and my friends. I am very lucky to have very supportive and loving parents who have given me so much; without whom, I would not be able to accomplish this dissertation. It is sometimes easy to take those who love us for granted, especially when going through stressful times. I am forever indebted to my parents. I would like to thank my sister for my personal growth during my journey to accomplish my doctoral degree. I would also like to dedicate this to all of my friends, especially those in New York City. In particular, I am truly lucky to have Lulu, Teddy, Heewon, and Brian in my life. I sometimes think to myself what I have done to deserve these wonderful people, with whom I connect on such a profound level. In addition, I would like to dedicate this dissertation to a dear friend, Marc, whose constant support and encouragement allowed me to sail through the toughest time during this journey.

Chapter 1: Introduction

1.1 Overview

One in three adults is obese in the U.S. (Hedley et al., 2004). In 2001-2002, the prevalence of severe obesity (body mass index (BMI) 35-40) was 7.0% and increased to 8.5% in 2007-2008. The prevalence of morbid obesity (BMI > 40) grew as well, from 5.1% in 2001-2002 to 5.7% in 2007-2008 (Flegal, Carroll, Ogden, & Curtin, 2010). Severe obesity (BMI 30.0 kg/m^2-34.9 kg/m^2) saw an increase from 18.5% in 2001-2002 to 19.5% in 2007-2008 (CDC/NCHS, 2010). A study that reports results from the latest NHANES data (2007-2008) regarding population trends in obesity, compared the obesity prevalence and rates over the 10-year period from 1999 through 2008 and found that in 2007-2008, the prevalence of obesity was 32.2% among adult men and 35.5% among adult women (Flegal et al., 2010).

Although there are different ways to reduce weight, such as diets, drugs, physical activity, and behavioral therapies, bariatric surgery is the most effective method to achieve long-term weight control (Brolin, 2002) and to help control comorbidities associated with excess weight such as type 2 diabetes and hypertension in clinically severe obese patients (Muscelli et al., 2005).

Depressive disorders are the most common psychological diagnoses in the bariatric population, followed by anxiety disorders (Grothe, Dubbert, & O'Jile J, 2006). The incidence of depressive disorders in bariatric surgical patients pre-surgery range from 4.4% to 53% (Song & Fernstrom, 2008). "Depressive symptoms negatively impacted physical function and increased eating in response to negative emotion and impaired appetite regulation" (Song & Fernstrom, 2008). Depressive and anxiety symptoms as correlates of psychological stress with regard to

obesity seem to be positive predictors of weight loss post-surgery (Herpertz, Kielmann, Wolf, Hebebrand, & Senf, 2004). However, more recent studies, such as Kinzl et al. (2006) found that individuals with two or more psychiatric disorders, such as depression, show less successful weight loss post-surgery. A review done by Pull (2010), which looked at articles and reports on new research findings published between August 2006 and August 2009, concluded that there is a clear need for more substantial information with regard to reliable psychological predictors of weight loss and mental health after surgery despite some evidence supporting the notion that bariatric surgical candidates with abnormal psychosocial profiles are at risk for poorer surgical outcome and increased complications. Thus, this study is set up to explore the relationship between depression, anxiety and BMI prior to bariatric surgery and depression, anxiety, weight loss and quality of life after bariatric surgery.

1.2 Obesity (Statistics, Impact, and Treatment Options)

Obesity has quickly become a serious epidemic in the United States with over 30% of the population being obese (Hedley et al., 2004). This number has increased from 14.5% in 1980 (Flegal, Carroll, Kuczmarski, & Johnson, 1998) to 22.9 % in 1994 (Flegal, Carroll, Ogden, & Johnson, 2002), to 30.5% in 2000 (Flegal et al., 2002), and to 33.8% in 2008 (Flegal et al., 2010). The health effects of obesity are detrimental as obesity has been linked to increased physical and psychosocial comorbidities, poor quality of life, increased risk of morbidity, and premature mortality from numerous related medical conditions (van Hout & van Heck, 2009).

The World Health Organization (2010) classifies people with a BMI between 18.5-24.9 kg/m^2 as normal range, BMI $\geq$ 25 as overweight, BMI 25-29.9 kg/m^2 as pre-obese, 30.0-34.9 kg/m^2 as obese class I, BMI 35.00-39.9 kg/m^2 as obese class II “severe obesity”, and BMI > 40

kg/m^2 as obese class III "morbid obesity." In the surgical literature, people with a BMI > 50 kg/m^2 are classified as "super obese" (Sturm, 2007). Morbid obesity and super obesity are the most dangerous subtype of obesity as they are the highest obesity categories. Although morbid obesity is defined as BMI > 40 kg/m^2, those with BMI ≤ 40 kg/m^2 may still have weight related comorbidities. Therefore, there is a trend to replace the term morbid obesity with clinically severe obesity. Approximately 4.9% of the U.S. population (over 9 million Americans) currently suffers from morbid obesity. This includes 2.8% of men and 6.9% of women (Ogden et al., 2006). The percentage of people who are morbid obese has increased from 2.9% in 1994 (Flegal et al., 2002). The rates of morbid obesity are increasing 2-3 times faster than the general rates of obesity (Sturm, 2007). This is particularly problematic because clinically severely obese individuals are at the highest risk of developing obesity-related physical and psychological health complications and death, such as coronary heart disease, hypertension, diabetes mellitus, dyslipidemia, obstructive sleep apnea, and cancer (Khwaja & Bonanomi, 2010). Other medical conditions that may be associated with clinically severe obesity are polycystic ovary syndrome, hence subfertility, gastro-esophageal reflux disease, genuine stress incontinence and venous stasis (Khwaja & Bonanomi, 2010).

1.3 Conventional or Non-Surgical Treatment (Diets, Drugs, and Physical Activity)

The most common weight loss approaches are diets, physical activity, behavioral therapy, medications, and bariatric surgery. Diets, drugs, and physical activity are considered conventional obesity or weight loss treatments. Based on existing research (Miller, 1999), conventional methods alone have not been effective in achieving a medically significant long-term weight loss in obese adults. The majority of patients who take the conventional weight loss

route appear to regain all of the weight lost within the following 5 years (Khwaja & Bonanomi, 2010). Miller examined the history and effectiveness of diet and exercise in obesity therapy. In this review paper, he mentioned that, "a brief survey of the most popular dieting techniques used over the past 40 years shows that most techniques cycle in and out of popularity and that many of these techniques may be hazardous to health" (Miller, 1999). He concluded that data from the scientific community indicate that a 15-week diet or diet plus exercise program produces a weight loss of about 11 kg with a 60-80% maintenance after 1 year. Although long-term follow-up data are meager, the data that do exist suggest almost complete relapse after 3-5 years (Miller, 1999).

Miller also reviewed the very low calorie diet (VLCD) programs and suggested that 12-16 weeks of dieting produces a 20 kg weight loss, of which a 10-13 kg loss can be maintained after 1 year (Miller, 1999). However, individual reports vary as to their success claims, so it is difficult to interpret the results because dropout rates can be as high as 80% in some VLCD programs. He also stated that results from programs with more moderate dietary restrictions seem less promising than those from the VLCD. However, the initial weight-loss success seen with VLCD is followed by gradual weight regain to the point that VLCD programs show no more success long-term, usually within 3-5 years, than other forms of therapy, not to mention the potential danger of following a VLCD, such as nausea, hyperuricemia, fatigue, and refeeding edema (Miller, 1999). Since weight loss success should account for both weight loss and maintenance, it is not only important to look for safe ways to lose weight but also to maintain the lost weight.

Flynn and Walsh also looked at 255 participants and evaluated the effect of a popular 26-week VLCD program. They concluded that even though a very-low-calorie diet program can be effective in maintaining a medically significant weight loss, weight loss of 10%, in some patients at 30 months after program entry, the high costs and rate of weight regain warrants the need to find a more affordable and effective strategy for weight loss (Flynn & Walsh, 1993). In their study, 55% of all patients were able to lose an average of 20 kg, but only 14% of all patients were able to maintain the weight loss 30 months after program entry.

Behavioral approaches are usually implemented over a short period, ranging from 10 to 20 weeks. Such approaches include techniques such as stimulus control, changing cognition, problem solving, social support, and self-reinforcement, and result in an average of 10 kg weight loss at the end of the treatment program (Wing, 1992). Programs restricting dietary fat and/or focusing on behavior modification have reported conflicting results for weight-loss maintenance and are generally no more effective than traditional dieting techniques (Miller, 1999).

Approaches using drug combination appear to have an unacceptably high association with cardiac valvular disease and have been withdrawn from therapeutic use because of these potentially life threatening sequelae (Kaplan, 2005). For instance, the euphoric and addictive effects of amphetamines, the hypertensive and arrhythmogenic effects of the adrenergic agents, the cardiac valvular effects of fenfluramine, and the steatorrhea associated with orlistat, have limited the use of these drugs significantly and in some cases have required their complete withdrawal from the market (Kaplan, 2005).

Even though there are many non-surgical approaches to obesity on the market, based on published studies, significant sustained weight loss by diet therapy, exercise, or behavior

modification in clinically severely obese patients has not been found in the long term (Fisher & Schauer, 2002). Twenty percent of overweight individuals are successful at long-term weight loss when defined as losing at least 10% of initial body weight and maintaining the loss for at least 1 year (McGuire, Wing, Klem, Seagle, & Hill, 1998). It has also been noted that weight loss maintenance may get easier over time; after individuals have successfully maintained their weight loss for 2–5 years, the chance of longer-term success greatly increases via continued adherence to diet and exercise strategies, low levels of depression and dis-inhibition, and medical triggers for weight loss (McGuire et al., 1998).

Comprehensive behavior modification programs along with pharmacological treatments (principally orlistat and sibutramine) have shown effectiveness in weight control for extreme obesity. These options typically produce an 8% to 10% reduction in initial weight, but weight regain after treatment discontinuation is often significant (Sarwer, Wadden, & Fabricatore, 2005).

1.4 Operative/Surgical Treatment

Bariatric surgery is the only method shown to achieve long-term weight control for the clinically severely obese. It is technically granted to patients for necessary medical purpose not for cosmetic reasons. According to the results from a large prospective, controlled Swedish Obese Subjects (SOS) study involving 4047 obese subjects (Sjostrom et al., 2007), maximum % weight losses in the surgical subgroups were observed after 1 to 2 years: gastric bypass, 32%; vertical- banded gastroplasty, 25%; and banding, 20%. After 10 years, even though some weight was regained, the weight losses from baseline were stabilized at 25%, 16%, and 14%, respectively. In the SOS study, 2010 subjects underwent bariatric surgery (surgery group) and 2037 subjects received conventional treatment (matched control group).

In the United States, open Roux-en-Y gastric bypass or laparoscopic Roux-en-Y gastric bypass (LRYGB) are the most common operations, but in Europe, laparoscopic adjustable gastric banding (LAGB) is performed more frequently (Buchwald & Williams, 2004). Adjustable gastric banding is called adjustable lap-banding. However, Roux-en-Y gastric bypass (RYGB) has emerged, since the late 1990s, to be the leading choice to treat clinically severe obesity in North America, due to its satisfactory long-term weight loss and low reoperation rate (Fisher & Schauer, 2002). Bariatric surgeries are categorized into three procedures: combination/bypass procedure, mal-absorptive procedure, and restrictive procedure (Brethauer, Chand, & Schauer, 2006). Some of the most popular surgeries are RYGB, LAGB, and biliopancreatic diversion (O'Brien, 2010).

Regardless of which bariatric surgery one undergoes, weight loss usually peaks around 18-24 months with some regain starting at 2-5 years after the surgery (Magro et al., 2008). Overall, a weight loss of 30–35 kg is typical (Monteforte & Turkelson, 2000), and this represents about 50–60% of excess weight (O'Brien, McPhail, Chaston, & Dixon, 2006). This weight loss has been shown to be associated with major improvement or complete resolution of multiple common and serious health problems plus improvement in quality of life and survival (O'Brien, 2010).

Bariatric surgery is an increasingly used method to treat clinically severe obesity because its benefits after surgery are believed to outweigh its complications for this particular cohort of population. The mortality rate among patients undergoing bariatric operations is generally quoted as between 0.05-2.0%. However, the low mortality rates in published studies are likely explained by surgical treatment of low-risk patients with minor comorbidities (Jamal et al., 2005).

Before receiving the surgery, there is usually a preliminary screening. A recent national survey indicated that 95% of bariatric surgeons now use a multidisciplinary team. However, not only are procedures inconsistent, there is little consensus as to how results should be used in the context of surgical care although more than 80% of programs require pre-surgical mental health evaluations (Kalarchian et al., 2007).

Besides mortality, other post-surgical complications can also be serious. Goldfeder and colleagues showed that the most common post-surgical complication was an anastomotic leak, a breakdown at the site of a post-surgical closure of a hollow organ, with subsequent infection (Goldfeder, Ren, & Gill, 2006). Omalu and colleagues who measured case fatality and death rates by time since operation, sex, age, specific causes of death, and mortality rates showed a substantial excess of deaths owing to suicide and coronary heart disease (Omalu et al., 2007). In other words, age- and sex-specific death rates after surgery are found to be higher than comparable rates for the age- and sex-matched control group, with higher age-specific death rates in men than in women and increased with age.

Although there has been effective weight loss outcome in clinically severely obese patients after surgery (Brethauer et al., 2006), a subset of patients, perhaps as great as 20%, fail to lose a significant amount of weight, which has been attributed to poor adherence to the post-surgical diet (Sarwer et al., 2005).

1.5 Psychological Characteristics of the Bariatric Population

Besides high BMI and high visceral fatness, there are many psychological complications to be found in the bariatric population. For instance, depressive disorders are the most common psychological diagnoses found in this population, followed by anxiety disorder (Grothe et al.,

2006). The incidence of depressive disorder in the bariatric surgical patients ranges from 4.4% to 53% in the literature (Song & Fernstrom, 2008). Depressive symptoms are also negatively associated with physical function and increased eating in response to negative emotion and impaired appetite regulation (Song & Fernstrom, 2008). While depression and anxiety disorders are the most prevalent, other diagnoses are also noteworthy. High incidences of somatization (29.3%), social phobia (18%), hypochondriasis (15%), and obsessive-compulsive disorder (13.6%) were found in the prospective bariatric population (Rosik, 2005).

Besides reports of higher levels of stress, anxiety, and depression, obese patients also have higher food craving, eating behavior disorder symptoms and lower levels of self-esteem and quality of life compared with normal-weight controls (Abilés et al., 2010). Quality of life is severely impaired with increasing degrees of obesity (Kral, Sjostrom, & Sullivan, 1992). Bariatric surgery candidates have been found to score significantly lower than the norms on most quality of life measures (Sarwer et al., 2005). However, after surgery, quality of life has been found to improve significantly (Ryden & Torgerson, 2006), especially in those with greater weight loss (Kolotkin, Meter, & Williams, 2001).

1.6 Bariatric Surgery and Health Outcomes

1.6.1 Bariatric Surgery and Comorbidities

A substantial majority of patients show improvement or complete resolution in comorbidities such as diabetes, hyperlipidemia, hypertension, and obstructive sleep apnea (Buchwald et al., 2004). However, bariatric surgery causes anatomic and physiological changes, which can affect both nutritional intake and psychological attitudes (Song & Fernstrom, 2008). In addition, there can be short-term complications such as wound infection, stomal stenosis,

marginal ulceration, and constipation, as well as symptomatic cholelithiasis, dumping syndrome, persistent vomiting, and nutritional deficiencies, which also may present as long-term complications (Virji & Murr, 2006).

1.6.2 Bariatric Surgery and Mental Health

In terms of post-surgical psychopathology, most studies report a general tendency for psychopathology to decrease and normalize following bariatric surgery (Green, Dymek-Valentine, Pytluk, Le Grange, & Alverdy, 2004; Sarwer et al., 2005). These psychological and interpersonal improvements have been speculated to be directly related to weight loss (Guisado et al., 2002). Although the mental health of patients may improve as a result of bariatric surgery, the benefits may be transient, and problems such as negative personality profiles, detrimental eating patterns, and negative body image persist to some extent (Song & Fernstrom, 2008). Nonetheless, psychological improvements have been found in patients who remained obese or those where no substantial weight loss was observed in the weeks immediately following surgery (Quality of Life, 2001). There is a strong tendency for patients to attribute their depression to weight. Psychological outcomes, such as depression, anxiety, and eating disorders tend to improve significantly after post-surgical weight loss (Thonney, Pataky, Badel, Bobbioni-Harsch, & Golay, 2010). It appears to be ego-syntonic to believe that when the weight is decreased, so is the depression. For a subset of depressed patients, the weight is actually a symptom of depression rather than the other way around (Alexander, 2008). The relationship between obesity and psychopathology is complicated and whether psychopathology is a cause or consequence of extreme obesity is still unclear (Sarwer et al., 2005).

So far research has shown that bariatric surgery is not a cure for depression though might be more so for diabetes and obesity. However, whether it is possible that certain types of bariatric surgery as a whole or compared to other types of surgery could improve or worsen a patient's psychological wellbeing still remains inconclusive. It is clear that depression could occur after bariatric surgery, so patients should be recommended to receive education about post-surgical depression. They should also be informed about the results from a recent study showing the elevated rate of suicide after surgery (Omalu et al., 2007). However, all of the facts concerning this particular finding still need much research investigation though positive association between obesity and suicide has been observed more frequently than a negative or absent association, and the risk of suicide seems to persist after bariatric surgery (Heneghan, Heinberg, Windover, Rogula, & Schauer, 2012).

Shortly after surgery, patients report improvement in their body image, but with time, some of them still feel overweight or are discontented with the increased skin-folds (Dixon, Dixon, & O'Brien, 2002), while other studies suggest the opposite (van Hout, Boekestein, Fortuin, Pelle, & van Heck, 2006). Although most studies are optimistic and report broad psychological improvements, a portion of patients do not benefit psychologically from surgery. For instance, some studies report that after bariatric surgery, up to 40% of their patient group had to deal with psychiatric disorders and that 25% reported seeing a mental health professional (van Hout et al., 2006). Some of the postoperative psychological problems may reflect an increase of pre-existing distress, an emergence, or re-emergence of symptoms (Mitchell et al., 2001; Segal, Libanori, & Azevedo, 2002).

1.6.3 Bariatric Surgery and Quality of Life

Assessment of health-related quality of life is often used to better understand how an illness interferes with a person's day-to-day life (CDC, 2011a). After surgery, most bariatric patients experience improvement in health-related quality of life (Sarwer et al., 2005). Quality of life improvement peaks peak around 6 to 12 months post-surgically with a slight to moderate decrease at the 2-year follow-up (Karlsson, Sjostrom, & Sullivan, 1998).

1.7 Background and Rationale for the Study

Depressive and anxiety symptoms, correlates of psychological stress with regard to obesity, were found to be positive predictors of weight loss post-surgery (Herpertz et al., 2004). This predictability was speculated and explained as that patients who did not have depressive or anxiety disorder prior to surgery may be more satisfied with their weight and less willing to comply with post-surgical recommendations than patients who are upset by their obesity and motivated to diet once barriers to weight loss are reduced by surgery (Herpertz et al., 2004). However, more recent studies, such as the one done by Kinzl et al. in 2006, found that individuals with two or more psychiatric disorders, such as depression, show less weight loss after surgery than those without such disorders (Kinzl et al., 2006). Other studies found no association between weight loss and psychiatric disturbances (Herpertz et al., 2004).

Even though research findings are mixed in examining the predictive nature of pre-surgery psychiatric conditions such as depression and anxiety of post-surgical outcomes, there is considerable consensus concerning the prevalence of psychopathology in bariatric population prior to surgery as well as the positive change in psychopathology after surgery (van Hout et al., 2006). A recent study in the Archives of Surgery found the suicide rate after bariatric surgery to

be at least five times that of the general population (Omalu et al., 2007). Most people approach the surgery with a positive attitude. Thoughts about future weight reduction, health benefits, and improved quality of life are dominant while awaiting surgery. After surgery, however, reality does not always live up to the pre-surgical expectations, and some patients experience depression (Kodama et al., 1998). One study found that of pre-surgical patients with no depression, over one-third of the sample developed depression post-surgically (Ryden, Olsson, Danielsson, & Nilsson-Ehle, 1989).

Research has compared whether different types of bariatric surgery can achieve a greater weight loss in the long term (O'Brien & Dixon, 2003). In general, the quality of the comparative studies was low. In most of the studies, surgical groups, such as LRYGB versus LAGB, were far from comparable (Tice, Karliner, Walsh, Petersen, & Feldman, 2008). For example, patients who underwent LAGB in some of the studies were treated in Europe, whereas those who underwent RYGB were treated in the United States, which makes it difficult to determine whether the observed differences in outcomes reflect differences in the respective health care systems, the patient populations, or true differences between the procedures. However, results from these comparative studies have found that compared with LRYGB, patients who underwent LAGB experienced a greater incidence of late complications, reoperations, less weight loss (Bowne et al., 2006; Tice et al., 2008), decreased overall satisfaction (Bowne et al., 2006), but had lower short-term morbidity (Tice et al., 2008). However, studies on the effect of different types of surgery on post-surgical psychological wellbeing such as depression and anxiety, and the effect of different types of surgery on post-surgical quality of life measures are lacking. There is also relatively little research and evidence examining the value of

psychological traits as predictors of weight loss and post-surgery psychosocial functioning (Pull, 2010). In addition, studies that evaluate surgical and long-term complication and mortality, and quality of life between different surgeries are still limited (Tice et al., 2008).

Success following bariatric surgery is dependent on weight loss and improvement or cure of co-morbid conditions, and equally important, the improvement in eating behavior, psychosocial variables, and quality of life (Oria & Moorehead, 1998). Poor and less than ideal weight loss results following bariatric surgery may be attributed to physiologic factors (sex, age, baseline BMI), technical factors (port-related complications for lap-banding surgery), motivational factors, pre-surgical comorbidities, psychological factors, and pre-surgical eating behaviors (nibbling, gorging, sweet-eating, and binge eating) (Busetto et al., 2005). Clear consensus has been reached regarding the benefits of weight loss and its physiological comorbidities after patients receive bariatric surgery as the treatment to combat clinically severe obesity. Nonetheless, post-surgical complications and pre-surgical conditions can also lead to different long-term health status results in each individual. To ensure better bariatric surgery candidate selection and post-surgical support, it is crucial to understand the relationship between potential predictive variables and surgical success or improvement in health outcomes, such as weight loss, psychological health, and quality of life, after surgery. Even though no official definition of surgical success has been established, losing 50% of one's baseline excess weight has been found in literature. Besides weight loss, surgical success in other outcomes such as psychological health and quality of life is not defined in the literature. Therefore, success is not always used as a precise term with a clear cut-off point but rather a term that reflects improvement in health outcomes. Existing literature about potential predictors of success after

bariatric surgery is far from conclusive; it is still uncertain which factors can predict weight loss success (Sarwer et al., 2005; van Hout, Verschure, & Van Heck, 2005). Even when psychosocial functioning does not predict outcome, it is important to identify patient characteristics which may be linked to their prognosis, and to provide necessary pre- and post-surgical psychosocial interventions (van Hout et al., 2005).

Kodama and colleagues presented three case reports of morbidly obese patients (two women and a man) who underwent vertical banded gastroplasty and who subsequently fell into depression, thus suggesting the notion that when psychiatric characteristics are confirmed in obese patients, obesity surgery should be undertaken more prudently because the patients may manifest depression post-surgically. The concern is that depressed individuals may have reduced ability to adjust to the new lifestyle that is required for successful post-surgical outcomes in the long term. The pre-surgical psychiatric assessment is, therefore, essential for a decision on or indication for obesity surgery (Kodama et al., 1998). The presence of depression has been found to be predictive of weight loss after surgery (Clark et al., 2003), but little is available in the field of psychiatric disorder development after bariatric surgery such as gastric bypass (Herpertz et al., 2004; van Hout, Verschure, & van Heck, 2005).

A review done by Pull, which looked at articles and reports on new research findings that have been published between August 2006 and August 2009, concluded that there is a clear need for more substantial information with regard to reliable psychological predictors of weight loss and mental health after surgery although there is some evidence to support the notion that bariatric surgery candidates with abnormal psychosocial profiles are at risk for poorer surgical outcome and increased complications (Pull, 2010).

Although most bariatric surgery patients undergo a pre-surgical psychological evaluation, the potential effect of psychiatric disorders on weight loss is not well understood (Kalarchian et al., 2008). To members of the bariatric surgery team, the pre-surgical psychological evaluation plays an important role in identifying potential bariatric surgery candidates, who might have comorbid mental health conditions, which would in turn merit further evaluation, treatment, intervention and/or support. Some studies found that those with a psychiatric disorder, such as depression, show less postsurgical weight loss and thus, are not ideal for such surgery since it would hinder surgical success (Kinzl et al., 2006). On the other hand, other studies claim that no clear consensus has been reached, suggesting that psychiatric disorders should not be a negative indicator for surgery if proper management is present (Buddeberg-Fischer, Klaghofer, Sigrist, & Buddeberg, 2004). It is therefore not clear whether a patient should be denied surgery solely because depression is a current comorbidity. Patients with psychiatric disorders might be at greater risk for post-surgical complications but study results are conflicting and clear predictors have not been identified (van Hout et al., 2005). Obese patients consider quality of life impairment to be the most serious accompaniment of their disease (Kral et al., 1992). However, there is little research looking at predictors of quality of life. Thus, it is important to find predictors of post-surgical quality of life measures.

The current study sought to fill the gap in the literature by examining whether the effects of surgery on post-surgical outcomes differ between different surgery types, in particular, LRYGB versus LAGB, and also further explore the relationship between pre-surgical predictors such as baseline psychopathology (depression and anxiety) and demographics (age, gender, education, race/ethnicity, and baseline BMI), with post-surgical outcomes (depression, anxiety,

weight loss, and quality of life (total, physical function, self-esteem, sexual life, public distress, and work)). The current study may, therefore, help answer some of the questions that not only surgical candidates, but also health care providers, might have about whether a certain type of bariatric surgery would incur greater improvement in someone than that in the other with respect to the post-surgical outcomes considered in the study, given specific pre-surgical demographics and psychological characteristics of a patient.

1.7.1 Purpose of the Study

The number of bariatric surgeries performed in the United States has increased dramatically over the past decade. Since the mid-1990s, the number has increased tenfold with approximately 220,000 operations performed in 2009 (Prachand, 2011). Despite this increase, relatively limited research has been conducted regarding predictors of post-surgical psychological well-being. Although weight loss efficacy has been compared between different types of surgery, such as LRYGB and LAGB, other outcomes such as quality of life and psychological well-being after surgery have not been studied. The main purpose of this study is to explore the predictive value of baseline psychopathology and demographics for post-surgical outcomes. In addition, to examine whether LRYGB shows greater improvement than LAGB on post-surgical outcomes other than weight loss. With the findings, health practitioners can better advise patients on their likelihood of pre- to post-surgical improvement in outcomes analyzed in the study. Moreover, this knowledge could help health practitioners identify those who need additional pre- and post-surgical support in addition to better patient selection to improve post-surgical success.

1.7.2 Research Questions

Research Question 1: Overall Surgery Effect

What is the overall effect of bariatric surgery on 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], and quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for demographic factors (age, gender, education, race/ethnicity, and baseline BMI) and baseline psychopathology (depression and anxiety)?

Research Question 2: Effect of Surgery Type

What is the effect of gastric bypass surgery versus lap-banding surgery on 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], and quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for demographic factors (age, gender, education, race/ethnicity, baseline BMI) and baseline psychopathology (depression and anxiety)?

Research Question 3: Psychological Predictors of 1 Year Post-surgical Outcomes

Are baseline psychopathological factors (depression and anxiety) predictive of 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], and quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for demographic factors (age, education, gender, race/ethnicity, and baseline BMI), baseline psychopathology (depression and anxiety), and surgery type?

Research Question 4: Demographical predictors of 1 Year Post-Surgical Outcomes

Are baseline demographic factors (age, gender, education, race/ethnicity, and baseline BMI) predictive of post-surgical outcomes (weight loss, depression, anxiety [total, performance, and

social], and quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for baseline psychopathology (depression and anxiety) and surgery type?

1.7.3 Significance of the Study

With increasing demands for bariatric surgery (Santry, Gillen, & Lauderdale, 2005), there is a strong need for empirical data to enhance the process of pre-surgical screening practices and to ensure post-surgical success and support given that psychological disorders might decrease postsurgical compliance with necessary medical and dietary recommendations. The National Institutes of Health Consensus Development Conference Panel recommends pre-surgical assessment by a multidisciplinary team (van Hout, Hagendoren, Verschure, & van Heck, 2009). Identifying predictors of post-surgical outcomes will improve patient selection and provide health care providers more information for post-surgical patient support/counseling and pre-surgical consultation to improve surgical outcome success and long-term health maintenance and benefits.

Chapter 2: Review of the literature

2.1 Definition of Obesity

The World Health Organization (2010) classifies people with a BMI between 18.5-24.99 kg/m^2 as normal range, BMI $\geq$ 25 kg/m^2 as overweight, BMI 25-29.99 kg/m^2 as pre-obese, 30.00-34.99 kg/m^2 as obese class I, BMI 35.00-39.00 kg/m^2 as obese class II "severe obesity," and BMI > 40 kg/m^2 as obese class III "morbid obesity." In the surgical literature, people with a BMI > 50 kg/m^2 are classified as "super obese" (Almogy, Crookes, & Anthone, 2004) and BMI > 60 kg/m^2 are classified as "super-super obese" (Regan, Inabnet, Gagner, & Pomp, 2003). Once obese, the higher the BMI, the more health threatening it is, such as cardiovascular diseases, high blood pressure, sleep apnea, and gallstone/cholecystectomy (NIH, 1998).

2.2 Obesity Prevalence and Trends

Approximately 4.9% of the U.S. population (over 9 million Americans) currently suffers from morbid obesity. This includes 2.8% of men and 6.9% of women (Ogden et al., 2006).The percentage of people who are morbidly obese has increased from 2.9% in 1994 (American Obesity Association, 2006). The rates of morbid obesity are increasing 2-3 times faster than the general rates of obesity (Sturm, 2007). Obesity has long reached epidemic proportion in the US, affecting over 72 million adults (Bean, Stewart, & Olbrisch, 2008). From 2001-2002, the prevalence of obesity was 7.0% and increased to 8.5% in 2007-2008. The prevalence of morbid obesity grew, as well, from 5.1% in 2001-2002 up to 5.7% in 2007-2008 (Flegal et al., 2010). Severe obesity saw an increase from 18.5% in 2001-2002 to 19.5% from 2007-2008 (CDC/NCHS, 2010). Obesity can lead to other medical comorbidities, including chronic heart

problems, joint deterioration, sleep apnea, and lower self-esteem (Armstrong, Anderson, Le, & Nguyen, 2009). The cost of obesity can be taxing on both the society and the individual.

2.3 Magnitude of the Problem

Obesity is a serious issue because not only can it cause death, but the financial burden on both the individual and society can be great, not to mention the medical and psychological complications that could accompany obesity.

The leading causes of death in 2000 in the United States were tobacco (435,000 deaths; 18.1% of total US deaths), and poor diet and physical inactivity (365,000 deaths; 15.2%) (Mokdad, Marks, Stroup, & Gerberding, 2004). These figures show that smoking remains the leading cause of mortality, but poor diet and physical inactivity may soon overtake tobacco as the leading cause of death. According to the World Health Organization, elevated BMI is a major risk factor for non-communicable diseases such as: cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2008 worldwide; diabetes; musculoskeletal disorders (especially osteoarthritis - a highly disabling degenerative disease of the joints); and some cancers (endometrial, breast, and colon). The risk for these non-communicable diseases increases with increase in BMI.

Health complications associated with obesity include coronary heart disease, type II diabetes, cancers (endometrial, breast, and colon), hypertension (high blood pressure), dyslipidemia (for example, high total cholesterol or high levels of triglycerides), stroke, liver and gallbladder disease, sleep apnea and respiratory problems, osteoarthritis (a degeneration of cartilage and its underlying bone within a joint), and gynecological problems (abnormal menses,

infertility) (NIH, 1998). For a complete list of obesity related medical complications, please refer to Appendix A.

Numerous psychological problems may result from obesity. They include lack of self-esteem possibly leading to social isolation, feelings of insecurity and despair, somatisation, denial of emotional stress, difficulties making interpersonal contact and poor social adjustment (van Gemert, Severeijns, Greve, Groenman, & Soeters, 1998). It is well established that severely obese subjects, especially younger women with poor body image, are at high risk for depression (Dixon, Dixon, & O'Brien, 2003; Sjostrom et al., 2007). Additionally, severity of obesity in women seems to be associated with frequency of symptoms of depression. Women with class III (BMI $\geq$ 40 kg/m^2) obesity report a history of psychological complications and greater stress compared to women with obesity of class I and class II (Wadden et al., 2006).

The direct and indirect costs of obesity to the society is estimated at $147 billion annually, which represents nearly 10 percent of all U.S. medical expenses (Finkelstein, Trogdon, Cohen, & Dietz, 2009). In 2006, obese patients spent an average of $1,429 or 42% more on their medical care than those of normal weight (Finkelstein et al., 2009). The direct healthcare costs in the United States for obesity during 2010 are estimated to be $194 billion, and Americans are spending US$59 billion on all available options to fight weight related concerns (O'Brien, 2010).

Obesity accounts for 8.5% of Medicare expenditure, 11.8% of Medicaid expenditure, and 12.9% of private insurance expenditure (Finkelstein et al., 2009). In 2006, health insurance companies, such as Medicare, Medicaid and private companies, spent 9.1% on costs associated with obesity, including prescription drugs, compared to 6.5% in 1998 (Finkelstein et al., 2009). This translates to an almost 30% increase in expenses. Medicare prescription drug payments for

obese recipients are about $600 a year more than for normal weight recipients. The rise in obesity prevalence added $40 billion to the annual healthcare bill for obesity (Finkelstein et al., 2009).

On September 21, 2010, released by The George Washington University School of Public Health and Health Services' Department of Health Policy, a report titled *A Heavy Burden: The Individual Costs of Being Overweight and Obese in the United States*, determined a cost of obesity to an individual by looking at measures such as indirect costs, lost productivity, and direct costs, such as obesity-related medical expenditures (Dor, 2010). The report shows that the individual cost of being obese is $4,879 for women and $2,646 for men annually. With the added value of lost wages due to disability and mortality, the numbers rise to $8,365 and $6,518, respectively. Compared to individuals of healthy weight, obese men pay six times and obese women pay nine times more for their medical care (Dor, 2010).

2.4 Treatment of Obesity

2.4.1 Conventional or Non-Surgical Treatment (Diets, Drugs, and Physical Activity)

Diets, drugs, and physical activity are considered conventional obesity treatments. Diets such as the Atkins (low carbohydrate), Zone (high protein, low carbohydrate), Ornish (very low fat), and Weight Watchers, have been studied in obese populations with similar weight loss at 1 year (Thompson, Cook, Clark, Bardia, & Levine, 2007). Dietary approaches to weight loss typically focus on energy restriction, high protein diets, increased intake of calcium and dairy products or fruits and vegetables, and low-glycemic index diets, but none of these diets have shown to have long-term success (Thompson et al., 2007). Drugs such as FDA approved appetite suppressants for short-term use (phentermine, benzphetamine, and phedimetrazine), and

impairments of energy absorption drugs such as Orlistat, are the two main categories. However, not only do the drugs not show long-term effects, but might cause other complications. For instance, those taking an appetite suppressant (rimonanbant) have reported having increased incidence of depression and anxiety as compared to those in the placebo groups. Blood pressure and heart rate increased modestly with sibutramine use. Another drug, Orlistat, even though shows improvement in alanine transaminase levels and steatosis in patients with nonalcoholic fatty liver independent of weight loss, reduction in LDL cholesterol, glucose, insulin and hemoglobin A1c as a result of weight loss and independent of weight loss (probably due to less fat absorption), it is expensive and may not be covered by insurance (Thompson et al., 2007).

No or modest weight loss has been found by most studies with exercise alone or with exercise added to diet (Thompson et al., 2007). Based on existing research, conventional methods alone have not been effective in achieving medically significant long-term weight loss in severely obese adults. The majority of patients who take the conventional weight loss route appear to regain all the weight lost over the subsequent 5 years (Khwaja & Bonanomi, 2010). Drug combination appears to have an unacceptably high association with cardiac valvular disease and has been withdrawn from therapeutic use because of these potentially life threatening sequelae (Kaplan, 2005). For instance, the euphoric and addictive effects of amphetamines, the hypertensive and arrhythmogenic effects of the adrenergic agents, the cardiac valvular effects of fenfluramine, and the steatorrhea associated with orlistat, have limited the use of these drugs significantly and, in some cases, have required their complete withdrawal from the market (Kaplan, 2005).

Not only has dietary approach shown no long term effect (Fisher & Schauer, 2002), short term weight loss by diet drugs is often associated with depression, anxiety, irritability, weakness and preoccupation with food (Doherty et al., 1993). The ill side effects limit the use of these drugs significantly and in some cases have required their complete withdrawal from the market (Kaplan, 2005).

2.4.2 Operative/Surgical Treatment

One in three adults is obese in the U.S. (Hedley et al., 2004). To combat obesity, bariatric surgery has emerged as the most effective treatment for class III obesity because bariatric surgery procedures provide greater and more durable weight reduction than behavioral and pharmacological interventions for clinically severe obesity (Bult, van Dalen, & Muller, 2008). Surgical treatment is medically necessary because it is found to be the most effective method of achieving long term weight control and reducing medical complications for the morbidly obese (Bult et al., 2008). A typical weight loss after bariatric surgery has been cited to be 20–40 kg or a 10–15 kg/m^2 reduction in BMI (Bult et al., 2008). After banding or bypass, a loss of 30–35 kg, representing 50–60% of excess weight, has also been cited (O'Brien, 2010). This weight loss has been shown to be associated with major improvements in or complete resolution of multiple common and serious health problems, plus improvements in quality of life and in survival (O'Brien, 2010). Although the initial weight loss after surgery cannot be fully maintained in the long term, the weight loss effect is, however, maintained at 50% excess weight loss (EWL) for gastric bypass patients who still attend follow-up 5 years after surgery (O'Brien, 2010) and 25% 10 years after surgery (Sjostrom et al., 2007).

Not a cosmetic instrument, bariatric surgery is used to help clinically severely obese people lose weight when other weight loss programs, such as dieting, behavioral modification, psychotherapy, exercise, and pharmacological interventions, have not worked. The American Society for Metabolic and Bariatric Surgery (ASMBS) recommends that bariatric surgery should only be performed on morbidly obese individuals or obese individuals with certain co-morbid medical conditions (ASMBS, 2009). It is estimated that approximately 22 million people in the U.S. are medically eligible for bariatric surgery (Martin, Beekley, Kjorstad, & Sebesta, 2010). However, before bariatric surgery candidates can receive a surgery of their choice, they must demonstrate failure in their efforts at one 'good faith attempt' to lose weight through non-surgical methods. Some insurance companies require proof from the patients to show that they have undergone some type of pre-surgical dietary counseling. However, there is data demonstrating that insurance-mandated pre-surgical dietary counseling is an obstacle to patient access for surgical treatment of severe obesity and has no impact on weight loss outcome or postsurgical compliance, and hence, should be abandoned by the insurance industry (Jamal et al., 2006).

Data from the National Impatient Sample between 2003 and 2008 showed that the number of bariatric operations peaked in 2004 at 135,985 cases and plateaued at 124,838 cases in 2008; the annual rate of bariatric operations peaked at 63.9 procedures per 100,000 adults in 2004 and decreased to 54.2 procedures in 2008; the proportion of laparoscopic bariatric operations increased from 20.1% in 2003 to 90.2% in 2008 (Nguyen et al., 2011). Increase in the use of the laparoscopic techniques, introduction of LAGB, and greater acceptance of the minimally invasive option by patients were partly and greatly responsible in the observed

increase and popularity in bariatric surgery rates during this period (Nguyen et al., 2011). In addition, bariatric surgery has become a popular surgery due to its low mortality rate of less than 1% (Omalu et al., 2007). Inpatient mortality following bariatric surgery for all groups was 0.1 % (ASMBS, 2009). Based on the rising number of bariatric surgeries performed in the last decade, it is evident that it has become one of the most popular treatments for clinically severe obesity. The estimated number of bariatric surgical procedures increased from 13,365 in 1998 to 72,177 in 2002 ($p < 0.001$) (Santry et al., 2005). There is research showing that 5 years after surgery, the majority of obese individuals whose surgical weight loss and improvement in quality of life deteriorate, but their BMI was still significantly lower than that before surgery (Folope et al., 2008).

There is no absolute contraindication to bariatric surgery. However, some relative contraindications to surgery found in the literature "may include severe heart failure, unstable coronary artery disease, end-stage lung disease, active cancer diagnosis/treatment, cirrhosis with portal hypertension, uncontrolled drug or alcohol dependency, and severely impaired intellectual capacity" (SAGES, 2008).

The three most commonly performed bariatric surgery procedures, based on their mechanism of action, are mal-absorptive procedure, restrictive procedure, and combination procedure (Brethauer et al., 2006).

During a mal-absorptive procedure, a part of the small intestine will be connected to a part of the stomach so that certain areas of the intestine will be bypassed. A major part of this surgery is that it works by creating mal-absorption, which keeps the body from being able to absorb certain nutrients. Stomach size is significantly reduced after this type of surgery. Thus,

patients who select this surgery need to be aware of the need to consume higher doses of dietary supplements to avoid medical complications such as malnutrition. This procedure accounts for 5 % of bariatric surgeries in the United States (Brethauer et al., 2006).

LAGB, vertical banded gastroplasty ("stomach stapling"), and sleeve gastrectomy fall into the category of restrictive procedure. These procedures physically limit the amount of food a patient can consume by reducing the size of the stomach or the amount it can expand. This is like the gastric bypass option but it does not work with the intestine. In many cases, adjustable lap bands are used at the top of the stomach to help control the intensity of the surgery but there are concerns about band slippage.

RYGB is a common combination surgery, which surgically reroutes the digestive tract so that food actually bypasses most of the stomach. In RYGB, a small pouch near the stomach is created through stapling and connected to the small intestine. The upper area of the intestine will then be reattached to a new configuration in order to properly redirect nutrients and other materials. Stomach size is reduced after this type of surgery as well. RYGB is the most commonly performed bariatric surgery procedure worldwide, representing nearly 65% of all bariatric operations and accounts for 80–90% of bariatric surgeries performed in the United States (van Hout & van Heck, 2009).

2.4.2.1 Laparoscopic Surgeries and Open Surgery

There are two ways to perform bariatric surgery, namely laparoscopic and open. Laparoscopic surgeries are minimally invasive surgeries. Compared to open surgery, laparoscopic surgeries create less pain, fewer wound complications, quicker recovery time and faster return to normal activity (Prachand, 2011). Laparoscopic bariatric weight loss surgeries

are performed via ports placed in the abdominal wall through which instruments are passed to operate on the internal organs and, due to small incisions, there is also little scarring (Nguyen, Ho, Palmer, & Wolfe, 2000) and no effect on bowel activity after receipt of laparoscopic surgeries.

In contrast, open surgery is performed through a larger incision and abdominal wall retractors are used for exposure. Surgical insult is found to be less when reducing the size of the surgical incision and the trauma associated with the surgical exposure, so laparoscopic might seem preferential compared to open surgery. In addition, less blood loss, a shorter hospital stay, and faster convalescence, or more rapid quality of life improvement 1 year after surgery are some other benefits of laparoscopic gastric bypass surgeries over open surgeries (Nguyen et al., 2001). Despite long surgical time and higher initial surgical costs for laparoscopic gastric bypass surgery, it will adequately offset the lower hospital costs due to shorter hospital stays (Nguyen et al., 2001). However, whether laparoscopic is suitable or not will depend on the candidate's body habitus, previous intra-abdominal surgery, and so forth.

Long-term weight loss after laparoscopic and open RYGB should not differ, as the primary difference between the two techniques is largely the method of access and not the gastrointestinal reconstruction (Puzziferri, Austrheim-Smith, Wolfe, Wilson, & Nguyen, 2006). Despite the advantages of the laparoscopic approach, open bariatric surgery still plays a prominent role in the management of clinically severely obese patients. Relative contraindications for laparoscopic bariatric surgery include patients with extremely high BMI with a current limit of BMI=70 kg/m^2 (Schauer, Ikramuddin, Gourash, Ramanathan, & Luketich, 2000), multiple previous upper abdominal surgeries or prior bariatric surgery (O'Brien, Dixon,

Laurie, & Anderson, 2005). Another limitation of the laparoscopic approach is the steep learning curve of this technically challenging procedure for the surgeon. Thus, it is not suggested for surgeons who have not been trained specifically in this technique (Schauer et al., 2000).

2.4.2.2 Laparoscopic Surgeries in the Study – Laparoscopic Roux-en-Y Gastric Bypass Surgery and Laparoscopic Adjustable Gastric Banding Surgery

In the current study, patients received either the LRYGB or LAGB. After LRYGB, patients are usually able to walk and move without discomfort within hours after surgery (Schauer et al., 2000). Typical hospital stay is 2-3 days and most patients are able to return to normal activities within 7-10 days (Hospital, 2010). Patients who undergo LAGB are usually discharged from the hospital within 24 hours of admission. Most patients are able to return to work within one week after lap-band surgery and begin more strenuous exercise (i.e. light aerobic exercise) within one month. The procedure can either be done in an outpatient setting in select patients where patients go home on the same day (Watkins, Montgomery, & Ahroni, 2005). Adjustments to the lap-band are done as outpatient procedures in the surgeon's office. They are short procedures and patients can immediately return to normal activities following the adjustment without the need for hospitalization and parenteral and/or enteral feeding that would have been required if nonadjustable gastric restriction procedures were performed (Busetto et al., 2003). Compared to RYGB, LAGB is a less-demanding procedure technically with shorter operating time, shorter length of hospital stay, and fewer initial complications (Tice et al., 2008).

2.4.2.3 Laparoscopic Adjustable Gastric Banding Surgery

LAGB surgery is the least invasive type of bariatric surgery. It is a reversible procedure in which the stomach is neither opened nor stapled. LAGB utilizes the "Lap-Band" system, in which a band is placed around the outside of the upper stomach (similar to a belt) to create an hourglass shape with a small pouch on top connected to the bottom with a narrow outlet. The band is connected with tubing to an access port placed beneath the skin of the abdomen. After surgery, adjustments are made to the band by adding or removing saline solution through the port to tighten or loosen the band. Tightness of the band controls the amount of food that can pass from the small upper stomach to the larger lower stomach. When the band is tighter, the patient feels full sooner with less food and requires a more restrictive diet. A looser band allows more food to pass between the upper and lower stomach allowing for increased food consumption (Woodward, 2003).

2.4.2.4 Laparoscopic Roux-en-Y Gastric Bypass Surgery

LRYGB is a non-reversible surgical procedure developed by Wittgrove, Clark, and Tremblay (1994) based on the original Roux-en-Y procedure pioneered by the French surgeon Dr. Roux in the 1800s. In this procedure, the stomach is cut with a stapler into two parts, a smaller upper part (which is measured to hold approximately 1 tablespoon of liquid) and a larger lower part of the stomach. The small upper part becomes the new stomach, which will hold food, and the lower part of the stomach will no longer contain any food. The small intestine is then cut a few inches below the stomach to be used as the "Roux limb", which is attached to the new smaller stomach. The bowel is connected side-to-side forming the "Y" and the small bowel is connected to the new stomach using a stapler instrument (Deitel, 2007).

"Dumping syndrome" symptoms can be found in approximately 50-75% of patients who undergo RYGB (Heinlein, 2009). "Dumping syndrome" occurs most commonly around the time when gastric bypass surgery patients transition back to a solid food diet. However, it sometimes becomes a chronic post-surgery issue. "Dumping syndrome" symptoms usually occur during a meal or within 30 minutes following a meal, but may also occur 1-3 hours after eating. Symptoms of "dumping syndrome" include nausea, vomiting, abdominal pain/cramps, diarrhea, dizziness/lightheadedness, bloating and belching, fatigue, heart palpitations/ rapid heart rate, sweating, weakness, shakiness, feelings of anxiety and nervousness, fainting, and mental confusion (Mayo Clinic, 2010b). "Dumping syndrome" is usually caused by overeating, eating refined sugars, and drinking liquids with meals (Appendix B), causing food and gastric juices from the stomach to move to the small intestine in an unregulated, abnormally fast manner (Mayo Clinic, 2010a), resulting in a fall in blood volume and thus significant sympathetic stimulation from various pressoreceptors (Deitel, 2008). To help reduce symptoms, patients should delay any liquid intake until at least 30 minutes after a meal (Tack, Arts, Caenepeel, De Wulf, & Bisschops, 2009).

2.4.3 Surgery Concern

The mortality rate among patients undergoing bariatric operations varies depending on the procedure and patient characteristics but is generally quoted as between 0.1-2.0% for early mortality (death < 30 days) and 0.1-4.6% after 30 days (Bult et al., 2008). According to the Centers of Excellence report, although the severely obese could be presented with serious surgical risks, a 0.35% 90-day mortality rate is documented throughout the United States, similar to the complication rates after cholecystectomy (Pories, 2008).

Following surgery, patients are recommended to change their eating habits. Immediately following surgery, they are prescribed a liquid diet for 1-2 weeks. They then transition to a pureed food diet, then a soft food diet, and eventually return to a solid food diet approximately one month after surgery (Appendix C). During the 3 to 6 months following bariatric surgery, patients could experience many symptoms as the body reacts to the rapid weight loss: body aches, feeling tired (as if you have the flu), feeling cold, dry skin, hair thinning and hair loss (Blackburn, Bistrian, & Hoag, 1977), and mood changes. These symptoms are similar to those observed on a VLCD (Saris, 2001). During the first 6 months following bariatric surgery, patients may experience vomiting and intense pain if they eat too much or eat too fast. It is recommended that patients eat several very small meals throughout the day (Parkes, 2006). Alcohol is not recommended after bariatric surgery due to high content of sugar and "empty calories." Gastric bypass surgery affects the way that the body metabolizes alcohol (Woodard, Downey, Hernandez-Boussard, & Morton, 2011). Post-surgery, alcohol is rapidly absorbed into the bloodstream, resulting in patients feeling drunk more quickly from consuming less alcohol and taking a longer time to return to sobriety (Hagedorn, Encarnacion, Brat, & Morton, 2007). Nutritional complication post-surgery is another area of discussion in research. Significant thiamine deficiency can occur acutely after bariatric surgery in patients with prolonged vomiting and can be associated with severe and sometimes irreversible neurological symptoms (Flancbaum, Belsley, Drake, Colarusso, & Tayler, 2006).

2.4.4 Traits of Bariatric Surgery Candidates

Studies investigating the relationship between bariatric surgery candidates and psychopathology have found that up to 84% of bariatric surgery candidates had a life-time

history of major mental disorders and 40-72% had a personality disorder (Black, Goldstein, & Mason, 1992). Bariatric surgery candidates have been found to have higher levels of psychosocial dysfunction, including difficulties in social relationships, than a control group of similar weight participants who were treated non-surgically (Herpertz et al., 2003). Nearly one third of bariatric surgical candidates have a history of substance abuse disorder (Song & Fernstrom, 2008). These findings may indicate that bariatric surgery candidates comprise a specific group of individuals whose weight-related psychosocial distress has caused them to choose the route of surgery or who have been unsuccessful at conventional weight loss efforts.

There is an increased prevalence of history of sexual abuse or childhood maltreatment in obese individuals. One study found that 69% of their sample of morbidly obese bariatric surgery male and female candidates reported childhood maltreatment (Grilo et al., 2005). Research points to higher rates of psychopathology and trauma in overweight and obese individuals. Obese individuals may attempt to cope with this psychopathology and trauma by overeating or binge eating. Additionally, psychopathology may be related to degree of obesity, but research findings have been mixed regarding suicidality and obesity. One study found that people who are obese are more likely both to contemplate suicide and to attempt suicide (Mather, Cox, Enns, & Sareen, 2009).

Self-esteem deficiency also has been shown in patients before gastric bypass surgery (Glinski, Wetzler, & Goodman, 2001). Body image dissatisfaction is significantly greater in the clinically severely obese compared with normal-weight control subjects; body image dissatisfaction is more prominent in women and is associated with a higher incidence of depression, low self-esteem, and perfectionism (Song & Fernstrom, 2008).

Males and females differ significantly on suspected psycho-surgical risk factors. Assessments of bariatric surgery candidates should recognize that males and females have different baselines for psycho-surgical risk factors (Kolotkin et al., 2008). Kolotkin and colleagues found that women have higher rates of depression, and lower BMI (Kolotkin et al., 2008; Mahony, 2008), and men have higher rates of sleep apnea. In addition, women are younger, and are less likely to be married; women's reduced health-related quality of life, particularly in self-esteem, sexual life, and physical functioning, and their greater rates of depression, might play a role in their decision to seek bariatric surgery. In another study that also focuses on gender difference found that females have tried significantly more diets than males, are more likely to report a history of depression and anxiety than males, received significantly higher scores on the PsyBari Depression Index, Beck Depression Invetory II (BDI-II) scores and the PsyBari Social Anxiety Index than males (Mahony, 2008). PsyBari is a test that detects and measures psycho-surgical risk factors. Although causality is not determined, this study by Kolotkin et al. (2008) is a first step toward understanding why women seek surgery 5 times more often than men, a ratio that translates to about 85% of women and 15% of men among those seeking bariatric surgery (Corsica, Azarbad, McGill, Wool, & Hood, 2010).

Bariatric surgery is usually considered for patients with a BMI of more than 40 kg/m^2 or those with a BMI of more than 35 kg/m^2 with concomitant obesity-related conditions after failure of conventional treatment (Bult et al., 2008). Therefore, surgery candidates' initial BMI immediately prior to receiving bariatric surgery is usually 35 kg/m^2 or above. However, there is research indicating that the application of the minimal BMI of 35 kg/m^2 as the major prerequisite for access to a bariatric surgical program is no longer appropriate because the index, now

incorporated in the requirements of Medicare, Medicaid and most private carriers, does not reflect the degree or distribution of adiposity. In addition, it discriminates unfairly on the basis of gender, race, age, fitness, and body fat composition (Pories, Dohm, & Mansfield, 2010). Furthermore, bariatric surgery can also induce full and durable remission of such comorbidities as type 2 diabetes even in patients with BMI < 30 kg/m^2, so increasing evidence is supporting the notion that new guidelines for admission must be pursued (Pories et al., 2010) .

2.4.5 Psychological Evaluation Before Surgery – As a Screening Tool

Pre-surgical psychological evaluation, as part of the screening routine for bariatric surgery program admission, serves as an important tool for members of the bariatric surgery team and may be crucial in identifying potential bariatric surgery candidates with comorbid mental health condition, which would, in turn, merit further evaluation, treatment, intervention and/or support. Some studies found that those with a psychiatric disorder such as depression, show less postsurgical weight loss and, thus, are not ideal for such surgery because it would hinder surgical success (Kinzl et al., 2006). Other studies claimed that no clear consensus has been reached regarding psychiatric disorders as predictors of post-surgical outcomes, so less weight loss incurred by those with psychiatric disorders should not be negative indicator for surgery if proper management is present (Buddeberg-Fischer et al., 2004). A survey sent out to 103 psychologists throughout the U.S. revealed significant variability in the number of evaluations that psychologists complete and in their choice of instruments to make clinical decisions. For most candidates, the evaluation results in psychological clearance for surgery (Walfish, Vance, & Fabricatore, 2007). However, approximately 15%, on average, are delayed or denied surgery for psychological reasons. Although previous studies reported rates of deferral

or denial that were more than double than those found in this survey, the wide variability mentioned previously is consistently observed among these studies (Walfish et al., 2007). "It appears that some evaluators recommend virtually all of the candidates they see for surgery, whereas others have much more stringent criteria that candidates must meet before they receive psychological clearance" (Walfish et al., 2007).

The most common reasons for delaying or denying surgery were significant psychopathology (including psychosis or bipolar disorder), untreated or undertreated depression, and lack of understanding about the risks and post-surgical requirements of surgery, which were reported by 51%, 39%, and 30% of respondents, respectively (Walfish et al., 2007). Based on a review of literature, approximately 25% of bariatric surgery patients reported treatment from a mental health professional at the time of surgery, 12% to 38% reported using psychiatric medications and between 3% and 20% of surgery candidates were excluded from surgical treatment because of psychiatric complications (Sarwer et al., 2005).

Some tests utilized by psychologists in their evaluations are the following: MMPI-2, Beck Depression Inventory, Millon Behavioral Medicine Diagnostic, Personality Assessment Inventory, Eating Disorder Inventory, Millon Clinical Multiaxial Inventory, Beck Anxiety Inventory, Weight and Lifestyle Inventory, Millon Behavioral Health Inventory, Shipley Institute of Living Scale, Mini-Mental Status Examination, and Quality of Life Inventory. The majority of obesity surgical programs use psychological evaluations; however, the exclusion criteria for surgery vary greatly (Bauchowitz et al., 2005). Thus, establishing uniform guidelines for the screening of bariatric surgery candidates is necessary. The question remains as to how psychologists should base their recommendations or conclusions for surgery admission.

Recent reports suggest an increase in the risk of suicide among patients who have undergone bariatric surgery compared with similarly obese patients who have not undergone such procedures (Omalu et al., 2007). Although the cause of increased suicide phenomenon can be attributable to many factors, such as pre-existing mental disorders and severe adjustment problems in the post-surgical period, it is crucial for bariatric surgeons to carefully evaluate their patient's psychological risk before surgery is performed.

2.5 Effects of Bariatric Surgery

2.5.1 Effect of Bariatric Surgery on Overall Health

Effective weight loss has been shown to be achieved in clinically severely obese patients after undergoing bariatric surgery (Brethauer et al., 2006). A substantial majority of patients with diabetes, hyperlipidemia, hypertension, and obstructive sleep apnea experienced complete resolution or improvement (Buchwald et al., 2004). However, bariatric surgery causes anatomic and physiological changes, which can affect both nutritional intake and psychological attitudes (Song & Fernstrom, 2008). Modifications of the gastrointestinal tract diminish the ability to absorb nutrients, electrolytes, and bile salts, cause dehydration, lactose intolerance, protein calorie malnutrition, mood and personality disorders, destructive eating behaviors, and poor body image (Song & Fernstrom, 2008). Psychological issues are often present in patients with clinically severe obesity and can affect surgical outcomes. For instance, "nearly one third of patients undergoing bariatric surgery also have a history of substance abuse disorder" (Song & Fernstrom, 2008). Bariatric surgery leads to sustainable, long-term weight loss and may be curative for such obesity-related comorbidities such as diabetes and obstructive sleep apnea in severely obese patients (Khan, Babb, Kaul, Williams, & Miller, 2009); however, some of the

common short-term complications of bariatric surgery are wound infection, stomal stenosis, marginal ulceration, and constipation, as well as symptomatic cholelithiasis, dumping syndrome, persistent vomiting, and nutritional deficiencies, which also may present as long-term complications (Virji & Murr, 2006). Van Hout and colleagues found that bariatric surgery leads to improvement in both weight loss and its comorbidities, as well as psychological comorbidities, although a significant minority of bariatric surgery recipients do not show significant psychological benefit post-surgery (van Hout et al., 2006).

2.5.2 Effect of Bariatric Surgery on Weight/BMI

Bariatric surgery represents a unique phenomenon. It greatly reduces an individual's weight over a relatively short period of time. On average, patients may lose upwards of 60% of their excess body weight within 6 months following gastric bypass surgery (Wittgrove & Clark, 2000). The amount of weight loss represents around one-third of pre-surgical weight (Herpertz et al., 2004). Weight loss will slow after 6 months but continue for 1-3 years following surgery (Monteforte & Turkelson, 2000). Adherence to a restricted diet after surgery is difficult for clinically severely obese individuals to maintain (Sarwer et al., 2005), and this may be related to an increase in psychopathology following bariatric surgery in some individuals.

A review article assessing the importance of lifestyle and psychosocial factors for weight loss maintenance after weight loss surgery suggested that weight drops faster initially, particularly during the first year after surgery and then slows down (Zalesin et al., 2010). The same article also suggested that although a modest weight regain is observed in most patients after the initial weight loss, about 15% of patients eventually regain 15% or more of excess weight lost in the first year or two after the surgery. Weight regain usually begins at about 18-24

months in about 30% of patients (Hsu et al., 1998). According to the review, binge eating behavior and lower metabolism may contribute to weight regain. The review did not identify an association between pre-surgical psychological status of obese individuals and their post-surgical weight loss outcomes. A study done by McDonald and colleagues looking at the reduction of progression and mortality of non-insulin-dependent diabetes after gastric bypass surgery found that the surgical patients lost 62.4% of excess body weight during the first year after the surgery and regained some weight in the next few years, reducing the weight loss percentage to 50% by 14 years check-up after the surgery (MacDonald et al., 1997).

A prospective long-term SOS Study followed 4047 obese subjects for an average of 11 years (Sjostrom et al., 2007). The subjects were randomized to bariatric surgery or conventional treatment. Those who received conventional treatment did not change their weight. Conversely, participants who underwent surgery lost 20-32% of their baseline weight, depending on the type of surgery, over the first two post-surgical years. During the next 8-10 years, weight loss among the surgical participants was stabilized at 14-25%. After 15 years, weight losses were 13-27%. In the surgical arm, those who underwent gastric bypass had the best % weight loss and weight stabilization results, followed by those with vertical-banded gastroplasty and then those with lap-banding surgery.

In a retrospective study, 200 patients were divided into sub-groups according to the period of time between the bariatric surgery and the study data collection: very short (3 months to 1 year), short (1–2 years), medium (2–5 years) and long-term (5–10.5 years). The study found that while weight loss occurred during the first 5 years after the surgery, the next 5 years were characterized by partial weight regain (Folope et al., 2008). The weight of patients at 5 and 10

years after the surgery was not different from their weight at 1 year after surgery. Therefore, patients lost most of their excess body weight during the first 5 years post-surgery. The maximal drop in BMI was obtained 5 years post-surgically. A limitation of the study was that patients differed in their follow-up time.

In summary, after bariatric surgery, most patients lose a significant amount of weight, with average weight loss of 20%-32% of body weight or 40-60% of excess body weight, within the first 1 to 5 post-surgical years. However, there is a definite weight regain after initial weight loss with about 15%-30% of surgery patients regaining between 5% and 15% of excess body weight within 2 -15 years after the surgery. Binge eating behavior and lower metabolism may contribute to weight regain after surgery.

2.5.3 Effect of Bariatric Surgery on Mental Health

Most studies report a general tendency for psychopathology to decrease and normalize following bariatric surgery (Green et al., 2004; Sarwer et al., 2005). These psychological and interpersonal improvements, such as improvements in negative self-esteem, drive for thinness, body dissatisfaction, anxiety, eating disorder, personality disorders (borderline, avoidant, passive-aggressiveness) have been speculated to be directly related to weight loss (Guisado et al., 2002). Nonetheless, psychological improvements have been found in patients who remained obese or those where no substantial weight loss was observed in the weeks immediately following surgery (Quality of Life, 2001). A review article by van Hout et al. (2006), focusing on psychosocial functioning following bariatric surgery, found that while some studies showing no substantial post-surgical change in psychopathology, some report moderate to severe psychological problems after surgery, “even after adequate weight loss, such as hypersensitivity

to criticism and difficulties in the expression of aggressive feelings." This review article states that the same pattern as described above holds for depressive symptoms, noting that various studies report a post-surgical decrease in depression to normal values even after long follow-up periods while other studies suggest that improvements in depressive symptoms lag behind the affective state of reference groups. In addition, the same review article suggests that some studies fail to find any difference between pre- and post-surgical depressive symptoms while others report patients dealing with depression and anxiety after surgery, and even patients attempting and committing suicide. In one study, post-surgical depressive symptomatology appeared to be especially apparent in patients with greater weight loss (Ryden et al., 1989), which might seem counterintuitive. In this study, twenty-one grossly obese patients were studied before and repeatedly after gastroplasty. Eighteen months after surgery, three groups of patients were identified which had similar pre-surgical weights but showed significantly different patterns of weight loss. About one-third of the patients were considered unsuccessful (less than 20% weight loss). Mild to moderate depressive reactions were found in two thirds of the patients post-surgically and were significantly more frequent among the successful patients. Acute depressive episodes, severe enough to require professional intervention, occurred in four patients, three of whom belonged to the successful group. The study suggests that the marked weight loss as such leads to problems of adaptation, which in turn may trigger depressive reactions.

In general, research on bariatric surgery does show that depression related to weight tends to decrease after surgery (Maddi et al., 2001; Masheb et al., 2007). Psychological outcomes, such as depression, anxiety, and eating disorders tend to improve significantly after post-surgical weight loss (Thonney et al., 2010). It appears to be ego-syntonic to believe that when the weight

is decreased, so is the depression. For a subset of depressed patients, the weight is actually a symptom of depression rather than the other way around (Alexander, 2008). For these people, weight loss may be disappointing in that they may still be depressed at goal weight. So far research has shown that bariatric surgery is not a cure for depression. However, whether it is possible that certain types of bariatric surgery could worsen a patient's psychological wellbeing still remains inconclusive. Thus far, if already severely depressed, bariatric surgery is usually recommended to be postponed until depression decreases whenever possible (Wadden et al., 2001). Depression after bariatric surgery is undoubtedly a possibility. Therefore, it is strongly recommended that each patient receive education about post-surgical depression, including the recent study showing the elevated rate of suicide (Omalu et al., 2007). There is a potential vulnerability that should be addressed, but all of the facts concerning this particular finding still need much research investigation. Furthermore, some studies show that bariatric surgery can improve patients' moods while the other studies conclude that depression can appear or worsen in the presence or absence of comorbidities.

Shortly after surgery, patients report improvement in their body image, but with time, some of them still feel overweight or are discontent with the increasing skin-folds (Dixon et al., 2002). In accordance with these last findings, there are studies reporting that patients who were satisfied with their appearance post-surgically had less weight loss than dissatisfied patients due to less skin surplus while other studies suggest the opposite (van Hout et al., 2006). Although most studies are optimistic and report broad psychological improvements, a significant minority of patients do not benefit psychologically from surgery. Some studies even report that up to 40%

of their patient group post-surgically had to deal with psychiatric disorders and that 25% reported seeing a mental health professional (van Hout et al., 2006).

2.5.4 Effect of Laparoscopic Adjustable Gastric Banding (LAGB) versus Laparoscopic Roux-en-Y Gastric Bypass (LRYGB) on Post-Surgical Outcomes

In terms of post-surgical weight loss outcomes, RYGB shows more favorable effect than LAGB. However, those who receive laparoscopic adjustable gastric banding show lower short-term morbidity than those treated with RYGB, but reoperation rates are higher among LAGB patients (Tice et al., 2008). Weight loss differences tend to diminish over time (Jan, Hong, Pereira, & Patterson, 2005).

2.5.5 Predictors of Surgical Health Outcomes

Successful outcomes depend on the patient's ability to implement lifestyle changes, which are affected by personality, psychosocial functioning, and eating behavior (van Hout et al., 2009). In order to ensure optimal surgical weight loss and other health outcomes such as psychological wellbeing, efforts have been made to identify potential predictors, which may serve as bariatric surgical program exclusion criteria. Predictors of interest can be seen as barriers to surgical success. When identified, it could provide health care providers and patients more information on the likelihood of post-surgical success, such as weight loss and psychological wellbeing, psychosocial wellbeing, or overall quality of life.

Psychosocial predictors of bariatric surgery outcome are essentially unknown. A recent study found that the presence of an Axis-I disorder, defined as any mental disorder that need clinical attention, particularly a mood or anxiety disorder, is associated with poorer weight outcomes at 6 months, after controlling for covariates such as gender, age, race, and baseline

BMI (Kalarchian et al., 2008). Psychosocial variables, psychological disorders, and demographic variables have also been observed as potential pre-surgical predictors. For instance, a review done by Pull which looked at articles and reports on new research findings that have been published between August 2006 and August 2009, concluded that there is a clear need for more substantial information on reliable psychological predictors of weight loss and mental health after surgery (Pull, 2010). Nevertheless, there is some evidence to support the notion that bariatric surgery candidates with abnormal psychosocial profiles are at risk for poorer surgical outcomes and increased complications. Another review by van Hout and colleagues also found that although predictor variables such as psychosocial functioning, personality, self-esteem, self-criticism, rigidity, history of sexual abuse, marital satisfaction and coping, have been studied, results are conflicting. In addition, no substantial psychosocial variable has been found to have predictive value for weight loss after surgery (van Hout et al., 2005).

Age and gender (Kinzl et al., 2006; Sczepaniak et al., 2012; van Hout et al., 2005), socio-economic status (van Hout et al., 2005), and baseline weight/BMI/percent of excess weight (Kinzl et al., 2006; Sczepaniak et al., 2012) have been found to be correlated with post-surgical outcome. However, some of the studies did not clearly demonstrate the direction of the association. In a review study, done by Herpertz et al. in 2004, which looked at age and pre-surgery body weight as possible predictors of weight loss after surgery, yielded inconsistent data for age. The review study assessed 10 different studies, among which 6 concluded a correlation between age and post-surgical weight loss while the other 4 did not (Herpertz et al., 2004). In terms of baseline body weight, the 6 studies that measured absolute weight at follow-up by the review study found that patients who were heavier before the surgery were less likely to have

successful weight loss. Baseline weight, BMI and percent excess weight have been found to be consistent predictors of post-surgical weight loss. Less obese patients show more relative success in weight loss in terms of percentage excess weight (Busetto et al., 2002; van Hout et al., 2005) compared to more obese patients before surgery, who tend to remain obese and experience more comorbidities (Bloomston, Zervos, Camps, Goode, & Rosemurgy, 1997). Super obese patients achieve positive effects after bariatric surgery (Fielding, 2003). Super obese is defined here as BMI > 60 kg/m^2.

Eating behavior has been associated to post-surgical outcome. For instance, having an eating disorder prior to surgery is not a negative predictor of weight loss after surgery (Kinzl et al., 2006). However, both pre- and post-surgical eating behaviors have been claimed and declined to have such association with weight loss after surgery (Kinzl et al., 2006). Lower energy intake (Kruseman, Leimgruber, Zumbach, & Golay, 2010) and regular sleep patterns (Ketchum & Morton, 2007) have also been linked to a higher degree of postsurgical weight loss. Younger individuals, < 40 years, demonstrate more likelihood in succeeding in post-surgical weight loss compared to older individuals (Busetto et al., 2002).

Comorbidities, surgeon experience, the ability of patients to adjust their eating behavior (predictors) (Ryden, Hedenbro, & Frederiksen, 1996; Sugerman et al., 1992), and preference for sweet foods (not a predictor) (Hudson, Dixon, & O'Brien, 2002) have also been studied. Self-efficacy and satisfaction with postsurgical weight loss were found to be positively correlated with each other (Kinzl et al., 2006).

The literature looking at predictors of surgical outcomes such as weight loss and psychological outcomes is summarized in Appendix D. Studies that looked at depression,

anxiety, and baseline BMI prior to surgery as predictors of surgical outcomes will be discussed in more details in the following sections.

2.6 Baseline BMI as a Predictor

A recent study (Sczepaniak et al., 2012) looked at predictors of weight loss after gastric bypass surgery at 12 month follow-up such as race, age, gender, technique, height, and initial weight and found that initial weight was the single most important predictor of weight loss after surgery. This study had 1551 gastric bypass patients (85.9% female) at baseline, but was only able to include 224 subjects for analysis due to loss to follow-up. Information about the predictors and post-surgical weight was obtained through medical records. Operations were performed by one surgeon at community hospitals in Southern California from 1989 to 2008 with 314 being laparoscopic surgery and 1237 open surgery. Initial weight was the most important predictor of weight loss after surgery, explaining 93% of the variability of average post-surgical weight while other recorded variables accounted for less than 1% of the variability.

A longitudinal prospective study (Masheb et al., 2007) assessed 137 extreme obese adults undergoing bariatric surgery to determine the link between weight and depressive symptoms as potential predictors of pre-and post-surgical quality of life. The follow-up period was 12 months after surgery. All patients were administered self-reported questionnaires and had their height and weight measured before and 1 year after surgery. Health related quality of life was assessed by the Medical Outcomes Study Short Form-36 (SF-36) Health Survey, measuring physical functioning, physical role limitation, bodily pain, general health, vitality, social functioning, emotional role limitation, and mental health. Two summary scores were generated: physical component summary (PCS) and mental component summary (MCS). The Beck depression

inventory II (BDI) was used to assess depression in study participants. At 1-year follow-up, significant improvements were observed in BMI status, BDI scores and SF-36 scores with BMI reduced by 35.7%. Mean BDI score improved from depressed to non-depressed range and SF-36 scores improved both in physical and mental aspects. Pre-surgical BMI was predictive at 4 out of 10 sub scales with contributions ranging from 4% to 14%. Pre-surgical BDI scores were predictive of 9 out of 10 health-related quality of life components, with contributions ranging from 25% to 55% for MCS sub scales, such as vitality, social functioning, emotional role limitation, and mental health and from 8% to 17% for the PCS sub-scales, such as physical functioning, physical role limitation, bodily pain, and general health. Post-surgically, BMI predicted 5 out of 10 scales with contributions ranging from 6% to 10%. Post-surgical BDI predicted all 10 scores of health-related quality of life and the contributions ranged from 3% to 20% and change in BDI predicted the same scales with contributions ranging from 3% to 37%. Demographic variables contributed little to the prediction of health-related quality of life both pre- and post-surgically. The results of the study suggest that lower scores on baseline weight and depression are predictive of better quality of life 12 months post-surgically with baseline depression contributions higher than those of baseline weight. Also, changes in depression severity from baseline to posttest (ranging from 3% to 37% for 10 of the 10 health-related quality of life variables) were more predictive of better quality of life than changes in weight (ranging from 4% to 8% for 4 of the 10 health-related quality of life variables). The authors of the study concluded that baseline depression and improvement in depression compared to baseline was more predictive of post-surgical quality of life than weight status or weight loss. Limitations of the study include a relatively small sample size, short duration of follow-up, use of generic

questionnaire, lack of assessment of antidepressant therapy or mental health treatment, and self-reported measure of depressive symptoms.

A prospective, longitudinal study (Thonney et al., 2010) evaluated 43 women (mean age, 39.3 years; mean BMI, 44.7 kg/m^2) before and at 1 and 2 years after gastric bypass to determine if depression and/or anxiety and eating disorders before gastric bypass have an influence on weight loss or if weight loss modifies both psychological profile of patients and their eating disorders. The women were evaluated using BDI-II, the Hospital Anxiety and Depression Scale (HADS) and Eating Disorder Inventory II (EDI-II). At 1-year follow-up body weight was significantly decreased compared with baseline (119.9 kg vs. 81.3 kg). Amount of weight loss at 2-year follow-up (33.3%) was similar to amount of weight loss at 1-year follow-up (32.1%). During the second year, 61% of subjects had additional weight loss (8.2 kg), and 39% of subjects regained some of the weight (5.3 kg). Pre-surgical mean score of depression was 13.7 and it decreased after 1 and 2 years to 9.7 and 9.3 compared with before surgery, respectively. Body weight before surgery had no association with depression, anxiety and eating disorders post-surgically. Depression score 2 years post-surgically was lower in those who lost the most weight. Lower baseline BMI and higher change in BMI were associated with better outcomes in terms of depression, when evaluated with BDI. HADS depression score was positively associated with EWL at 2 years post-surgically. Anxiety and depression scores before surgery were not predictive of weight loss at 1 or 2 years after surgery. Limitations of the study are small sample size and use of generic tools.

A study with 1-year follow-up (Averbukh et al., 2003) studied 47 morbidly obese patients (7 male, 40 female; mean age, 40.4 years; mean weight, 142.3 kg; mean BMI, 52.9 kg/m^2) who

underwent gastric bypass surgery to determine the relationship between severity of pre-surgical depression and degree of weight loss. From the 145 patients whose charts were reviewed, only those who pre-surgically completed BDI and 1-year follow-up were admitted to the study. Mean weight loss at 1-year follow-up was 41.4 kg. Twenty-four patients (51%) were diagnosed with depression pre-surgically. Pre-surgical BDI score was predictive of increased weight loss at 1-year follow-up. In addition, age was a negative predictor, and BMI was a positive predictor of post-surgical weight loss. The authors' explanation for the positive predictive value of depression and weight loss was the post-surgical decreased frequency of binge eating disorder in depressed obese patients due to reduced stomach capacity. The results of the study suggest that severity of depression should not be an exclusion criterion when considering surgery for weight loss in the obese population. The limitations of the study include small sample size, no psychological assessment at 1-year follow-up and the fact that other aspects of psychopathology such as anxiety, personality and binge eating disorder, were not assessed.

In another prospective, longitudinal study with 5.7-year follow-up (Powers, Rosemurgy, Boyd, & Perez, 1997), 131 bariatric surgery patients (mean age, 39.4 years), 85% female, mean pre-surgical weight 149 kg) were studied to determine the association between pre-existing psychiatric disorder and various parameters at late follow-up. The patients were seen for clinical evaluation at 3 months, 6 months, 1 year and 2 years. The pre-surgical examination included medical and psychiatric history, mental status examination with Diagnostic and Statistical Manual of Mental Disorders and anthropometric measures. A post-surgical clinical examination included vital signs, weight, and assessment of any physiological or psychological complications.

Additionally, after the initiation of the study, the patients were mailed questionnaires to assess various aspects of physical health, nutritional habits, psychological symptoms, work and financial status, social relationships and cosmetic appearance. Five patients had died during follow-up. Outcome data at mean follow-up was available for 86 patients (66%). Mean change in weight at the mean 5.7-year follow-up was 41 kg, or 27% of pre-surgical weight. Weight loss was greatest in the first 3 months but continued until 1 year, when weight regain started. The lowest mean weight achieved was 90 kg but by follow-up (mean 5.7 years) a mean of 18 kg had been regained. At follow-up, 35 patients had gained weight from the 2nd year post-surgical evaluation. Prior to surgery, 44% of patients had Axis I psychiatric disorders, including affective disorders such as bipolar disorders and major depressive disorder, adjustment disorders and anxiety disorders. Twenty-four percent of the patients had pre-existing Axis II psychiatric disorders. The study did not find a relationship between the pre-surgical psychiatric status and weight loss at follow-up. Although most patients indicated that their overall mental health, mood and mood swings improved, there was no significant relationship between the pre-surgical Axis I psychiatric disorders and post-surgical overall mental health, mood or mood swings. There was no association between pre-existing Axis II psychiatric disorders and overall mental health, mood or mood swings at follow-up. Patients' age and gender were not statistically correlated with weight loss, while pre-surgical BMI was predictive of a greater post-surgery weight loss. The limitations of the study include high attrition rate despite massive efforts to reach the patients and offering financial incentives and smaller weight loss than expected (probably due to very high BMI before the surgery).

In a prospective, longitudinal study with 1-year follow-up (Dixon, Dixon, & O'Brien, 2001), 440 Lap Band patients (mean age, 40.0 years; mean weight, 126 kg; mean BMI, 45.6 kg/m^2) were studied to determine pre-surgical predictors of weight loss. The patients were pre-surgically assessed to obtain basic demographic and anthropometric information, and past medical, psychiatric and obstetric history. Quality of life was measured with Health Survey (SF-36), consisting of PCS and MCS in 175 patients. Pre-surgical BMI and age had a negative influence on weight loss. Other variables were adjusted for BMI and age. The following scales of SF-36 were predictive of weight loss at 1-year follow-up: physical function, pain, general health and emotional role. In general, PCS was more predictive of EWL than any other scale scores. On the other hand, neither the total mental component summary, nor any of its components, such as social function, emotional role, and mental health, were predictive of the EWL at 1-year follow-up. Regular alcohol intake was positively associated with EWL with those drinking greater than 100 g/week having a mean EWL of 50.4%, those drinking more than 20 g/week having an EWL of 45.4 % and non-drinkers having a mean EWL of 40.0% at 1-year follow-up. Additionally, hyperinsulinemia was a significant predictor of a low rate of weight loss. The results of the study imply that history of mental illness or a mental component summary score on the SF-36 does not affect weight loss after lap-band surgery.

In another retrospective study (Busetto et al., 2002), 260 patients who underwent adjustable gastric band surgery (27% male; mean age, 37.6 years; mean weight, 130.8 kg; mean BMI, 46.6 kg/m^2) were studied to explore outcome predictors. Follow-up rate was 97% at the first year evaluation, 95% at the second year, and 96% at the third year. At 1-year follow-up the mean body weight fell to 105.8 kg, and stabilized. At three-year follow-up it was 103.2 kg. In 3

years, BMI reduced from 46.6 kg/m^2 to 36.8 kg/m^2. Overall, at three-year follow-up success rate of EWL (loss of > 50% of the initial excess weight) was 35.7%, failure rate (EWL < 20%) was 14.1% and weight regain (weight regain > 10%) was 20.7%. The only statistically significant predictors of success were found to be age < 40 years (47.5% vs. 21.5%) and pre-surgical BMI < 50 kg/m^2 (40.6% vs. 23.6%). Success rate was higher than 40% in patients with BMI < 45 kg/m^2 and only 30% in patients with higher BMI. Patients with BMI > 50 kg/m^2 had a success rate about half that observed in patients with BMI < 50 kg/m^2. BMI was also a statistically significant predictor of weight regain with patients with BMI < 50 kg/m^2 regaining more weight than super-obese patients (24.7% vs. 10.3%). The study concluded that weight outcomes of weight loss surgery vary greatly and can be explained by physiologic and technical reasons than by pre-surgical depression or diabetes. Besides, super-obese patients may require more aggressive operations to promote weight loss although weight loss seems to be more stable in the super-obese, with lower rates of weight regain.

In a prospective study with 4-year follow-up, Branson and colleagues investigated intermediate-term outcome after banding in 404 severely obese patients (79% women; mean age, 42 years; mean BMI, 42.1 kg/m^2) and the possible effects of pre-surgical age, sex and BMI on weight loss outcome (Branson et al., 2005). The patients were evaluated using the Bariatric Analysis and Reporting Outcome System to assess percentage of EWL, improvement or deterioration in comorbidities, quality of life, and complications and reoperations. Mean % weight loss at 4-year follow-up was 26.0% and BMI decreased by 11.5 kg/m^2. Patients with BMI > 50 kg/m^2 lost more weight (30.5%; BMI, 15.7) 4 years after gastric banding than patients with BMI < 50 kg/m^2. Patients with BMI < 35 kg/m^2 lost the least weight (22.8%; BMI, 7.6).

Patients with BMI 35-40 kg/m^2 lost significantly less weight than patients with BMI 40.1-50.0 kg/m^2 (23.5% vs. 27.2%, BMI units lost 8.9 vs. 12.0) and BMI > 50 kg/m^2. Patients with BMI 40.1-50 kg/m^2 tended to experience the most gastric complications, and patients with BMI < 35 kg/m^2 tended to be least likely to have gastric complications. Follow-up rate of the study was 98.5%. The study concluded that weight loss was proportional to the initial fat mass, as patients with a higher BMI before surgery lost more weight than patients with a lower BMI before surgery. The results of the study imply that patient selection before restrictive bariatric operations should yield improved weight loss results.

A prospective, longitudinal study with 3-month follow-up assessed the short-term change in quality of life after Laparoscopic gastric bypass in 171 patients (147 women, 24 men; mean age, 43.1 years) using the SF-36 questionnaire (Torquati, Lutfi, & Richards, 2007). Body mass index decreased significantly at 3 months (48.5 kg/m^2 to 38.4 kg/m^2) with EWL of 37.4% ± 9.2%. Quality of life showed significant improvement (44.2 to 78.6). Patients' demographics, BMI and comorbidities were compared against the quality of life change to check for correlation. None of these variables were found to have a significant impact on quality of life change. However, dichotomous group analysis found a correlation between characteristics of two groups, who achieved the same weight loss and change of quality of life. One of them also achieved major improvements in their quality of life (group B) and the other had minor or no improvement in their quality of life (group A) after surgery. Group A had an average pre-surgical BMI of 47.4 kg/m^2, which decreased to 38.1 kg/m^2 post-surgically. Group B started with a BMI of 47.9 kg/m^2, which decreased post-surgically to an average of 38.7 kg/m^2. Group A was characterized by a significantly higher percentage of males (24%) and a lower prevalence of diabetes (16%).

Diabetes increased the likelihood of major improvement in quality of life after gastric bypass by 6.2 times, whereas being a woman increased this likelihood by 16.1 times. The study concluded that morbidly obese women with type II diabetes have the highest odds of achieving a major quality of life improvement after laparoscopic gastric bypass and, therefore, they should represent the ideal target population for surgical weight loss program.

A prospective, longitudinal study with 2-year follow-up (Ma et al., 2006) studied 494 weight loss surgery subjects (84% female; mean age, 44 years; majority Caucasian, with hyperlipidemia and 12.8% with sleep apnea) to examine weight change at 1-2 years following laparoscopic RYGBP and evaluate predictors of post-surgery weight loss. Follow-up rates: 90% at 6-months, 90% at 1 year, and 51% at 2 years. BMI decreased to 37.4 kg/m^2 at 6 months, 33.0 kg/m^2 at 1 year, and 32.1 kg/m^2 at 2 years. Mean % EWL at 1 year was 65%. The success rate ($\geq$ 50 % EWL) at 1 year was 85%. Younger age and lower baseline weight were predictors of a higher % EWL. Presence of elevated depressive symptoms did not significantly predict % EWL. The limitations of the study are high attrition rate at 2-year follow-up (51%) and short duration of follow-up.

Another longitudinal, prospective study with a median follow-up of 50 months (Kinzl et al., 2006) followed 220 morbidly obese females who underwent laparoscopic Swedish, Adjustable gastric banding to investigate psychosocial predictors of weight loss. All patients were interviewed for mental disease and eating disorders using the structured Clinical Interview for Mental Diseases and were also administered semi-structural interviews to assess socio-demographic factors, adverse childhood experiences, eating patterns, partnership and sexuality prior to surgery. At least 30 months post-surgically, the participants were mailed self-

administered questionnaire assessing weight, extent and satisfaction with weight loss, physical activity, eating behavior, adjustment problems and quality of life. Analyzing only those who completed the study (63%), average BMI decrease was 14.6 kg/m^2 and pre-surgical weight was not predictive of post-surgical weight loss. Those with atypical eating disorders ("grazing", characterized by continual eating and "night eating syndrome", characterized by hyperphagia at night) lost the most weight (BMI decreased by 20 kg/m^2) while those with no pre-surgical eating disorder reduced their BMI the least (BMI decreased by 13.4 kg/m^2). The authors speculated two explanations. First, "bariatric surgery may cause a greater change and improvement in eating behavior in obese individuals with a pre-surgical eating disorder." In addition, "obesity in individuals with no appreciable eating disorder pre-surgically is induced more by genetic and metabolic factors than by nutritional causes; therefore, weight loss is more limited in those obese individuals than in individuals with a predominantly diet-induced obesity." The most frequent pre-surgical psychiatric disorders were adjustment disorders, depression, anxiety and personality disorders, with 32% of patients having one and 7% of patients having two or more. Those with two or more psychiatric disorders lost significantly less weight than those with one or none (10.8 kg vs. 14.0 kg vs. 16.1 kg, respectively). Adverse childhood experiences, such as dysfunctional family background, emotional neglect, early experience of separation or loss, and physical and/or sexual abuse constituted a negative predictor to post-surgical weight loss and those participants who lost the most weight were more satisfied with their weight loss and scored higher on the self-efficacy scale. The results of the study suggest that some psychosocial variables are predictive of weight loss after surgery but psychological interventions targeting improved outcomes after surgery should be individualized. Mean body weight before surgery was 124 kg

(range 98-165), and average BMI was 43.7 kg/m^2 (range 34-69). Average weight loss was 42 kg (range 0-120), and average BMI loss was 14.6 kg/m^2 (range 0-44).

A retrospective study (Alvarado et al., 2005) studied 90 weight loss surgery patients (10% male; 87% with at least one comorbidity; mean age, 42 years; mean BMI, 48.1 kg/m^2) to determine if pre-surgical weight loss was associated with positive outcomes, including increased EWL, improvement in correction of comorbidities, and less intraoperative complications. Follow-up ranged from 6 to 18 months, and 79 patients (87.8%) had at least a 1-year follow-up. Only 17% of patients lost the recommended amount of weight (10%) pre-surgically. Pre-surgical weight loss ranged from 0 to 23.8% (mean 7.25%). Nearly 70% of the patients (69.9%) obtained a pre-surgical weight loss of ≥ 5%. At 12 months follow-up, 86.9% of the co-morbid factors (hypercholesterolemia, depression, hypertension, obstructive sleep apnea, gastroesophageal reflux disease, and diabetes) had been corrected or improved. At 12 months follow-up, mean post-surgical EWL was 74.4%. Pre-surgical weight loss correlated significantly with post-surgical EWL even after accounting for age, gender and co-morbid factors. Higher baseline BMI correlated with a decrease of 1.34% of EWL. Finally, a pre-surgical weight loss of ≥ 5% correlated with a decrease in surgical time of 36.2 minutes. However, the improvement in post-surgical comorbidities was not correlated with the pre-surgical weight loss. The results of the study suggest that those patients who lose weight pre-surgically are more motivated and compliant, and therefore, lose more weight post-surgically when they have to follow a diet and exercise program. Since the heaviest patients were losing less weight, lowering initial BMI by pre-surgical dieting may lead to greater post-surgical weight loss. The limitations of the study

are retrospective design, small number of subjects, and the fact that only 17% of patients managed to lose the recommended 10% of weight pre-surgically.

The amount of weight reduction after bariatric surgery is crucial in its relation to decreased medical complications and risk factors. Thus, the difference between inadequate weight reduction, defined as < 20% to 30% (Herpertz et al., 2004), compared to the usual post-surgical weight loss of 55% to 65% makes identification of possible predictors more important. Other than post-surgical weight loss outcome, psychopathology, such as depression and anxiety, and quality of life after surgery are also important. Results of studies investigating pre-surgical BMI as a predictor of post-surgical quality of life suggest that lower pre-surgical BMI is predictive of better quality of life (Masheb et al., 2007). It is also predictive of post-surgical depression (Thonney et al., 2010) at 12-24 months (Masheb et al., 2007; Thonney et al., 2010). A short-term study with only 3 months follow-up found that pre-surgical BMI was not predictive of quality of life post-surgically (Torquati et al., 2007), but the follow-up period was probably not long enough to determine the effect.

Additionally, higher pre-surgical BMI has found to be a positive predictor of post-surgical weight loss at 1- 5.7 years follow-up (Averbukh et al., 2003; Branson et al., 2005; Mamplekou, Komesidou, Bissias, Papakonstantinou, & Melissas, 2005; Masheb et al., 2007; Powers et al., 1997). In one of these studies, patients with baseline BMI > 50 kg/m^2 lost more weight (% weight change) 4 years after gastric banding than patients with baseline BMI < 50 kg/m^2, while patients with BMI < 35 kg/m^2 lost the least amount of weight (Branson et al., 2005). In addition, the study done by Averbukh and colleagues only included 47 subjects in its analysis, a relatively small sample. Five of the analyzed studies showed higher pre-surgical BMI as a

negative predictor of post-surgical weight loss at 1-2 years follow-up (Alvarado et al., 2005; Busetto et al., 2002; Dixon et al., 2001; Ma et al., 2006; Sczepaniak et al., 2012) with success rate (loss of > 50% excess body weight) higher than 40% in patients with BMI < 45 kg/m^2 and only 30% in patients with higher BMI (Busetto et al., 2002). This implies that super obese patients may sometimes require more aggressive operations to achieve weight loss (Busetto et al., 2002). Only one study did not find any association between pre-surgical BMI and weight loss after bariatric surgery (Kinzl et al., 2006).

2.7 Quality Of Life

2.7.1 Definition

Quality of life has generally been defined as the patient's perception of performance in at least one of four important domains: somatic sensation, physical function, emotional state and social interaction (Duval, Marceau, Perusse, & Lacasse, 2006). The terms 'quality of life', and more specifically, health-related quality of life, in other words, are used to refer to the 'physical, psychological, and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations, and perceptions' (Kolotkin, Meter et al., 2001). Health-related quality of life is a reflection of a given individual's subjective evaluation and reaction to health or illness (Kolotkin, Meter et al., 2001).

Quality of life measures help provide information on the impact of obesity on functioning and well-being, help evaluate the effects of treatment and may influence the development of clinical pathways, service provision, healthcare expenditures and public health policy (Duval et al., 2006). Generally, questionnaires used to measure quality of life are divided into two roles as either discriminative tools, to differentiate between groups of patients, or as

evaluative tools, to measure how much quality of life has changed over time (Duval et al., 2006). The instrument for this study is an evaluative tool. Health related quality of life instruments may be divided into three groups: generic, disease-specific, and preference-based. For details, please refer to Appendix E (Kolotkin, Meter et al., 2001).

2.7.2 Quality of Life Before Surgery

Numerous studies have demonstrated that obese persons experience significant impairments in quality of life as a result of their obesity, with greater impairments associated with greater obesity (Kolotkin, Meter et al., 2001). Results from the SOS registry, an ongoing, large-scale national registry of obese persons (BMI $\geq$ 34) who had completed an extensive battery of validated health related quality of life measures, clearly and strongly show that "health related quality of life improves dramatically in those who lose a great deal of weight post bariatric surgery" (Kolotkin, Meter et al., 2001). It is found in these studies that obese individuals experience poorer quality of life than both the reference groups in the general population prior to surgery (Kolotkin, Meter et al., 2001). However, "patients undergoing surgical treatment for obesity may not be comparable to individuals from the general obese population and are likely to be more impaired than other obese individuals in terms of psychological distress and quality of life" (Kolotkin, Meter et al., 2001). This shows that there seems to be some difference between obese individuals who choose to undergo surgery and obese individuals who do not (Kolotkin, Crosby, & Williams, 2002).

2.7.3 Quality of Life After Surgery

Health-related quality of life is used often by physicians to measure the effects of chronic illness in their patients to better understand how an illness interferes with a person's day-to-day

life (CDC, 2011a). Most weight-loss surgery patients experience improvements in health-related quality of life post-surgically (Sarwer et al., 2005) with most improvements seen in the first 1 year or 2 after surgery, but some patients fail to adapt to the new eating pattern and may experience deterioration in health-related quality of life (van Hout & van Heck, 2009). Some of the quality of life measures assessed in the literature included the following: mobility, respiratory functioning, sleeping, the performance of usual acts, vitality and sexuality, physical functioning, social functioning, mental health, pain, general health perception, health changes, self-esteem, and labor quality of life are most commonly improved. Patients who lose the most weight commonly score better on health-related quality of life questionnaires. In the well-known SOS study, patients reported peak improvements in health-related quality of life at 6 and 12 months post-surgically with a slight to moderate decrease at the 2-year follow-up (Karlsson et al., 1998).

A 2-year follow-up study from the SOS study examined the effects of weight change on coping and distress in severely obese subjects treated conventionally or undergoing weight reduction surgery (Ryden, Karlsson, Sullivan, Torgerson, & Taft, 2003). The study used Obesity Coping scale measuring emotion-focused, maladaptive coping (Wishful Thinking) and problem-focused, adaptive coping (Social Trust and Fighting Spirit). Obesity Distress scale (Intrusion and Helplessness) and the HADS were also utilized. A total of 1146 surgical candidates and 1085 conventionally treated patients completed the Obesity Coping and Obesity Distress scales before treatment and after 24 months. Participants losing 20 kg or more improved in problem-focused coping, resulting in even greater improvements regarding distress. Emotion-focused coping deteriorated regardless of the direction of weight change, suggesting a general intervention effect of receiving professional help and support. The study concluded that

regardless of the type of treatment, the pattern and magnitude of change in coping and distress was related to the amount of weight change. In addition, improvement in problem-focused coping required major weight reduction, whereas minor weight gain led to deterioration.

A health-related quality of life questionnaire with domains of general well-being, health distress, depression, self-esteem, self-regard, physical appearance, work productivity, and physical and social activities was administered pre- and 1 year post-surgically to 50 morbidly obese subjects and 100 healthy-weight subjects, matched for socio-demographic parameters (Mathus-Vliegen, de Weerd, & de Wit, 2004). The weight-loss surgery patients improved the most in general well-being, health distress, and perceived attractiveness, and the least in depression, social activities and self-regards aspects. Patients who lost the most weight scored better on health-related quality of life questionnaire.

Ninety-five Finnish obese individuals were assessed pre-surgically, 52 operated patients were followed up at 12 months, and 52 patients were followed up cross-sectionally at a median of 28 months after laparoscopic adjustable gastric banding (Tolonen, Victorzon, & Makela, 2004). The assessment was carried out with Moorehead-Ardelt questionnaire, a disease-specific measure of quality of life, with subcategories of self-esteem, physical, social, labor, and sexual quality of life. Another group of 75 patients were assessed pre-surgically using a generic, 15-dimensional questionnaire measuring quality of life and including 15 dimensions: breathing, mental function, speech (communication), vision, mobility, usual activities, vitality, hearing, eating, elimination, sleeping, distress, discomfort and symptoms, sexual activity, and depression. Thirty-four patients were followed up after 1 year using the same questionnaire. All scores of Moorehead-Ardelt questionnaire were significantly improved 1 year after the surgery, but no

further improvement was observed at a median of 28 months follow-up. Overall, health-related quality of life measured by 15D questionnaire was also improved when compared to baseline, however, only in the dimensions of mobility, respiratory functioning, sleeping, the performance of usual acts, vitality and sexuality. Dimensions of eating and eliminating were worse than pre-surgical values. Eight of the patients, three of whom had unsatisfactory weight losses at 1 year, had a significant decrease in quality of life, compared to baseline. Furthermore, when overall health-related quality of life of the operated patients were compared to that of Finnish Age Norm, measured in 1995 among 710 healthy Finnish individuals 40-49 years old, both pre-surgical (0.843) and post-surgical scores (0.892) were lower from the Finnish Age Norm (0.933). Limitations of the study are a small number of participants, relatively short follow-up, and the mixture of prospective and cross-sectional study designs.

A population-based study evaluated 148 patients who underwent RYGB (Batsis et al., 2009). The study involved a survey consisting of baseline and follow-up single-item overall quality-of-life items (Linear Analogue Self-Assessment Questionnaire), follow-up quality of life (Short-Form-12), and activity (Goldman's Specific Activity Scale). The Short-Form-12 is divided into physical (PCS) and mental (MCS) component summary scores using Likert scales. This study examined whether bariatric patients have better quality of life and self-reported functional status compared with obese adults without surgery. The groups had a mean follow-up of 4 years. The adjusted Short-Form-12 score was 14.4 points higher in surgical patients at follow-up. In addition, surgical patients had symptomatic improvement as measured by Specific Activity Scale status and self-reported exercise tolerance at follow-up compared with non-

surgical patients. The surgical group lost a statistically significant amount of weight, 42 kg, after surgery, while non-surgical group did not.

2.8 Depression

2.8.1 Definition of Depression

Based on the information posted on the webpage of the National Institute of Mental Health (NIMH, 2009), depression occurs if someone has feelings of sadness and unhappiness, which can have a clinical form when these feelings interfere with everyday life for a long period of time. There are three common types of depression, namely major depressive disorder, dysthymic disorder, and minor depression. A major depressive disorder is a short term disabling disorder preventing the person from functioning normally and often recurring throughout the lifespan. On the other hand, a dysthymic disorder is long-term (2 years or longer) with lesser degree of severity. Symptoms of minor depression are similar to major depression and dysthymia but with less severity and shorter duration.

Symptoms of depression may include persistent sad, anxious or "empty" feelings, feelings of hopelessness and pessimism, feelings of guilt, worthlessness, irritability, restlessness, loss of interest in activities or hobbies, fatigue and decreased energy, difficulty concentrating, insomnia, early-morning wakefulness, excessive sleeping, overeating or appetite loss, thoughts of suicide, suicide attempts, persistent aches or pains, headaches, aches or digestive problems that do not ease with treatment (NIMH, 2009). Depression often coexists with other disorders, such as anxiety disorder, obsessive-compulsive disorder, panic disorder, social phobia and generalized anxiety disorder (NIMH, 2009). Depression may be caused by genetic factors, trauma and environmental factors (NIMH, 2009).

2.8.2 Depression Before Surgery

A review article by Bean and colleagues stated that "the best studies based on nationally representative samples indicate that obese populations do not have higher prevalence of depression overall" (Bean et al., 2008). However, the severity of psychological disorders has been related to the degree of obesity, presenting a positive association between the presence of psychopathology and BMI (Abiles et al., 2008). In addition, levels of obesity are higher in those with schizophrenia and depression, as is mortality from obesity-related conditions such as coronary heart disease (Allison et al., 2009). Thus, those with higher grade of obesity report greater depression, and many studies have shown that obesity is associated with mild (Dymek, le Grange, Neven, & Alverdy, 2001; Grilo, Masheb, Brody, Burke-Martindale, & Rothschild, 2005) to moderate (de Zwaan et al., 2003) depressive symptoms. In addition, the association between obesity and depression appears to vary by gender with positive association in women and either negative or no association in men (Carpenter, Hasin, Allison, & Faith, 2000; Onyike, Crum, Lee, Lyketsos, & Eaton, 2003; Palinkas, Wingard, & Barrett-Connor, 1996; Stunkard, Faith, & Allison, 2003). Gender moderates the obesity and depression relationship, with obese women, especially younger women with poor body image (Dixon et al., 2003), reporting higher rates of depression than men (Fabricatore & Wadden, 2006). The prevalence of psychosocial distress in patients seeking obesity treatment is high (Clark et al., 2003). At the time of evaluation for bariatric surgery, approximately 25% of female candidates report clinically significant symptoms of depression, pointing to the importance of such evaluation in this population (Krukowski, Friedman, & Applegate, 2010). Reported in a nationally representative sample from the National Comorbidity Survey Replication, the estimated prevalence of major depression is 16.6% (Kessler

et al., 2005). The most frequent individual diagnosis among individuals seeking weight loss surgery is major depressive disorder (42.0% lifetime and 10.4% current) (Kalarchian et al., 2007).

The prevalence of obesity and mortality is disproportionately high among those with psychiatric disorders such as schizophrenia and depression. Obesity is reported almost twice as frequently in visits to medical doctors for patients with severe mental illness than those without (Daumit, Pratt, Crum, Powe, & Ford, 2002). A recent study showed that the relative rate of death was higher in those with schizophrenia and bipolar disorders than the general population (Colton & Manderscheid, 2006). A 2009 National Institute of Mental Health Meeting Report showed that levels of obesity are higher in those with schizophrenia and depression, as is mortality from obesity-related conditions such as coronary heart disease (Allison et al., 2009). Although there are many weight-management programs and strategies for the general population, adequate research attention and empirically based interventions has been lacking for obese individuals with mental disorders (Allison et al., 2009).

Although obesity and depression seem to co-exist (Werrij, Mulkens, Hospers, & Jansen, 2006), there is not enough data to demonstrate a causal relationship between the two (Allison et al., 2009). A study that included 9374 adolescents in grades 7-12 suggests that having a depressed mood during adolescence may increase the prevalence of obesity over time, but adolescent obesity may not cause considerable levels of depression (Barefoot et al., 1998). Another study exploring the association between obesity and depressive mood by factoring gender, race, and BMI found that when race and SES were controlled, young overweight or obese women were significantly more likely to experience a depressed mood than non-overweight or non-obese women (Heo, Pietrobelli, Fontaine, Sirey, & Faith, 2006). In contrast,

only young, non-obese men were significantly more likely to experience depressed mood, suggesting that the significant association between obesity and depressed mood exists especially among young women but not obese men or older individuals. A study with older study subjects explored the temporal relationship between obesity and depression and found that non-obese depressed subjects at baseline were no more likely to become obese than were non-depressed subjects when gender, age, education and marital status were controlled. However, non-depressed obese subjects were twice as likely to develop depression during the 5-year follow-up period as were those who were not obese at baseline when controlling for the same covariates mentioned previously (Roberts, Deleger, Strawbridge, & Kaplan, 2003). Together, longitudinal studies suggest that age may be a significant factor in the temporal relationship of obesity and depression, but more research is needed.

To complicate the issue further, psychotropic medications, such as mood stabilizers (lithium and valproate) and anti-depressants, have been found to produce weight gain, although there are psychotropic drugs that induce weight loss (Allison et al., 2009). The weight gain associated with it varies, depending on the particular antipsychotic agent. For example, weight gain for patients taking clozapine, olanzapine, risperidone, and ziprasidone was 4.5, 4.2, 2.1, and 0.4 kg, respectively, over 10 weeks of treatment (Allison et al., 1999). However, reported means of weight gain are commonly based on last-observation-carried-forward analyses that can underestimate effects of treatment. Importantly, it is worth noting for health providers to consider weight change when switching patients to a new medication with a higher or lower weight gain liability. If both drugs function comparably in terms of effectiveness and side effects, switching to a lower weight gain liability drug may be ideal.

Although more search in weight control methods for the population with mental disorders is still warranted, especially those with more severe conditions, studies that focus on lifestyle modification have shown promising results. For instance, several studies have found significantly more favorable weight changes with lifestyle modification than with treatment-as-usual, ranging from minimal gain (2.0 kg vs. 9.9 kg, respectively) (Evans, Newton, & Higgins, 2005) to modest reduction (3.9 kg vs. 1.5 kg, respectively) (Kwon et al., 2006).

In terms of dietary prescription for obese population, omega-3 fatty acids and folate supplementation have shown beneficial effects on mental disorder syndromes, particularly depression (Allison et al., 2009). Research on exercise and mental disorders has been focused on patients with depression; hence, more effort is needed to examine its effectiveness with other types of mental disorders (Allison et al., 2009).

2.8.3 Depression After Surgery

Depression is the most prevalent psychological disorder in the obese population (Grothe et al., 2006). However, weight loss after surgery does not guarantee improved depressive status. On the other hand, some studies even found increased depression in certain patients (Elkins et al., 2005). Below are studies that looked at depression after the surgery to understand if bariatric surgery can help improve depression status among the obese population.

A study followed twenty-one grossly obese patients for 1.5 years after surgery and found that although signs of regressive defense and immature identity decreased after surgery, those patients that lost the most weight were also more likely to suffer from depression (Ryden et al., 1989). The authors of the study suggested that those patients who lost the most weight might not

be adapting to this change successfully and, therefore, were more likely to experience depressive symptoms.

In a study identifying predictors of depression in 487 gastric weight-loss surgery patients, pre-surgical BDI score for the whole group was 18.2, which falls into the "borderline clinical depression" category (Dixon et al., 2003). Twenty-eight patients had a clinically significant rise in BDI at 1 year post-surgically. This group of patients had a lower BDI score pre-surgically (9.2) compared with the remainder (18.2). A score below 10 is considered "normal" without any mood disturbance. The authors claim that this rise could not be attributed to the weight loss resulting from the surgery, but was rather triggered by non-surgery-related factors, such as a previous history of depression, post-surgical complications, postpartum depression and employment difficulties. Besides, the BDI score mean of 7.8 at 1 year and 9.6 at 4 years after surgery, indicate a slight non-significant rise at 4 years post-surgically, compared to 1 year post-surgically.

The SOS study measured health-related quality of life in a large sample of 1703 consecutive subjects enrolled between 1987 and 1995 (Karlsson, Taft, Ryden, Sjostrom, & Sullivan, 2007). Depression and anxiety were presented as separate domains in the total health related quality of life score and were measured using the HADS. Both depression and anxiety improved significantly 1 year after surgery, decreasing to 50% of the baseline level. However, a gradual increase in the severity of symptoms was observed in the next 6 and 10 years follow-up. Depression scores were 25% and 27% higher than the baseline level at 6 and 10 years follow-up, respectively. Anxiety improved by 20% and 23%, respectively.

A smaller study of 462 patients who underwent the Greenville gastric bypass looked into these patients' mental health status at 6 months, 1 and 2 years after the surgery (Waters et al., 1991). The data were obtained using a 22-item mental health battery known as the Health Insurance Study. The patients scored much better at 6 and 12 months follow-up after surgery compared to baseline level. All scores of mental health improved significantly by 6 months post-surgically. At 24 months, scores were back to pre-surgical levels. The main limitation of the study was a significant dropout rate, with 65 patients responding to the 1-year follow-up and only 18 patients responding to the 2-year follow-up.

A small study of 59 Greek, obese, female bariatric patients measured anxiety, depression and sexual function 1 week before and 1 year after surgery using the Hospital Anxiety and Depression Scale and the Female Sexual Function Index (Assimakopoulos et al., 2011). The study found that while sexual function and depression symptoms improved significantly after surgery, anxiety levels remained the same. The authors suggested that the unchanged anxiety status could be attributed to the tendency in post-surgical patients to worry about the healing process or adaptation. In addition, it is possible that anxiety interacts with personality more than with body image depression, which seems to be improved with the weight loss.

A study measuring psychological outcomes 2 years after bariatric surgery used BMI, HADS, SF-36, and Rosenberg Self-Esteem Scale, to measure weight change and psychological symptoms of 149 bariatric surgery patients pre-surgically and at 1 and 2 years post-surgically (Burgmer et al., 2007). The study reported a decrease in BMI, and significant improvement in depression and self-esteem scores at both 1 and 2-year follow-up. Anxiety, on the other hand, improved slightly by the first year check-up but then returned to baseline levels by the second

post-surgical year. None of the changes in anxiety level were significant, however. The authors also noted that the anxiety level during the pre-surgical testing was unusually low, which could explain why no significant improvement was achieved later.

In summary, depression improves at 6 months, 1 year and 2 years after surgery with some gradual regression at 6-10 years after surgery.

2.8.3.1 Confounders

2.8.3.1.1 Education/Gender and Depression

"High levels of depressive symptoms are particularly common among individuals with economic problems and those of lower socioeconomic status" (APA, 2012). Less education and unemployment impose more risk on individuals in developing depression, and these risk factors are overrepresented among women (APA, 2012). Compared to Caucasian women, non-Caucasian women are more likely to share a number of socioeconomic risk factors for depression, including racial/ethnic discrimination, lower educational and income levels, segregation into low status and high-stress jobs, unemployment, poor health, larger family size, marital dissolution, and single parenthood (APA, 2012). Women confronting the impact of immigration and acculturation reported a higher level of depression than those without such conflicts. Across all ethnicities, the rate of sexual and physical abuse is a major factor in women's depression; depressive symptoms may be long-standing effects of post-traumatic stress disorder for many women (APA, 2012). Married women have higher rates of depression than unmarried women. For men, the reverse is true. In unhappy marriages, women are three times as likely as men to be depressed (APA, 2012). "Women's risk of depressive symptoms and demoralization is higher

among mothers of young children and increases with the number of children in the house" (APA, 2012).

2.8.3.1.2 Age and Depression

According to Centers for Disease Control and Prevention (CDC), older adults are at increased risk for depression; 80% of older adults have at least one chronic health condition, and 50% have two or more (CDC, 2010). Depression is more commonly found in those who also have other illnesses (such as heart disease or cancer) or whose function becomes limited. In addition, older adults are often misdiagnosed and undertreated. Healthcare providers may mistake an older adult's symptoms of depression as just a natural reaction to illness or the life changes that may occur as we age and, therefore, not see the depression as something to be treated. Older adults themselves often share this belief and do not seek help because they don't understand that they could feel better with appropriate treatment. However, estimates of major depression in community-dwelling older people range from less than 1% to about 5%, but rise to 11.5% - 13.5% in those who require hospitalization and home healthcare.

2.8.3.1.3 Ethnicity and Depression

Obesity disproportionately affects minority populations. According to a study published in the July 17th 2009 issue of the U.S. Centers for Disease Control and Prevention's *Morbidity and Mortality Weekly Report,* African Americans have a 51% higher prevalence of obesity than non-Hispanic Caucasian Americans, and Hispanic Americans have a 21% higher prevalence of obesity than non-Hispanic Caucasian Americans (CDC, 2009). Being African American appears to confer protection against depression, as prior research has demonstrated that although African Americans have higher rates of most physical health conditions than non-Hispanic Caucasian

Americans, they tend to have equivalent or lower rates of major depression (Siefert, Heflin, Corcoran, & Williams, 2001). It is impressive that this pattern persists even in this economically disadvantaged sample. It might be worthwhile to identify the health-enhancing resources within the African American population that may be protective of mental health.

2.8.4 Depression as a Predictor Of Bariatric Surgery Outcome Success

Most studies show a negative correlation between depressive disorder and weight loss (Ryden et al., 1996) while there are also studies suggesting the opposite (Averbukh et al., 2003). Thus, results are mixed (van Hout et al., 2005).

As a group, patients with pre-surgical depressive disorder demonstrate beneficial post-surgical weight loss and improvement in depression, which provides evidence to argue against the statement that depressive disorder should be a contraindication for bariatric surgery. A study found that individuals with more severe depressive status evaluated before bariatric surgery tend to lose more weight at 1-year follow-up compared to those with less severe depressive status (Averbukh et al., 2003), which might suggest that degree of pre-surgical depression should not be overlooked in research.

2.8.4.1 Depression - A Negative Predictor

Legenbauer and colleagues did a prospective study, looking at three different groups of obese individuals: participation in a conventional weight loss treatment program (n = 250), obesity surgery patients (n = 153), and obese control individuals (n = 128) (Legenbauer et al., 2009). Everyone was asked about current medication usage, which serves the purpose of excluding certain individuals, such as those who reported the use of anorexic or obesogenic drugs. Depression and other mental disorders and BMI were assessed at baseline through the use

of structured psychiatric interviews (Composite International Diagnostic Interview) and at 4-year follow-up. Participants in the conventional weight loss program received treatments based on Optifast program, a multidimensional theory approach with weekly group sessions during a period of 1 year. Obesity surgery participants were recruited on the same day they were admitted to the hospital for surgery. Gender was controlled for the analysis in exploring the relationship between depression and obesity. Results showed that baseline current depression and/or anxiety disorders influenced weight change in certain individuals. In particular, surgical patients but not conventional treatment participants who suffered from a comorbid depressive/anxiety disorder at baseline lost significantly less weight compared to those who were mentally healthy at baseline. In addition, obese controls suffering from a current depressive and/or anxiety disorder at baseline showed a trend toward gaining weight, whereas those controls without depression or anxiety disorder did not lose weight. However, no effect could be detected in individuals participating in the conventional treatment program. A trend to gain weight during follow-up was observed among obese control individuals with a depressive and/or anxiety disorders whereas obese control patients without current mental disorders at baseline lost some weight. Independent of baseline depressive and/or anxiety disorders, conventional treatment participants showed significant weight loss during follow-up. The study concluded that it is important to address current depressive and anxiety disorders in obese patients, especially those seeking surgical treatments. Due to the fact that samples of patients with a current depressive and/or anxiety disorder were rather small, the impact of a single current mental disorder on the course of changes in weight could not be analyzed separately. In addition, conventional treatment and obesity surgery patients were not randomly selected.

Another study done by Kinzl and colleagues followed 140 obese female patients for a minimum follow-up of 30 months following laparoscopic Swedish adjustable gastric banding (Kinzl et al., 2006). The study found that the extent of weight loss for those with no mental disorder, one mental disorder, and two or more mental disorders were 16.1, 14.0, 10.8 kg/m^2 (BMI unit), respectively. These figures show that psychiatric disorders such as depression, adjustment disorders, and/or personality disorders are negative predictors of successful weight loss outcome.

2.8.4.2 Depression - A Positive Predictor

Averbukh and colleagues looked at 145 medical charts of patients who underwent RYGB and investigated whether depression score predicts weight loss after surgery (Averbukh et al., 2003). Forty-seven patients, who completed 1 year of a follow-up questionnaire such as the BDI, were included for analysis. The study found that weight loss at 1 year post-surgery was significantly related to the BDI score prior to surgery and BDI prior to surgery was found to be a significant predictor of the amount of weight loss 1 year post-surgery. Age and initial BMI had a significant independent relation to % EWL. Other variables such as gender, ethnicity, family history of obesity, diagnosis of diabetes or hypothyroidism or psychiatric medication use were also analyzed and found to be non-significant predictors for weight loss following RYGB. However, several limitations and interpretations of results were discussed by the authors, such as potential selection bias of the participants. There were only 47 subjects who filled out the BDI prior to surgery and completed the 1-year follow-up, and hence, were included for analysis. In addition, other variables such as anxiety, personality disorder, and binge eating disorder were not assessed even though they might contribute to such results.

2.8.4.3 Depression – not a Predictor

Ma and colleagues analyzed data from 377 patients prior and 1 year following laparoscopic RYGB to explore whether pre-surgery comorbidities and depression would help predict weight loss after surgery (Ma et al., 2006). Linear regression was used to identify predictive factors in predicting % EWL at 1 year. The study used two pre-surgical depression assessment scales at pre-surgical assessment and 1 year post-surgical follow-up, namely Center for Epidemiological Studies – Depression Scale (CES-D) and BDI. If either BDI or CES-D exhibited mild or greater depression (BDI $\geq$ 10 or CES-D $\geq$ 16), depression is noted as positive. Excess weight was calculated using the measured weight minus ideal weight based on the Metropolitan Life Insurance Company 1983 height/weight tables. Percent excess weight was calculated as pre-surgical excess weight minus post-surgical excess weight divided by pre-surgical excess weight and multiplied by 100%. A % EWL of 50 is the minimum criterion for "success" in the study following the surgery. The study found that at 1-year follow-up, pre-surgery comorbidities and depression do not predict post-surgical weight loss. Eight-five percent of the patients achieved > 50% EWL by 1 year. The extent of weight loss was predicted by pre-surgery non-diabetes, younger age, male gender, and lower BMI.

A longitudinal prospective study with 2-year follow-up (Thonney et al., 2010) evaluated 43 obese women before and 1 and 2 years after gastric bypass surgery to investigate the relationship between weight loss and psychosocial functioning among bariatric surgery patients. The study participants were administered BDI, HADS, and EDI-II. Weight loss at 1 year was 32.1% and at 2 years 33.3%. During the second year, 61% (8.2 kg) of subjects lost additional weight, while 39% subjects regained some of the weight lost (5.3 kg) at 1 and 2 years post-

surgically patients scored better on depression, anxiety and eating disorder scales with all psychological outcomes being positively associated with change in BMI. However, anxiety, depression, and binge eating disorder scores before the surgery were not predictive of weight loss at 1 or 2 years post-surgically. Limitations of the study include a small sample size, self-administered questionnaires, and short follow-up.

2.9 Anxiety

2.9.1 Definition of Anxiety

Anxiety is a normal reaction to stress that can transform into a clinical disorder when it is experienced often in reaction to everyday situations. The main types of anxiety disorders are (NIMH, 2011):

1) Generalized anxiety disorder - chronic anxiety, exaggerated worry and tension without a real reason. People often experience physical symptoms such as fatigue, headaches, muscle tension, difficulty swallowing, trembling, and so forth.

2) Obsessive-compulsive disorder - obsessive thought in patients are accompanied by repetitive behaviors, with the latter being performed as an effort to make the unwanted thought go away.

3) Panic - sudden and recurrent episodes of intense fear accompanied by chest pain, heart palpitations, shortness of breath, dizziness, or abdominal distress.

4) Post-Traumatic Stress Disorder, PTSD - anxiety disorder caused by a traumatic experience in the past; symptoms include persistent frightening thoughts, memories and feeling emotionally numb.

5) Social Phobia, or Social Anxiety Disorder - an anxiety triggered by everyday social situations, ranging from specific occasions, such as public speaking to a more severe form,

where no social situations are tolerated by patients. Patients with social phobia fear being watched and judged by others and often experience physical symptoms such as blushing, sweating, trembling, and nausea.

2.9.2 Anxiety Before Surgery

Both individuals seeking weight loss treatment and obese women seem to have high rates of anxiety disorders; high anxiety scores were reported by obese individuals when a questionnaire was administered to them; however, there is less understanding of the relationship between obesity and anxiety disorder (Legenbauer et al., 2009). An estimated 50% of patients seeking bariatric surgery report having been diagnosed with a mood disorder or anxiety disorder (Sarwer et al., 2005).

Whether psychopathology such as anxiety disorder is a cause or consequence of extreme obesity is unclear, attributable to the intricate relationship between extreme obesity and psychopathology. According to a review article, there are anecdotal reports suggesting that "some individuals may eat excessively as a maladaptive coping mechanism for psychological problems, thus contributing to obesity", but for others, "the detrimental health effects and social stigma of extreme obesity may contribute to a mood or anxiety disorder in an otherwise psychiatrically healthy individual" (Sarwer et al., 2005).

2.9.3 Anxiety After Surgery

Clark and colleagues investigated whether patients with pre-surgical psychosocial problems who either participated in a treatment program or not would have an impact on post-surgical outcome 2 years following RYGB (Clark et al., 2003). Eighty subjects (62 women and 18 men) who completed the 2-year follow-up questionnaire were used for analysis. The study

used t-tests to look at the relation of having received mental health treatment to percentage of EWL 2 year following surgery. The study found that those who had received treatment for psychiatric comorbidity (75% EWL) lost more weight compared to those without such histories (62% EWL). A patient is classified as having received psychiatric treatment if either they had been hospitalized for psychiatric reasons, or if they had received professional mental treatment. Classification is based on a patient's medical records. During follow-up, standardized questionnaires were mailed to all patients at 12 and 24 months post-surgically. Those who failed to return the first attempted questionnaire were contacted by a repeat mailing of another questionnaire or direct phone interview when necessary. One major limitation of the study was the self-report weights on the questionnaires. The study concluded that a history of having received mental health treatment is an indicator of improved weight loss post-surgically.

2.9.4 Anxiety as a Predictor

A prospective, longitudinal study with 4-year follow-up (Legenbauer et al., 2009) investigated 51 obese individuals participating in conventional weight loss program (n = 250), obesity surgery patients (n = 153) and obese control individuals (n = 128). The study aimed to compare the effect of current mental disorders in general on weight loss and depressive and/or anxiety disorders and binge eating, in particular. Mental disorders, including depressive disorders and anxiety, were assessed at follow-up with structured psychiatric interviews. Binge eating behavior and eating disorder not otherwise specified were assessed through the use of the Structured Interview for Anorexia and Bulimia Nervosa. Approximately 22% of participants dropped out and they reported having fewer mental disorders and depression/anxiety disorders at baseline than those who remained in the study. However, those who dropped out did not differ

significantly in age, BMI, gender, presence of binge eating behavior, or presence of any disorder other than anxiety/depression compared to those who remained in the study. The follow-up assessment revealed that those with comorbid depressive and/or anxiety disorder in weight loss surgery and control groups lost less weight than those without mental disorders (BMI difference, 7.9 kg/m^2 vs. 12.5 kg/m^2 in surgery group and 0.5 kg/m^2 vs. -1.8 kg/m^2 in control group). Mental status of participants in the conventional treatment group had no effect on their weight loss. No other comorbid mental disorder or binge eating disorder status affected the weight loss in any of the study groups. Presence of mental disorders in the conventional treatment group did not have any effect on weight loss. The results of the study suggest that identification of depression and/or anxiety in patients undergoing weight loss surgery or conventional weight loss treatment could lead to improved weight-loss outcomes. Strengths of the study include using structured psychiatric interviews instead of self-reported questionnaires. Limitations are a small sample size, relatively short follow-up period, non-randomized study groups, and the fact that those who dropped out had fewer depression/anxiety disorders than those who remained in the study.

A prospective, longitudinal 4-year study assessed 118 morbidly obese female patients of weight-loss surgery to investigate the link between the levels of marital and personal psychopathology before surgery and post-surgical weight loss (Hafner, Rogers, & Watts, 1990). Prior to and 1 year after surgery, patients (n = 118 and 71, correspondingly) were psychiatrically evaluated using a clinical interview and self-report questionnaires: the Crown Crisp Experimental Index, assessing generalized anxiety, phobic anxiety, obsessionality, somatization, depression; the Hostility and Direction of Hostility Questionnaire, assessing extrapunitiveness,

intropunitiveness, assertion discomfort and assertion behavior; the Assertion Inventory and the Marital Attitudes Evaluation Scale, assessing control feeling, control behavior, affection feeling/behavior, inclusion feeling and inclusion behavior. BMI was measured prior to surgery (n = 118) and at 1 (n = 114), 2 (n = 111), 3 (n = 102), and 4-year follow-up (n = 91). Results of the study showed that maximum weight loss occurred during the first year after the surgery (mean 35 kg) with only 29% of patients continuing to lose weight after the first year of follow-up and 71% of the patients regaining some of the weight they lost during the first year after surgery with an annual rate of 1.9 kg. At 1-year follow-up only scores of phobia subscale, overall total of the Crown Crisp Experimental Index, and affection feeling/behavior subscale of the Marital Attitudes Evaluation Scale were significantly lower than pre-surgical levels. Lower scores on the anxiety subscale of the Crown Crisp Experimental Index were a negative predictor of BMI at 4 years (8% of the variance in BMI). High pre-surgical phobia scores were associated with increased phobia scores at 1 year post-surgically and with better weight-loss maintenance (8.3% of the variance in BMI). Increased pre and post-surgical extrapunitiveness (mainly irritability and criticism of others) scores were associated with lower weight loss rates and weight regain. The link found between the psychiatric status and weight loss was weak and the findings suggest that that it is more important to focus on psychological problems emerging after the surgery and impacting weight loss than to try to predict the outcome with psychological measures. The limitations of the study are small group size, relatively short follow-up period, use of self-reported questionnaires, different set of psychiatric assessment procedures pre-surgically and at 1 year post-surgically and high drop-out rate for the psychiatric questionnaire at 1-year follow-up (40%).

A longitudinal prospective study with a median follow-up of 50 months (Kinzl et al., 2006) followed 220 morbidly obese female laparoscopic Swedish adjustable gastric banding patients to investigate psychosocial predictors of weight loss. All patients were interviewed for mental disease and eating disorders using the structured Clinical Interview for Mental Diseases (SCID) and were also administered semi-structural interviews to assess socio-demographic factors, adverse childhood experiences, eating patterns, partnership, and sexuality pre-surgically. At least 30 months post-surgically, the participants were mailed questionnaires assessing weight, extent and satisfaction with weight loss, physical activity, eating behavior, adjustment problems, and quality of life. Analyzing only those who completed the study (drop out rate = 37%), average BMI decrease was 14.6 kg/m^2 and pre-surgical weight was not predictive of post-surgical weight loss. Those with atypical eating disorders ("grazing" and "night eating syndrome") lost the most weight (BMI decreased by 20 kg/m^2) while those with no pre-surgical eating disorder reduced their BMI the least (BMI decreased by 13.4 kg/m^2). The most frequent pre-surgical psychiatric disorders were adjustment disorders, depression, anxiety and personality disorders, with 32% of patients having one and 7% of patients having two or more. Those with two or more psychiatric disorders lost significantly less weight than those with one or none (10.8 kg vs. 14.0 kg vs. 16.1 kg, correspondingly). Adverse childhood experiences, such as dysfunctional family background, emotional neglect, early experience of separation or loss, and physical and/or sexual abuse constituted a negative predictor to post-surgical weight loss. Those participants who lost the most weight were more satisfied with their weight loss and scored higher on the self-efficacy scale. The results of the study suggest that some psychosocial

variables are predictive of weight loss after the surgery but psychological interventions targeting improved outcomes after the surgery should be individualized.

Another prospective, longitudinal study (Thonney et al., 2010) evaluated 43 women (mean age, 39.3 years; mean BMI, 44.7 kg/m^2) before and 1 and 2 years after gastric bypass to determine if depression and/or anxiety and eating disorders before gastric bypass have an influence on weight loss or if weight loss modifies both psychological profile of patients and their eating disorders. The women were evaluated using BDI-II, HADS, and EDI-II. At 1-year follow-up, body weight was decreased compared with baseline (81.3 kg vs. 119.9 kg). Amount of weight loss at 2-year follow-up (33.3%) was similar to amount of weight loss at 1-year follow-up (32.1%). During the second year that 61% of subjects had additional weight loss (8.2 kg), and 39% of subjects regained some of the weight (5.3 kg). Pre-surgical mean score of depression was 13.7 and it decreased significantly after 1 and 2 years to 9.7 and year 2 to 9.3 compared with before surgery, respectively. Body weight before surgery had no association with depression, anxiety and eating disorders post-surgically. Depression score 2 years post-surgically was lower in those who lost the most weight. Lower baseline BMI and higher change in BMI were associated with better outcomes in terms of depression when evaluated with BDI-II. The HADS score was positively associated with EWL at 2 years post-surgically. Anxiety and depression scores before surgery were not predictive of weight loss at 1 or 2 years after surgery. Limitations of the study are small sample size and use of generic tools.

A prospective study with 2-year follow-up studied 62 women and 18 men, among whom some had received treatment for either substance abuse (n = 10) or psychiatric comorbidity (n = 39) before gastric bypass surgery (Clark et al., 2003). Those with Axis I psychiatric disorders

were treated and reevaluated 6 months later. Those who were "successfully treated" proceeded to undergo bariatric surgery. Patients were followed up at 12 and 24 months post-surgically with a mailed weight loss questionnaire. Drop-out rate at first year was 20% and at second year 43%. Analyzing only the patients who completed the study (n = 80), % EWL at 2-year follow-up was 69%, ranging from 31% to 108%. Those who received a treatment prior to surgery for substance use (n = 10) lost more weight than those who did not, with the mean EWL of 79% versus 67%, respectively. Those who received mental health treatment prior to surgery (n = 39) lost more weight than those who did not, with the mean EWL of 75% versus 62%, respectively. The main finding of the study was that a history of having received mental health treatment or substance abuse treatment before surgery was predictive of increased weight loss following bariatric surgery compared to absence of such treatments. The limitations of the study are non-specified type of psychiatric questionnaires, unclear meaning of "successful treatment", significant attrition rate, depression not studied separately, absence of psychiatric data in follow-up questionnaire, and a small number of subjects who received treatment for substance abuse.

Another prospective, longitudinal study with 5.7-year follow-up (Powers et al., 1997) studied 131 bariatric surgery patients (85% female; mean age, 39.4 years; mean weight, 149 kg) to determine the association between pre-existing psychiatric disorder and various parameters at late follow-up. The patients were seen for clinical evaluation at 3 months, 6 months, 1 year and 2 years. The pre-surgical examination included medical and psychiatric history, mental status examination with Diagnostic and Statistical Manual of Mental Disorders and anthropometric measures. Post-surgical clinical examination included vital signs, weight, and assessment of any physiological or psychological complications. Additionally, after the initiation of the study, the

patients were mailed questionnaires to assess various aspects of physical health, nutritional habits, psychological symptoms, work and financial status, social relationships, and cosmetic appearance. Outcome data at follow-up was available for 86 patients (66%). Mean change in weight at the 5.7-year follow-up was 41 kg, or 27% of pre-surgical weight. Weight loss was greatest in the first 3 months but continued until 1 year, when weight regain started. The lowest mean weight achieved was 90 kg but by follow-up a mean of 18 kg had been regained. At follow-up, 35 patients had gained weight from the 2-year evaluation. Prior to surgery, 44% patients had Axis I psychiatric disorders, including affective disorders such as bipolar disorders and major depressive disorder, adjustment disorders and anxiety disorders. Twenty-four percent of patients had pre-existing Axis II psychiatric disorders. The study did not find a relationship between the pre-surgical psychiatric status and weight loss at follow-up. Although most patients indicated that their overall mental health, mood and mood swings improved, there was no significant relationship between the pre-surgical Axis I psychiatric disorders and post-surgical overall mental health, mood or mood swings. There was no association between pre-existing Axis II psychiatric disorders and overall mental health, mood or mood swings at follow-up. Patients' age and gender were not correlated with weight loss, while pre-surgical BMI was predictive of the post-surgery weight loss. The limitations of the study include high attrition rate despite massive efforts to reach the patients and offering financial incentives and smaller weight loss than expected (probably due to very high BMI before the surgery).

In another prospective longitudinal study with 1-year follow-up (Dixon et al., 2001) 440 lap-band patients (mean age, 40.0 years; mean weight, 126 kg; mean BMI, 45.6 kg/m^2) were studied to determine pre-surgical predictors of weight loss at 1-year follow-up. The patients

were pre-surgically assessed to obtain basic demographic and anthropometric information, and past medical, psychiatric and obstetric history. Quality of life was measured with SF-36, consisting of PCS and MCS in 175 patients. Pre-surgical BMI and age had a negative influence on weight loss. Other variables were adjusted for BMI and age. The following scales of SF-36 were predictive of weight loss at 1-year follow-up: physical function, pain, general health and emotional role. In general, PCS was more predictive of EWL than any other scale scores. On the other hand, neither total mental component summary, nor any of its components, such as social function, emotional role, and mental health, were predictive of the EWL at 1-year follow-up. Regular alcohol intake was positively associated with EWL with those drinking greater than 100 g/week having a mean EWL of 50.4%, those drinking more than 20 g/week having an EWL of 45.4% and those who do not drink having a mean EWL of 40% at 1-year follow-up. In addition, hyperinsulinemia was a significant predictor of a low rate of weight loss. The results of the study imply that history of mental illness or a mental component summary score on the SF-36 does not affect weight loss after lap-band surgery.

In summary, there is limited evidence as to what effect pre-surgical anxiety has on weight loss surgery outcomes, such as weight loss, quality of life, depression and anxiety. One of the studies, with a 2-year follow-up, found that post-surgical psychological functioning, including severity of anxiety symptoms, was best predicted by its pre-surgical status (van Hout & van Heck, 2009). Therefore, pre-surgical anxiety score may be predictive of post-surgical anxiety. In some cases, high pre-surgical levels of anxiety may negatively impact surgery outcomes at 4-year follow-up (Legenbauer et al., 2009), with patients who were diagnosed with comorbid anxiety or more than two psychiatric disorders before the surgery losing less weight than those

without any mental disorder (Kinzl et al., 2006; Legenbauer et al., 2009), and those patients whose symptoms of depression and anxiety were treated successfully before the surgery losing more weight 2 years after the surgery compared to controls (Clark et al., 2003). However, anxiety seems to be a weak predictor of post-surigcal BMI, explaining only 8% of the BMI difference post-surgically (Hafner et al., 1990). Nevertheless, the results of these studies suggest that identification of depression and/or anxiety in patients undergoing weight loss surgery or conventional weight loss treatment could potentially lead to improved weight-loss outcomes.

On the other hand, a number of studies showed that anxiety levels before the surgery were not predictive of weight loss at 1-5.7 years post-surgically (Dixon et al., 2001; Kinzl et al., 2006; Powers et al., 1997; Thonney et al., 2010; van Hout & van Heck, 2009). Studies using psychopathology as predictors of weight loss have been inconclusive. Not all, but several studies found that post-surgical weight loss is unrelated to baseline psychopathology or the presence of specific baseline psychiatric symptoms (Sarwer et al., 2005).

Chapter 3: Methods

3.1 Study Setting

The current study, a secondary data analysis, is an ancillary study to the Bariatric Questionnaire Study (BQS), which is being conducted at the New York Obesity Nutrition Research Center at St. Luke's-Roosevelt Hospital Center in New York City. Both will be discussed in detail in the following sections.

3.2 Study Design

The BQS (parent study) is a one-group pre-test-post-test design study. The current study will explore and analyze select data collected from the BQS looking at four specific research questions.

3.2.1 Parent Study

The BQS is being conducted at the New York Obesity Nutrition Research Center at St. Luke's-Roosevelt Hospital Center. The primary goal of the BQS is to investigate the influence of pre-surgical eating disorders, such as binge eating disorder or night eating syndrome, on surgical outcomes (e.g. changes in weight). The study also examines changes in eating disorders and other psychological factors pre- and post-surgery. Based on these primary goals, a packet of specifically chosen questionnaires was administered to the patient three weeks prior to surgery. If the patient undergoes a surgery, either a LRYGB or a LAGB, the same packet of questionnaires is given to him or her at 1 month, 3 months, 6 months, and 12 months after the surgery during follow-up visits at the surgeon's office. Information is collected on demographics (age, sex, education, ethnicity, height, current weight, heaviest weight to date), binge eating tendencies (QEWP-R), depression (Zung scale), physical/society anxiety/fear (Liebowitz/LSAS-

SR), self-esteem (Rosenberg Self-Esteem Scale), night-eating (Night Eating Diagnostic Scale), body image, quality of life (IWQOL-Lite), appetite (EMAQ), eating behaviors (DEBQ-EX and DEBQ-RS), compulsive behaviors, and nicotine dependence (FTND).

Subjects in the BQS are about three weeks away from receiving bariatric surgery at St. Luke's-Roosevelt Hospital. Inclusion criteria for the BQS are the same as entry into the bariatric surgery program at St. Luke's-Roosevelt. While inclusion criteria is often case specific, general inclusion criteria include the following: BMI $\geq$ 40 kg/m^2, BMI $\geq$ 35 kg/m^2 with two significant health problems related to their weight, having tried a conventional weight loss regimen, such as diet and exercise, and failed, and between the ages of 18-75 years old. IRB approval and signed consent form are required for entering the BQS. Although there is no standardized pre-screening protocol, an interdisciplinary team of a physician, registered nurse, registered dietitian, and psychiatrist is usually involved. Whenever a patient is considering getting a bariatric surgery, a packet of information sheets is distributed. The content of the packet includes the following:

a. A welcome letter
b. How do I get a surgery date
c. Facts on bariatric surgery
d. Bariatric Surgery: Your Guidelines for Food Choices and Nutrition
e. Patient information form
f. New Patient history Questionnaire
g. Nutrition Assessment form
h. How to make an appointment for the psychological evaluation
i. Lap Band Support Group Schedule

j. Gastric Bypass Support Group Schedule

k. Spanish Support Group Schedule

l. Sample Letter 1: A letter of support by your primary doctor to recommend that you should be receiving bariatric surgery.

m. Sample Letter 2: Another letter of support by your primary doctor to recommend that you should be receiving bariatric surgery.

n. Food Fitness First Flyer

o. First Visit Checklist

p. Research participation opportunities at St. Luke's-Roosevelt Hospital: This is where the BQS comes in.

q. Resources

After the potential candidate reads all of the information provided in the packet and decides to meet with a physician, he/she would need to make sure that he/she finishes what is required for the first visit as mentioned above. A telephone number is provided in the packet for candidates to make an appointment for the first visit. The entire process starting from orientation to the post-surgical follow-ups includes the following:

a. Orientation seminar

b. First office visit, Pre-surgical tests, including a psychological evaluation (current study pre-surgical questionnaire)

c. Minimum of two support groups

d. Second visit

e. Mandatory pre-surgical review session, including pre-testing

f. Two post-surgical nutrition classes

g. Regular follow-up visits with the physician (current study post-surgical follow-up questionnaires)

The current study comes in at "b" during the first office visit. Participants were asked if they would like to join the current study. If the participant said "yes", he or she was administered with the packet of questionnaire mentioned previously and asked to sign a consent form. At the follow-up visit "g", the participant was asked to fill out the same packet of questionnaires. For a detailed description of the procedure for surgical admission in the current study, please refer to Appendix F.

3.2.2 Current Study

The current study, a secondary data analysis study of the parent study, focuses on information from three of the questionnaires administered to the study participants, namely, Zung Self-rating Depression Scale (ZSDS), quality of life measure scale (IWQOL-Lite), and physical/society anxiety/fear scale (Liebowitz/LSAS-SR). Furthermore, in the current study, an additional inclusion criterion for subject selection is to include only those who have completed questionnaires 3 weeks prior to surgery and 1 year after surgery. Data collected 3 weeks prior to surgery and 1 year after surgery are chosen for analysis in the current study. The reason why 1 year post-surgical data is the only post-surgical data used for analysis is because in the immediate months after surgery, there are many factors that could bias results, such as wound healing and unusual dietary requirement, such as liquid dieting. Further, many lap-banding patients might go back for bandage adjustment to resolve vomiting issue which is not common in gastric bypass patients. In addition, weight loss does not peak for either type of surgery within

the first 6 months. Thus, in order to compare results, it is more meaningful to look at a time point after surgery in which most surgery related complications have already been resolved. However, the other time points might provide useful information if one is interested in looking at surgical outcomes during a period of time when surgery related complications and issues are still occurring. The current study focuses on surgical results after complications related to surgery have most likely been resolved and patients have already lost most of their weight. Data chosen for analysis in the current study help answer the following four research questions.

Research Question 1: Overall Surgery Effect

What is the overall effect of bariatric surgery on 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for demographic factors (age, gender, education, race/ethnicity, baseline BMI) and baseline psychopathology (depression and anxiety)?

Research Question 2: Effect of Surgery Type

What is the effect of gastric bypass surgery versus lap-banding surgery on 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for demographic factors (age, gender, education, race/ethnicity, baseline BMI) and baseline psychopathology (depression and anxiety)?

Research Question 3: Psychological Predictors of 1 Year Post-surgical Outcomes

Are baseline psychological factors (depression and anxiety) predictive of 1 year post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for

demographic factors (age, education, gender, race/ethnicity, baseline BMI), baseline psychopathology (depression and anxiety), and surgery type?

Research Question 4: Demographical Predictors of 1 Year Post-Surgical Outcomes

Are baseline demographic factors (age, gender, education, race/ethnicity, baseline BMI) predictive of post-surgical outcomes (weight loss, depression, anxiety [total, performance, and social], quality of life [total, physical function, self-esteem, sexual life, public distress, and work]), controlling for baseline psychopathology (depression and anxiety) and surgery type?

In the current study, the dependent/outcome variables are: post-surgical depressive/anxiety, post-surgical weight loss (% weight loss, % EWL, and absolute weight loss (kg)), and post-surgical quality of life (total, physical function, self-esteem, sexual life, public distress, and work). Treatment is bariatric surgery, either LRYGB or LAGB. Independent (predictive) variables are baseline depression, and baseline anxiety (total, performance, and social). In addition, age, education, gender, race/ethnicity, and baseline BMI were examined as potential predictors of the same outcome variables listed previously.

3.3 Measures and Instrument

This study used the Zung Self-rating Depression Scale (ZSDS), the Liebowitz Social Anxiety Scale - Self Report version (LSAS-SR), and Quality of Life-Lite (IWQOL-Lite) questionnaires. These are part of the packet of questionnaires given to participants. Scores from the three scales are left as continuous variables. Please refer to Appendix G for actual scales.

3.3.1 Zung Self-Rating Depression Scale (ZSDS)

ZSDS is a short, self-administered survey with 20 items on the scale that rates the three common characteristics of depression or diagnositic criteria: the pervasive effect, the

physiological equivalents or concomitants, and psychological concomitants to quantify the depressed status of a patient (Zung, Richards, & Short, 1965). There are 10 positively worded and ten negatively worded questions. Each question is scored on a scale of 1 through 4 (based on these replies: 'none or a little of the time', 'some of the time', 'good part of the time', and 'most of the time'). Sample positively worded questions are "I feel hopeful about the future" and "I find it easy to make decisions." Sample negatively worded questions are "I am more irritable than usual" and "I have trouble sleeping at night." To obtain a total score, positive items are reversed in scores (1 as 4, 2 as 3, and vice versa), and then all items are summed. In the current stuty, a score of 1 was automatically assigned to question 5 ("I eat as much as I used to") and question 7 ("I notice that I am losing weight") at the final summation step to reduce bias for this population. Maximum possible raw score ranges from 20 to 80. The raw score is then converted to a diagnostic score, which range from 25 through 100. A diagnostic score can fall into four ranges: normal (25-49), mild depression (50-59), moderate depression (69-69), and severe depression (70+).

The ZSDS has been established as a reliable (Cronbach's internal reliability = 0.82) (McLaren, Gomez, Bailey, & Van Der Horst, 2007) and valid instrument (Dugan et al., 1998). It is significantly correlated with DSM-III diagnostic criteria for depression (r = 0.72) (Griffin & Kogut, 1988). ZSDS has been compared to the Depression (D) scale of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) and was found to be the primary discriminating variable in distinguishing depressed from non-depressed participants and contributed significant incremental validity over the D scale and showed greater accuracy in identifying non-depressed individuals (Thurber, Snow, & Honts, 2002).

Although ZSDS is not often found in literature to measure depression in obese populations, it is significantly correlated with the BDI, which has been utilized extensively in such populations (Kerner & Jacobs, 1983).

3.3.2 Liebowitz Social Anxiety Scale - Self Report version (LSAS-SR)

Liebowitz Social Anxiety Scale - Self Report version (LSAS-SR) (Baker, Heinrichs, Kim, & Hofmann, 2002) was used to measure anxiety. This instrument is a self-report version of the Liebowitz Social Anxiety Scale (LSAS) (Liebowitz, 1987). The LSAS-SR is a 24-item measure that assesses anxiety, fear, and avoidance in a variety of social situations based on a 4-point Likert scale. Likert scale options are: 0 = none, 1 = mild, 2 = moderate, and 3 = severe. Sample items for this measure include: '1. Telephoning in public', '7. Going to a party', '17. Taking a test', and '24. Resisting a high pressure salesperson.' Scores on the LSAS-SR are divided into a performance anxiety score and a social anxiety score. Scores on the performance anxiety subsection can range from 0 to 39 and scores on the social anxiety subsection can range from 0 to 33. Lower scores indicate lower levels of anxiety.

The LSAS-SR has demonstrated good internal consistency ($\alpha > 0.79$), good convergent validity with the LSAS ($r = 0.785$) and other measures of social anxiety ($r = 0.52$ with the Social Phobia and Anxiety Inventory), and good sensitivity to treatment effects ($r = 0.60$ with the pre-test post-test change scores on the Social Phobia and Anxiety Inventory) (Baker et al., 2002).

3.3.3 Quality of Life - Lite (IWQOL-Lite)

To measure quality of life, Quality of Life-Lite (IWQOL-Lite) is utilized. The Impact of Weight on Quality of Life-Lite (IWQOL-Lite) is a validated, 31-item, self-report measure of obesity-specific quality of life (Kolotkin, Crosby, Kosloski, & Williams, 2001). It is a quality of

life scale that includes five domains: physical function (11 questions), self-esteem (7 questions), sexual life (4 questions), public distress (5 questions), and work (4 questions).

In addition to a total score, each domain receives an individual score based on a 5-point Likert scale. Likert scale options are: always true (5 points), usually true (4 points), sometimes true (3 points), rarely true (2 points), and never true (1 point). The individual scores in each domain are then divided by the possible maximum score for that particular domain to obtain a percentage. This percentage is also calculated for the total score. These percentages are then entered into the SPSS database for analysis. The scale has been found to have good internal consistency (ranging from 0.90 to 0.96) (Kolotkin, Crosby et al., 2001), responsiveness to weight loss and weight gain (Engel et al., 2003), good test-retest reliability (0.83 to 0.94) (Kolotkin & Crosby, 2002), and sensitivity to the degree of obesity (White, O'Neil, Kolotkin, & Byrne, 2004).

3.3.4 Demographics

In the BQS, a section in the front of the questionnaire packet asks the participant to provide basic demographic information such as age, gender, education, and ethnicity. To answer questions for education and racial/ethnic backgrounds, each participant is asked to select one of the following levels: level 1 = grammar school, junior high or less, level 2 = some high school, level 3 = high school graduate or equivalency, level 4 = some college or associate degree, level 5 = completed college. For race/ethnicity, the following five categories were provided for selection: Black, Hispanic, White, Asian, and Others. In addition, the participants are asked to write in their height, current weight and heaviest weight to date. During the surgeon's office visit at each follow-up time point, every patient is weighed on a tronix scale (5702 Bariatric Stand-On Scale), by a registered nurse or a registered dietitian. The scale is built for the bariatric

population with a capacity of 1,000 lbs/445 kg. Weight measured in the clinic rather than the self-reported weight on the questionnaire is used for analysis. The patient's height was measured 3 weeks prior to surgery. This height and the weight collected by the nurse or the dietitian in the clinic are used to calculate BMI in the database.

3.4 Data Collection and Data Entry

In the parent study, data was collected 3 weeks prior to surgery, and 1 month, 3 months, 6 months, and 1 year after surgery. Data was derived from a packet of questionnaires administered to the patient during their follow-up visits to the surgeon's office. In the current study, only data collected 3 weeks before surgery and 1 year after surgery were used for analysis.

To ensure that all questions were filled out completely, research assistants were trained to check all responses before accepting a questionnaire. However, when a patient did not show up for a follow-up visit and also did not reschedule, he/she was contacted via phone. Then, given their permission, a blank questionnaire with a return envelope was mailed out for the patient to complete. Upon receipt of a completed questionnaire, the study subject was given compensatory options between round-trip MTA cards ($4.50) or four dollars. If the study subject mailed in the questionnaires, a round-trip MTA card was mailed to them. On average, three attempts were made whenever the first attempt failed.

After a questionnaire was completed by a participant, either at the surgeon's office or distributed via mail, it was then scored by a research assistant and double checked by another research assistant to reduce human error. After a given questionnaire was scored and checked, it was then entered into SPSS for analysis. Like scoring, data entry was first entered and then double-checked by another research assistant.

3.5 Data Analysis:

3.5.1 Research Question 1: Overall Surgery Effect

According to existing literature, psychological problems such as depression and anxiety tend to improve significantly after post-surgical weight loss (Thonney et al., 2010). In addition, quality of life impairment, which most obese patients consider to be the most serious accompaniment of their disease (Kral et al., 1992), also tends to improve after surgery (Karlsson et al., 1998). To confirm and reflect these findings for this study group, paired-sample t-tests with a two-tailed index for significance level were done to test significant differences of means between pre- and 1 year post-surgical data on the following outcomes: weight in kg, BMI, depression, total anxiety, and quality of life measures (total, physical function, self-esteem, public distress, sexual life, and work). This analysis was done to confirm previous findings that weight does indeed decrease, and psychopathology, in particular depression and anxiety, and quality of life do indeed improve after surgery.

Several new variables were computed into the existing database in BQS, and they each represent 1) % EWL, 2) baseline BMI, 3) BMI at year 1, 4) excess body weight, 5) ideal body weight, 6) absolute weight loss (kg), 7) percent weight loss, and 8) surgery type. In addition, pre- and post-surgical weight data, which were originally collected in pounds were converted to kilograms by using the compute variable function in SPSS. In the database, education is a categorical variable with the following levels: level 1 = grammar school, junior high or less, level 2 = some high school, level 3 = high school graduate or equivalency, level 4 = some college or associate degree, level 5 = completed college. Another categorical variable is race,

which has the following five categories: Black, Hispanic, White, Asian, and Others. Surgery type was added as a new categorical variable with 1 being LRYGB and 2 being LAGB.

Percent EWL is calculated as (baseline weight - weight 1 year post-surgery) /excess body weight x100. Excess body weight = weight – ideal body weight, where ideal body weight = 50 kg for male and 45.5 kg for female, +2.3 kg per inch above 5 feet. This formula, published by Dr. Devine in 1974 (Devine, 1974), has been used in obesity research articles to calculate ideal body weight. Baseline BMI is calculated as pre-surgical weight in kilograms divided by pre-surgical height in meters squared. Absolute weight loss is calculated as pre-surgical weight minus 1 year post-surgical weight in kilograms. Percent weight loss is calculated as [(pre-surgical weight - 1 year post-surgical weight)/pre-surgical weight].

3.5.2 Research Questions 2: Effect of Surgery Type

To answer questions 2, type III sum of squares GLM (generalized linear model) univariate analysis (Univariate Analysis of Variance) was conducted for each dependent variable of interest, namely, post-surgical depression, post-surgical anxiety (total anxiety, social anxiety, performance anxiety), post-surgical quality of life (total quality of life, physical function, self-esteem, sexual life, public distress, and work), and post-surgical weight loss (% weight loss, % EWL, absolute weight loss (kg)). All these dependent variables were respectively and independently analyzed in each statistical model, controlling for demographic factors (age, gender, education, race/ethnicity). In addition, baseline measures of the dependent variables of interest are also controlled. The reason to control baseline data is because post-surgical psychological values have been found to be well predicted by their baseline values (van Hout et al., 2009). Thus, in the current study, baseline BMI, baseline depression, baseline anxiety

(baseline total anxiety, baseline social anxiety, baseline performance anxiety) and baseline quality of life measures (baseline physical function, baseline self-esteem, baseline sexual life, baseline public distress, and baseline work) were respectively controlled when post-surgical weight, depression, anxiety and quality of life are the dependent variable of interest, respectively. Below is the table format of what has been described.

Statistical Tests for Research Question 2

Statistical Tests	Dependent variables (1 year post-surgical outcomes)	Predictor	Covariates
Test 1	Depression	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety
Test 2	Total Quality of Life	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Total Quality of life
Test 3	Physical Function	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Physical Function
Test 4	Self-esteem	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Self-esteem
Test 5	Sexual Life	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Sexual life
Test 6	Public Distress	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Public Distress
Test 7	Work	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Work
Test 8	Total Anxiety	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety
Test 9	Social Anxiety	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Social Anxiety
Test 10	Performance Anxiety	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Performance Anxiety
Test 11	% Weight Loss	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety
Test 12	% Excess Weight Loss	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety
Test 13	Absolute Weight Loss	Surgery Type	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety

3.5.3 Research Question 3 and 4: Predictors of Post-Surgical Outcomes

Similar to research question 2, type III sum of squares GLM (generalized linear model) univariate analysis (Univariate Analysis of Variance) was conducted for research question 3 and 4. For research question 3, baseline psychological factors, depression and anxiety (total, performance, and social), were included as predictors respectively while controlling for demographic factors (age, gender, education, race/ethnicity, baseline BMI), and surgery type. Question 3 and 4 look at the same set of outcome variables as dependent variables in each of the statistical models, namely, post-surgical depression, post-surgical anxiety (total anxiety, social anxiety, performance anxiety), post-surgical quality of life (total quality of life, physical function, self-esteem, sexual life, public distress, and work), and post-surgical weight loss (% weight loss, % EWL, absolute weight loss (kg)). For research question 4, demographic factors were examined as predictors. Below is the table format of what has been described.

Statistical Tests for Research Question 3

Statistical Tests	**Dependent variables (1 year post-surgical outcomes)**	**Predictor**	**Covariates (all models include age, gender, race, education, Baseline BMI, Surgery Type) as well as the following:**
Test 1	Depression	Baseline Depression	Baseline Total Anxiety
Test 2	Depression	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 3	Total Quality of Life	Baseline Depression	Baseline Total Anxiety Baseline Total Quality of life
Test 4	Total Quality of Life	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Total Quality of life
Test 5	Physical Function	Baseline Depression	Baseline Total Anxiety, Baseline Physical Function
Test 6	Physical Function	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Physical Function
Test 7	Self-esteem	Baseline Depression	Baseline Total Anxiety, Baseline Self-esteem
Test 8	Self-esteem	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Self-esteem
Test 9	Sexual Life	Baseline Depression	Baseline Total Anxiety, Baseline Sexual life
Test 10	Sexual Life	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Sexual Life
Test 11	Public Distress	Baseline Depression	Baseline Total Anxiety, Baseline Public Distress
Test 12	Public Distress	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Public Distress
Test 13	Work	Baseline Depression	Baseline Total Anxiety, Baseline Work
Test 14	Work	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression, Baseline Work

Statistical Tests	**Dependent variables (1 year post-surgical outcomes)**	**Predictor**	**Covariates (all models include age, gender, race, education, Baseline BMI, Surgery Type) as well as the following:**
Test 15	Total Anxiety	Baseline Depression	Baseline Total Anxiety
Test 16	Total Anxiety	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 17	Social Anxiety	Baseline Depression	Baseline Social Anxiety
Test 18	Social Anxiety	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 19	Performance Anxiety	Baseline Depression	Baseline Performance Anxiety
Test 20	Performance Anxiety	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 21	% Weight Loss	Baseline Depression	Baseline Total Anxiety
Test 22	% Weight Loss	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 23	% Excess Weight Loss	Baseline Depression	Baseline Total Anxiety
Test 24	% Excess Weight Loss	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression
Test 25	Absolute Weight Loss	Baseline Depression	Baseline Total Anxiety
Test 26	Absolute Weight Loss	Baseline Anxiety (Total, Performance, or Social)	Baseline Depression

Statistical Tests for Research Question 4

Statistical Tests	Dependent variables (1 year post-surgical outcomes)	Predictor	Covariates
Test 1	Depression	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Surgery Type
Test 2	Total Quality of Life	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Total Quality of life, Surgery Type
Test 3	Physical Function	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Physical Function, Surgery Type
Test 4	Self-esteem	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Self-esteem, Surgery Type
Test 5	Sexual Life	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Sexual life
Test 6	Public Distress	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Public Distress
Test 7	Work	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Baseline Work, Surgery Type
Test 8	Total Anxiety	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Surgery Type
Test 9	Social Anxiety	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Social Anxiety, Surgery Type
Test 10	Performance Anxiety	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Performance Anxiety, Surgery Type

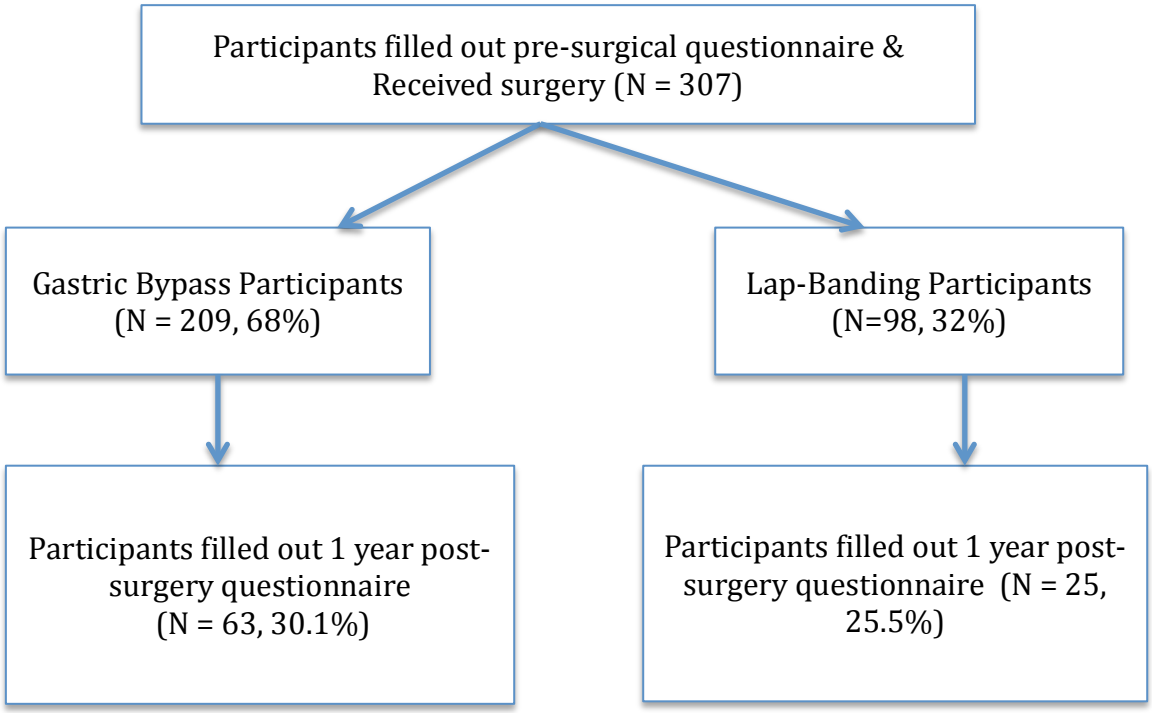
Statistical Tests	Dependent variables (1 year post-surgical outcomes)	Predictor	Covariates
Test 11	% Weight Loss	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Surgery Type
Test 12	% Excess Weight Loss	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Surgery Type
Test 13	Absolute Weight Loss	Age, Gender, Race, Education, or Baseline BMI	Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, Surgery Type

Note. Whenever a demographic factor is included as a predictor, it is not included as a covariate. Upon running any statistical model above, multi-collinearity is assessed first. A tolerance of less than 0.20 and/or a VIF of 5 and above is used as indicative of such concern (O'Brien, 2007).

Chapter 4: Results

4.1 Study Design and Descriptive Characteristics

4.1.1 Study Design



Three hundred and seven (N = 307) participants filled out the baseline questionnaire and underwent surgery, among which 209 (38%) underwent LRYGB and 98 (32%) underwent LAGB. Among those who underwent LRYGB, 63 (30.1%) completed the 1 year post-surgical follow-up questionnaire. Among those who underwent LAGB, 25 (25.5%) completed the 1 year post-surgical follow-up questionnaire. Overall, 88 (28.7%) participants completed the 1 year post-surgical follow-up questionnaire.

4.1.2 Descriptive Characteristics

Among the 88 participants who completed the 1 year post-surgical follow-up questionnaire, the average weight of this cohort was 131.3 kg (range = 82.3-250.9 kg, SD = 27.9), BMI was 47.3 kg/m^2 (range = 35.4-82.7 kg/m^2, SD = 8.2), and age was 40 years (Range = 18-69 years, SD = 11.3). Sixty-three (71.6%) participants received LRYG and 25 (28.4%) participants received LAGB surgery. Around 40.9% (N = 36) identified themselves as "Black", 38.6% (N = 34) as "Hispanic", 15.9% (N = 14) as "white", 2.3% (N = 2) as "Asian", and 2.3% (N = 2) "other." The sample included 81 females (N = 81) and 7 males (N = 7). However, depending on the particular dependent variable of interest, the N (size of participant population) differs (Table 1). There were no significant baseline differences in age, BMI, weight, race, education, depression, anxiety (total, performance, and social), sexual life, and public distress between the participants and those lost to follow-up group at 1-year follow-up after surgery. However, there were differences in gender, total quality of life, physical function, self-esteem, and work (Table 2). There were no significant differences between the two surgery groups with 1-year follow-up data in baseline characteristics (age, weight, BMI, race, gender, and education), baseline quality of life (total, physical function, self-esteem, sexual life, public distress, and work), and baseline anxiety (total, performance, and social) (Table 3).

Table 1: ***Size of Participant Population (N) Based on Outcomes***

	Gastric Bypass		Gastric Banding		Combined	
Outcomes	Pre	Post	Pre	Post	Pre	Post
BMI ($kg/m^{2)}$	63	63	25	25	88	88
Weight (kg)	63	63	25	25	88	88
Depression	62	63	25	25	87	88
Total Anxiety	63	62	25	25	88	87
Performance Anxiety	63	62	25	25	88	87
Social Anxiety	63	62	25	25	88	87
Total Quality of Life	63	56	23	21	86	77
Physical Function	63	62	25	25	88	87
Self-esteem	63	62	25	25	88	87
Sexual Life	63	58	24	22	87	80
Public Distress	63	60	25	23	88	83
Work	63	58	24	22	87	80

Note. These size (N) figures reflect those who completed the pre-surgical and 1 year post-surgical questionnaire.

Table 2: ***Baseline Characteristics: Participants vs. Loss to Follow-Up 1 Year After Surgery***

Baseline characteristics	Participants (N=88)			Loss to Follow-up (N=219)			Mean Δ[a]	t-/Chi-Sq Tests (Δ)	*P*-Value (Δ)
	N	Mean or %	SD	N	Mean or %	SD			
Age (years)	88	40.2	11.3	219	38.8	11.9	1.4	1.0	0.34
Weight (kg)	88	131.3	27.9	219	129.6	29.5	1.7	0.5	0.58
BMI (kg/m^2)	88	47.3	8.2	219	46.9	8.6	0.4	0.5	0.61
Gender								5.1	**0.023***
Male	7	8%	--	40	18.3%	--	-10.3%	--	--
Female	81	92%		179	81.7%	--	10.3%	--	--
Race								8.9	0.063
Black	36	40.9%	--	61	27.9%	--	13%	--	--
Hispanic	34	38.6%	--	115	52.5%	--	-13.9%	--	--
White	14	15.9%	--	32	14.6%	--	1.3%	--	--
Asian	2	2.3%	--	1	0.5%	--	1.8%	--	--
Other	2	2.3%	--	10	4.6%	--	-2.3%	--	--
Education								4.0	0.41
Grammar school, junior high school or less	0	0%	--	2	0.9%	--	-0.9%	--	--
Some high school	9	10.2%	--	15	6.9%	--	3.3%	--	--
High school graduate or equivalency (GED)	15	17.0%	--	38	17.5%	--	-0.5%	--	--
Some college or associate degree	30	34.1%	--	94	43.3%	--	-9.2%	--	--
Completed college	34	38.6%	--	68	31.3%	--	7.3%	--	--
Surgery Type								--	--
Gastric Bypass	63	72%	--	--	--	--	--	--	--
Lap-Banding	25	28%	--	--	--	--	--	--	--
Psychopathology									

Baseline characteristics	Participants (N=88)			Loss to Follow-up (N=219)			Mean Δ[a]	t-/Chi-Sq Tests (Δ)	*P*-Value (Δ)
	N	Mean or %	SD	N	Mean or %	SD			
Depression	87	46.8	9.4	217	49.1	9.5	-2.3	-1.9	0.052
Total Anxiety	88	17.7	14.7	217	19.5	14.8	-1.8	-1.0	0.34
Performance Anxiety	88	9.8	7.7	217	10.7	8.0	-0.9	-0.9	0.39
Social Anxiety	88	7.9	7.6	217	8.8	7.4	-0.9	-1.0	0.33
Quality of life									
Total Quality of life	86	54.0	23.2	216	46.6	20.2	7.4	2.7	**0.006***
Physical Function	88	46.5	25.4	218	39.6	23.4	6.9	2.3	**0.024***
Self-esteem	88	49.2	28.9	219	42.0	26.2	7.2	2.1	**0.035***
Sexual Life	87	63.3	33.6	214	55.5	32.5	7.8	1.9	0.062
Public Distress	88	55.3	30.8	218	48.5	28.3	6.8	1.9	0.065
Work	87	73.5	26.1	218	62.1	28.5	11.4	3.2	**0.001***

Note. For psychopathology, the higher the number, the worse the psychopathology. For quality of life measure, the higher the number, the better the quality of life.

a. Mean Δ (mean difference) = mean (participants) – mean (loss to follow-up). *$p < 0.05$.

Table 3: ***Baseline Characteristics (Participants) by Surgery Type***

Baseline characteristics	Gastric Bypass (N = 63)			Gastric Banding (N = 25)			*P*-Value (Δ)
	N	Mean or %	SD	N	Mean or %	SD	
Age (years)		39.1	11.4		43	10.7	0.14
Weight (kg)		131.5	25.6		130.7	33.6	0.91
BMI (kg/m^2)		47.5	7.6		46.9	9.7	0.74
Gender							0.99
Male	5	7.9%	--	2	8%	--	--
Female	58	92.1%	--	23	92%	--	--
Race							0.85
Black	25	39.7%	--	11	44%	--	--
Hispanic	25	39.7%	--	9	36%	--	--
White	10	15.9%	--	4	16%	--	--
Asian	1	1.6%	--	1	4%	--	--
Other	2	3.2%	--	0	0%	--	--
Education							0.15
Some high school	5	7.9%	--	4	16%	--	--
High school graduate or equivalency (GED)	12	19%	--	3	12%	--	--
Some college or associate degree	25	39.7%	--	5	20%	--	--
Completed college	21	33.3%	--	13	52%	--	--
Psychopathology							
Depression	62	46.2	9.7	25	48.4	8.8	0.33
Total Anxiety	63	16.9	14.3	25	19.6	15.7	0.44
Performance Anxiety	63	9.3	7.3	25	11.2	8.5	0.31
Social Anxiety	63	7.6	7.6	25	8.5	7.6	0.63
Quality of life							
Total Quality of life	63	55.4	23.9	23	50.2	20.9	0.36
Physical Function	63	47.4	26.6	25	44.1	22.4	0.59
Self-esteem	63	51.1	29.2	25	44.4	27.9	0.33
Sexual Life	63	64.9	33.7	24	59.1	33.1	0.47
Public Distress	63	55.6	32.2	25	54.6	27.5	0.90
Work	63	74.9	27.6	24	69.8	21.9	0.42

Note. Δ represents difference. *$p < 0.05$.

4.2 Research Question 1: Overall Surgery Effect

This part of the analysis reports differences in pre- and post-surgical outcomes (surgeries combined). Paired sample T-tests were performed on weight, depression, total anxiety, social anxiety, performance anxiety, total quality of life measure and the five components of quality of life measure (physical function, self-esteem, sex life, public distress, and work) to test for mean difference between pre (3 weeks prior to surgery) and post-surgical (1 year after surgery) data. Among these variables, between the two time points, weight ($t = 18.6$, $p < 0.001$), BMI ($t = 18.8$, $p < 0.001$), depression ($t = 5.3$, $p < 0.001$), total quality of life ($t = -11.3$, $p < 0.001$), physical function ($t = -12.7$, $p < 0.001$), self-esteem ($t = -9.2$, $p < 0.001$), sex life ($t = -6.1$, $p < 0.001$), public distress ($t = -9.1$, $p < 0.001$), and work ($t = -6.4$, $p < 0.001$) showed significant improvement after surgery. However, total anxiety ($t = 1.5$, $p = 0.15$), performance anxiety ($t = 0.9$, $p = 0.35$), and social anxiety ($t = 1.7$, $p = 0.09$) did not significantly improve after surgery (Table 4).

Table 4: ***Research Question 1: Effect of Bariatric Surgery on Body Weight and Psychological Factors (Pre- and Post-Surgical Outcome Differences)***

Outcomes (Range)	Mean (Pre)	Mean (Post)	Mean Δ (pre-post)	SD	t	*P*-Value
BMI (kg/m^2)	47.3	33.2	14.1[a]	7.0	18.8	**< 0.001***
Weight (kg)	131.3	92.0	39.3[a]	19.8	18.6	**< 0.001***
Depression (25-100)	46.8	41.2	5.6[a]	10.0	5.3	**< 0.001***
Total Anxiety (0-72)	17.7	15.9	1.8[a]	11.5	1.5	0.15
Performance Anxiety (0-39)	9.8	9.1	0.7[a]	6.4	0.9	0.35
Social Anxiety (0-33)	7.9	6.8	1.1[a]	6.0	1.7	0.09
Total Quality of Life (%) (N=76)[c]	54.3	82.3	-28.0[b]	21.6	-11.3	**< 0.001***
Physical Function (%)	47.0	81.9	-34.9[b]	25.7	-12.7	**< 0.001***
Self Esteem (%)	49.8	77.7	-27.9[b]	28.3	-9.2	**< 0.001***
Sex Life (%)	63.0	84.7	-21.7[b]	32.1	-6.1	**< 0.001***
Public Distress (%)	55.8	84.2	-28.4[b]	28.4	-9.1	**< 0.001***
Work (%) (N=79)[c]	73.8	91.9	-18.1[b]	24.9	-6.4	**< 0.001***

Note. Δ represents difference. *$p < 0.0042$, two-tailed. To be conservative, the Bonferroni correction ($\beta = \alpha/n$) is used to correct for errors from multiple testing. The conservative significance level is set to be 0.0042 (derived from 0.05/12).
a. For these outcome measures, positive difference denotes improvement after surgery.
b. For these outcome measures, negative difference denotes improvement after surgery.
c. This N differs from the N presented in Table 2 by 1 due to paired sample statistical procedure.

GLM repeated measure analyses and Pearson correlation analyses were then done to test whether significant changes (improvement) in depression and quality of life (total, physical function, self-esteem, sexual life, public distress, and work) vary by weight loss after surgery (Table 5). The results show that improvements in total quality of life ($F = 5.6$, $p = 0.02$), physical function ($F = 7.2$, $p = 0.009$), self-esteem ($F = 4.5$, $p = 0.04$), and public distress ($F = 16.7$, $p < 0.001$) are positively correlated with weight change.

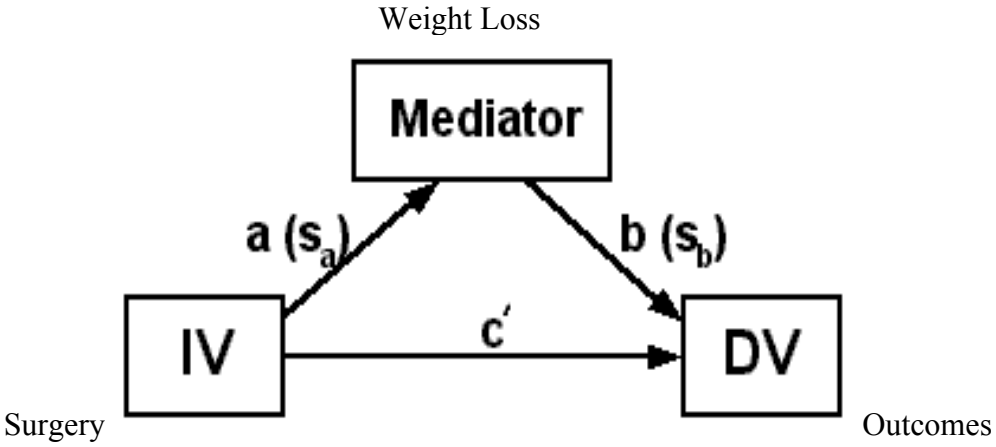
Table 5: ***Effect of Post-Surgical Weight Change on Significant Outcome Improvement***

Outcomes	F	*P*-Value	Pearson Correlation
Improvement in Depression	0.06	0.82	-0.03
Improvement in Total Quality of Life	5.6	**0.02***	0.27
Improvement in Physical Function	7.2	**0.009***	0.28
Improvement in Self-esteem	4.5	**0.04***	0.23
Improvement in Sexual Life	0.3	0.60	0.06
Improvement in Public Distress	16.7	**0.000***	0.41
Improvement in Work	1.1	0.30	0.12

Note. *$p < 0.05$.

In order to examine whether weight loss mediates all of the effect that surgery has on improvements in total quality of life, physical function, self-esteem, and public distress, the following mediator analysis was conducted (Figure 1).

Figure 1: ***Mediator Analysis Model***



In the current study, IV (independent variable) represents surgery, mediator represents weight loss, and DV (dependent variable) represents the improvements in post-surgical total quality of life, physical function, self-esteem, and public distress. C' represents the direct effect that surgery has on the improvements in these outcomes, and the product of "a" and "b"

represents the indirect effect that surgery has on the improvements in these four outcomes after surgery. In other words, the product of "a" and "b" represents the effect that weight loss has on the improvements in these four outcomes after surgery. The results show that weight loss partially mediates the effect of surgery on the improvements in total quality of life ($p = 0.019$), physical function ($p = 0.008$), and self-esteem ($p = 0.035$) (Table 6). Weight loss only partially but not completely mediates the effect that surgery has on the improvements in total quality of life, physical function, and self-esteem because the direct effect of surgery on the improvements in total quality of life ($p = 0.002$), physical function ($p = 0.001$), and self-esteem ($p = 0.022$) were also significant. The improvements in total quality of life, physical function, and self-esteem could only be partially explained by weight loss, and it is not clear as to what exactly but something about the surgery other than weight loss led to the improvements in total quality of life, physical function, and self-esteem after surgery. Weight loss mediates nearly all of the effect that surgery has on the improvement in public distress because the direct effect that surgery has on the improvement in public distress disappeared after taking into account the effect that weight loss has on public distress ($p < 0.001$). In other words, the direct effect that surgery has on the improvement in public distress was no longer significant ($p = 0.4$), so weight loss after surgery was essentially responsible for all of the improvement in post-surgical public distress. The mediation analysis was conducted under the assumption that improvements in these outcomes of interest were not due to the natural passing of time but were due to surgery.

Table 6: ***Mediator Analysis***

Outcomes	a	S_a	b	S_b	P-value (Sobel Test: indirect effect)	Total Surgical Mean Improvement (direct + indirect effects)	c' (direct effect)	S_c	P-value (c')
Improvement in Total Quality of Life	39.3	2.1	0.28	0.12	**0.019***	28.0	16.7	5.3	**0.002***
Improvement in Physical Function	39.3	2.1	0.36	0.13	**0.008***	34.9	20.8	5.9	**0.001***
Improvement in Self-esteem	39.3	2.1	0.32	0.15	**0.035***	27.9	15.4	6.6	**0.022***
Improvement in Public Distress	39.3	2.1	0.58	0.14	**< 0.001***	28.4	5.3	6.3	0.40

Note. "a" represents (unstandardized) regression coefficient for the association between surgery and weight loss. "b" represents (unstandardized) coefficient for the association between weight loss and the outcome variables. "S_a" and "S_b" are the standard errors for "a" and "b" respectively. c' represents (unstandardized) regression coefficient for the association between surgery and surgery and outcome variables. Sobel test is used to test the indirect effect of surgery on outcomes through weight loss. *$p < 0.05$.

4.3 Research Question 2: Effect of Surgery Type

Multi-collinearity was first assessed. None of the models with the given dependent variable mentioned previously violated muti-collinearity. To see the VIF and tolerance values for each model, please refer to Appendix H.

The results showed that there is a significant difference between LRYG and LAGB on the following post-surgical outcomes, controlling for baseline measures: quality of life ($F = 12.5$, $p = 0.001$, $N = 75$), physical function ($F = 11.2$, $p = 0.001$, $N = 86$), self-esteem ($F = 9.5$, $p = 0.003$, $N = 86$), public distress ($F = 13.8$, $p < 0.001$, $N = 82$), work ($F = 8.8$, $p = 0.004$, $N = 78$), % weight loss ($F = 126.3$, $p < 0.001$, $N = 87$), % EWL ($F = 124.8$, $p < 0.001$, $N = 87$), and post-surgical absolute weight loss (kg) ($F = 87.7$, $p < 0.001$, $N = 87$). There is no significant difference between the two surgeries in the following post-surgical measures, controlling for baseline measures: depression ($F = 0.03$, $p = 0.87$, $N = 87$), sexual life ($F = 0.9$, $p = 0.35$, $N = 79$), total anxiety ($F = 0.9$, $p = 0.35$), performance anxiety ($F = 0.5$, $p = 0.47$), and social anxiety ($F = 1.0$, $p = 0.32$). All these statistical figures were controlled for age, gender, education, race/ethnicity, baseline psychological health (depression and anxiety), and their own baseline measures.

Compared to LAGB, LRYGB showed greater improvement in post-surgical total quality of life by 14.4 ± 4.1 units ($t = 3.5$, $p = 0.001$), post-surgical physical function by 14.4 ± 4.3 units ($t = 3.3$, $p = 0.001$), post-surgical self-esteem by 17.4 ± 5.6 units ($t = 3.1$, $p = 0.003$), post-surgical public distress by 17.8 ± 4.8 units ($t = 3.7$, $p < 0.001$), post-surgical work by 10.7 ± 3.6 units ($t = 3.0$, $p = 0.004$), post-surgical % weight loss by 22.6 ± 0.02 % ($t = 11.2$, $p < 0.001$), post-surgical % EWL by 40.3 ± 3.6 % ($t = 11.2$, $p < 0.001$), post-surgical absolute weight loss

by 28.4 ± 3.0 kg ($t = 9.4$, $p < 0.001$) (Table 7). Please refer to Appendix I for detailed statistical outputs. Again, all these statistical figures were controlled for age, gender, education, race/ethnicity, baseline psychological health (depression and anxiety), and their own baseline status. Most of the scales used to measure the outcomes of interest have not established a clear clinical cutoff. Thus, whether these statistically significant differences between the two surgeries are also clinically significant are up to clinician's interpretation. However, in terms of improvement in % EWL, the difference between the two surgeries is 40.3%, which seems objectively large to conclude that LRYGB is more effective in % EWL compared to LAGB both statistically and clinically.

Table 7: ***Research Question 2: Compared Effects of Gastric Bypass and Lap-Banding***

	Gastric Bypass (GB)			Lap-Banding (LB)			Change (GB) - Change (LB)	*P*-Value (Adjusted Δ)
Outcomes	Pre	Post	Change (Pre-Post)	Pre	Post	Change (Pre-Post)		
BMI (kg/m^2)	47.5 (SD=7.6)	30.4 (SD=18.9)	17.1[a] (SD=5.0, N=63)	46.9 (SD=9.7)	40.4 (SD=9.7)	6.5[a] (SD=5.4, N=25)	10.6	**< 0.001***
% Weight Loss	N/A	N/A	35.9%[a]	N/A	N/A	13.9%[a]	22.0%	**< 0.001***
% Excess Weight Loss	N/A	N/A	65.8%[a]	N/A	N/A	26.7%[a]	39.1%	**< 0.001***
Weight (kg)	131.5 (SD=25.6)	84.2 (SD=5.5)	47.3[a] (SD=14.1, N=63)	130.8 (SD=33.6)	111.6 (SD=25.7)	19.2[a] (SD=17.9, N=25)	28.1	**< 0.001***
Depression	46.2 (SD=9.7)	40.4 (SD=10.3)	5.8[a] (SD=10.3, N=62)	48.4 (SD=8.8)	43.0 (SD=10.0)	5.4[a] (SD=9.5, N=25)	0.4	0.87
Total Anxiety	16.9 (SD=14.4)	14.4 (SD=12.5)	2.5[a] (SD=12.4, N=62)	19.6 (SD=15.7)	19.6 (SD=15.9)	0.0[a] (SD=9.1, N=25)	2.5	0.35
Performance Anxiety	9.2 (SD=7.4)	8.4 (SD=7.3)	0.8[a] (SD=6.9, N=62)	11.2 (SD=8.5)	11.0 (SD=9.0)	0.2[a] (SD=5.0, N=25)	0.6	0.47
Social Anxiety	7.6 (SD=7.7)	6.1 (SD=5.9)	1.5[a] (SD=6.4, N=62)	8.5 (SD=7.6)	8.5 (SD=7.6)	0.0[a] (SD=4.8, N=25)	1.5	0.32
Total Quality of Life	56.5 (SD=23.0)	86.9 (SD=16.2)	-30.4[b] (SD=22.3, N=56)	48.4 (SD=21.0)	69.3 (SD=21.6)	-20.9[b] (SD=18.0, N=20)	-9.5	**0.001***
Physical Function	48.2 (SD=26.1)	86.6 (SD=16.5)	-38.4[b] (SD=27.7, N=62)	44.1 (SD=22.4)	70.2 (SD=23.6)	-26.1[b] (SD=16.9, N=25)	-12.3	**0.001***
Self-esteem	51.9 (SD=28.7)	83.6 (SD=22.7)	-31.7[b] (SD=29.8, N=62)	44.4 (SD=27.9)	62.9 (SD=31.9)	-18.5[b] (SD=21.7, N=25)	-13.2	**0.003***
Sexual Life	65.1 (SD=32.7)	87.4 (SD=25.1)	-22.3[b] (SD=33.3, N=58)	57.4 (SD=33.4)	77.6 (SD=22.8)	-20.2[b] (SD=29.3, N=22)	-2.1	0.35
Public Distress	56.0	89.4	-33.4[b]	55.4	70.7	-15.3[b]	-18.1	**< 0.001***

	Gastric Bypass (GB)			Lap-Banding (LB)			Change (GB) - Change (LB)	*P*-Value (Adjusted Δ)
Outcomes	Pre	Post	Change (Pre-Post)	Pre	Post	Change (Pre-Post)		
	(SD=32.4)	(SD=20.9)	(SD=28.4, N=60)	(SD=28.2)	(SD=30.1)	(SD=24.2, N=23)		
Work	75.3 (SD=27.6)	94.9 (SD=13.7)	-19.6[b] (SD=26.1, N=58)	69.9 (SD=83.4)	84.1 (SD=18.6)	-14.2[b] (SD=21.0, N=21)	-5.4	**0.004***

Note. Δ represents difference. * denotes a significant difference ($p < 0.005$) between the change after gastric bypass and the change after lap-banding, controlling for covariates.

a. For these outcome measures, positive difference denotes improvement after surgery.

b. For these outcome measures, negative difference denotes improvement after surgery.

Even when the significance level is set to be 0.005 rather than 0.05 to account for potential errors that could result from multiple testing, the results shown here are still significant. A further analysis was conducted to test if the outcomes of interest would differ between the two surgery types when adding weight change as an additional independent variable in the model. The results showed that the only outcome that still holds significant differences between the two surgeries was work (F = 4.3, p = 0.04). There was no significant difference in depression, anxiety (total, performance, and social), and quality of life (total, physical function, self-esteem, sexual life, and public distress) (Table 8). Please refer to Appendix J for detailed statistical outputs.

Table 8: ***Effect of Surgery Types Controlling for Weight Change***

Dependent Variable (Post-Surgical)	Predictor	F	*P*-Value
Total Quality of Life (N = 75)	Type of Surgery	1.0	0.33
Physical Function (N = 86)	Type of Surgery	< 0.001	0.98
Self-esteem (N = 86)	Type of Surgery	1.4	0.25
Sexual Life (N= 79)	Type of Surgery	0.04	0.85
Public Distress (N = 82)	Type of Surgery	1.6	0.22
Work (N = 78)	Type of Surgery	4.3	**0.04***
Depression (N = 87)	Type of Surgery	0.08	0.78
Total Anxiety (N = 86)	Type of Surgery	0.5	0.47
Performance Anxiety (N = 86)	Type of Surgery	0.3	0.59
Social Anxiety (N = 86)	Type of Surgery	0.7	0.40

Note. *p < 0.05.

4.4 Research Question 3: Baseline Psychological Predictors of Post-Surgical Outcomes

The following section examines whether pre-surgical psychopathology (depression and total anxiety respectively) helps predict post-surgical outcomes. A statistical result reported about a specific predictor is a reflection of controlling for all the other variables in the model, including surgery type. In other words, whenever a specific predictor is being interpreted, all the other variables, which serve as covariates, are held constant. These variables are listed in a table format at the end of chapter 3.

Predictor: Baseline Depression

Baseline depression ($F = 8.4$, $p = 0.005$) is a predictor of post-surgical depression ($N = 87$). For every unit increase in baseline depression ($t = 2.9$, $p = 0.005$), there is a 0.4 ± 0.1 unit increase in post-surgical depression scale. Baseline depression is not a predictor of % EWL, % weight loss, absolute weight loss, anxiety (total, performance, and social), and quality of life (total, physical function, self-esteem, sexual life, public distress, and work).

Predictor: Baseline Total Anxiety

Baseline total anxiety is a predictor of post-surgical depression ($F = 13.0$, $p = 0.001$, $N = 86$) and post-surgical total anxiety ($F = 43.8$, $p < 0.001$, $N = 86$). For every unit increase in baseline total anxiety ($t = 3.6$, $p = 0.001$), there is a 0.3 ± 0.08 unit increase in post-surgical depression, and for every unit increase in baseline total anxiety ($t = 6.6$, $p < 0.001$), there is a 0.6 ± 0.1 unit increase in post-surgical total anxiety. Baseline total anxiety is also a predictor for postsurgical total quality of life ($F = 8.6$, $p = 0.005$, $N = 75$), post-surgical sexual life quality ($F = 5.0$, $p < 0.001$, $N = 79$), post-surgical public distress ($F = 4.4$, $p = 0.04$, $N = 82$) and post-surgical work quality of life ($F = 4.3$, $p = 0.04$, $N = 78$). For every unit increase in baseline total

anxiety, there is a 0.4 ± 0.2 unit decrease in post-surgical total quality of life (t = -2.0, p = 0.005). For every unit increase in baseline total anxiety, there is a 0.7 ± 0.2 unit decrease in post-surgical sexual life quality (t = -3.4, $p < 0.001$), a 0.4 ± 0.2 unit decrease in post-surgical public distress (t = -2.1, p = 0.04), and a 0.3 ± 0.1 unit decrease in post-surgical work quality (t = -2.1, p = 0.04).

Predictor: Baseline Performance Anxiety

Baseline performance anxiety is a predictor of post-surgical depression (F = 6.1, p = 0.02, N = 87), post-surgical total anxiety (F = 36.7, $p < 0.001$, N = 86), post-surgical performance anxiety (F = 38.9, $p < 0.001$, N = 86), and post-surgical social anxiety (F = 25.6, $p < 0.001$, N = 86). For every unit increase in baseline performance anxiety, there is a 0.4 ± 0.2 unit increase in post-surgical depression (t = 2.5, p = 0.02), a 1.1 ± 0.2 unit increase in post-surgical total anxiety (t = 6.1, $p < 0.001$), a 0.7 ± 0.1 unit increase in post-surgical performance anxiety (t = 6.2, $p <$ 0.001), and a 0.5 ± 0.1 unit increase in post-surgical social anxiety (t = 5.1, $p < 0.001$). Baseline performance anxiety is also a predictor for post-surgical total quality of life (F = 5.8, p = 0.02, N = 75) and post-surgical sexual life (F = 10.3, p = 0.002, N = 79). For every unit increase in baseline performance anxiety, there is a 0.7 ± 0.3 unit decrease in post-surgical total quality of life (t = -2.413, p = 0.019) and a 1.2 ± 0.4 unit decrease in post-surgical sexual life quality (t = -3.2, p = 0.002). Baseline depression did not predict any of the post-surgical weight loss measures.

Predictor: Baseline Social Anxiety

Baseline social anxiety is a predictor of post-surgical depression (F = 20.2, $p < 0.001$, N = 87), post-surgical total anxiety (F = 37.7, $p < 0.001$, N = 86), post-surgical performance

anxiety (F = 26.3, $p < 0.001$, N = 86), and post-surgical social anxiety (F = 42.9, $p < 0.001$, N = 86). For every unit increase in baseline social anxiety, there is a 0.7 ± 0.1 unit increase in post-surgical depression (t = 4.5, $p < 0.001$), a 1.2 ± 0.2 unit increase in post-surgical total anxiety (t = 6.1, $p < 0.001$), a 0.6 ± 0.1 unit increase in post-surgical performance anxiety (t = 5.1, $p < 0.001$), and a 0.6 ± 0.09 unit increase in post-surgical social anxiety (t = 6.5, $p < 0.001$). Baseline social anxiety is also a predictor for post-surgical total quality of life (F = 10.0, $p = 0.002$, N = 75), post-surgical sexual life (F = 10.8, $p = 0.002$, N = 79), post-surgical public distress (F = 5.0, $p = 0.03$, N = 82), and post-surgical work (F = 6.3, $p = 0.02$, N = 78). For every unit increase in baseline social anxiety, there is a 0.9 ± 0.3 unit decrease of post-surgical total quality of life (t = -3.2, $p = 0.002$), a 1.3 ± 0.4 unit decrease of post-surgical sexual life quality (t = -3.3, $p = 0.002$), a 0.8 ± 0.4 unit decrease of post-surgical public distress (t = -2.2, $p = 0.03$), and a 0.6 ± 0.2 unit decrease of post-surgical work quality of life (t = -2.5, $p = 0.02$). Baseline anxiety (total, performance, and social) did not predict any of the post-surgical weight loss measures.

4.5 Research Question 4: Demographic Predictors

Demographic predictor: Age

Age (F = 5.3, $p = 0.03$) helps predict post-surgical sexual life (N = 79), when other demographic variables (education, race, gender) and baseline status variables (baseline sexual life, baseline depression, baseline anxiety) and type of surgery were controlled. In such case, for every year of age increase, there is a decrease in post-surgical quality of sexual life by 0.6 ± 0.3 point (t = -2.3, $p = 0.03$). Age also helps predict post-surgical % EWL (F = 4.0, $p = 0.05$, N = 87) and post-surgical absolute weight loss (F = 4.2, $p = 0.04$, N = 87). In such cases, for every

year of age increase, there is a decrease of 0.3 ± 0.2 % in post-surgical % EWL (t = -2.0, p = 0.05) and a decrease of 0.3 ± 0.1 kg in post-surgical absolute weight loss (t = -2.1, p = 0.04). Age did not significantly predict the following post-surgical measures: depression, total quality of life, physical function, self-esteem, public distress, work, total anxiety, performance anxiety, social anxiety, and % weight loss.

Demographic predictor: Gender and Race

Neither gender nor race was a significant predictor of any of the dependent variables of interest.

Demographic predictor: Education

Education (F = 3.4, p = 0.02, N = 78) was a significant predictor of quality of life at work. In such case, when comparing those who had some high school education to those who completed college, the quality of life at work for those with some high school is 18.1 ± 6.1 units lower. However, when comparing those with completed high school or those with some college or associate degree with those who completed college, the difference is not significant. Education did not significantly predict the following post-surgical measures: depression, total quality of life, physical function, self-esteem, sexual life, public distress, total anxiety, performance anxiety, social anxiety, % weight loss, % EWL, and absolute weight loss.

Predictor: Baseline BMI

Baseline BMI is a significant predictor for weight loss in kilograms (F = 33.6, p < 0.001, N = 87). For every unit increase in BMI (t = 5.8, p < 0.001), there is an increase of 1.0 ± 0.2 kg in absolute weight loss. Baseline BMI (F = 4.2, p = 0.046, N = 75) is also a significant predictor of total quality of life. For every unit increase in BMI (t = -2.0, p = 0.046), there is a decrease of

0.5 ± 0.2 unit in total quality of life post-surgically. Baseline BMI is also a predictor of physical function (F= 4.4, p = 0.04, N = 86), in which for every unit increase in BMI (t = -2.1, p = 0.04), there is a decrease of 0.6 ± 0.3 units in physical function. It also predicts public distress (F = 4.2, p = 0.04, N = 82). For every unit increase in BMI (t = -2.1, p = 0.04), there is a decrease of 0.6 ± 0.3 unit in public distress. Baseline BMI does not predict % weight loss but it predicts % EWL (F = 5.8, p = 0.02, N = 87). For every unit increase in BMI (t = -2.4, p = 0.02), there is a decrease of 0.5 ± 0.2 % in % EWL.

Predictor: Baseline quality of life

When looking at whether pre-surgical quality of life could predict post-surgical quality of life, among all the baseline quality of life measures (total, physical function, self-esteem, sexual life, public distress, and work), baseline public distress (F = 4.6, p = 0.04, N = 82) is the only significant predictor of its post-surgical status.

Predictor Summary

Table 9 is a summary predictor table. For detailed statistical results, please refer to Appendix I, K, and L. The list of variables on the first row represents predictors while the list of variables on the first left hand column represents 1 year post-surgical outcomes. NS represents non-significant predictability. The symbol "+" represents a positive predictability while the symbol "-" represents a negative predictability. The level of significance is set at $p < 0.05$. The current study aims to investigate the predictability of baseline psychopathology (depression and total anxiety) and demographic factors (age, gender, education, race/ethnicity, baseline BMI) of post-surgical outcomes. The significance level did not correct for multiple testing for several reasons. First, it has been argued that if statistical tests are only performed when there is a strong

basis for expecting the results to be true, multiple comparisons adjustments are not necessary and use of multiple testing corrections is an inefficient way to perform empirical research, since multiple testing adjustments control false positives at the potential expense of many more false negatives (Rothman, 1990). However, testing of large number of hypotheses with no prior basis for expecting many of the hypotheses to be true can be problematic, in which case, one will need to correct for multiple testing due to increased chance of high false positive rates (Loannidis, 2005). However, the current study is based on previous literature, not randomly trying to test for a large numbers of hypotheses. Thus, multiple testing was not adjusted. In addition, in certain branches of science such as genetic testing, when a large scale of testing, such as expression levels of tens of thousands of genes can be measured, and genotypes for millions of genetic markers can be measured, multiple testing is highly encouraged. However, testing of the current study is based on 13 outcome measures, some of which are associated with each other, rather than completely independent from each other. A policy of not making adjustments for multiple testing is preferable because it will lead to fewer errors of interpretation when the data under evaluation are not random numbers but actual observations on nature and that scientists should not be so reluctant to explore leads that may turn out to be wrong that they penalize themselves by missing possibly important findings (Rothman, 1990).

Table 9: ***Summary Table (Predictors of 1 Year Post-Surgical Outcomes)***

Predictors / Outcomes	Baseline Depression	Baseline Total Anxiety	Baseline Performance Anxiety	Baseline Social Anxiety	Baseline BMI	Age	Gender	Race	Education
Absolute Weight Loss (kg)	NS	NS	NS	NS	+	-	NS	NS	NS
% Weight Loss	NS	NS	NS	NS	NS	NS	NS	NS	NS
% Excess Weight Loss	NS	NS	NS	NS	-	-	NS	NS	NS
Depression	+	+	+	+	NS	NS	NS	NS	NS
Total Anxiety	NS	+	+	+	NS	NS	NS	NS	NS
Performance Anxiety	NS	+	+	+	NS	NS	NS	NS	NS
Social Anxiety	NS	+	+	+	NS	NS	NS	NS	NS
Total Quality Of life	NS	-	-	-	-	NS	NS	NS	NS
Physical Function	NS	NS	NS	NS	-	NS	NS	NS	NS
Self-esteem	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sexual Life	NS	-	-	-	NS	-	NS	NS	NS
Public Distress	NS	-	NS	-	-	NS	NS	NS	NS
Work	NS	-	NS	-	NS	NS	NS	NS	+

Note. "+" indicates positive predictability; "-" indicates negative predictability.

Chapter 5: Discussion

Highlights

Similar to other study findings (van Hout et al., 2006), after bariatric surgery weight decreased and psychological disorders such as depression improved. More specifically, the current study found that baseline anxiety is a significant predictor of total post-surgical quality of life, post-surgical sexual life, and post-surgical public distress and work, which represent most of the quality of life measures in the current study, but baseline depression does not help predict such measures. Lower baseline BMI and better baseline anxiety status are predictors of improvement in quality of life after surgery. Younger age (Ma et al., 2006; Sczepaniak et al., 2012) and lower baseline BMI (Ma et al., 2006; Sczepaniak et al., 2012) are significant predictors of post-surgical weight loss (% EWL and absolute weight loss). Those with lower baseline BMI lost less absolute weight after surgery, but they lost a higher % EWL. Results of the current study indicated that gastric bypass surgery is not only more effective than lap-banding surgery in terms of weight loss but also showed greater improvement in quality of life after surgery compared to lap-banding surgery. However, this surgical difference in quality of life improvement disappeared when taking into account changes in weight from pre- to post-surgery.

Predictors of Surgical outcomes

Although some of the past literature shows a negative correlation between baseline depressive disorder and post-surgical weight loss (Kinzl et al., 2006; Ryden et al., 1996), as a group, patients with pre-surgical depressive disorder have also demonstrated beneficial post-surgical weight loss and improvement in depression (Averbukh et al., 2003). However, in line

with previous studies, results of this study indicate that presence of depressive symptoms did not significantly predict post-surgical % EWL (Ma et al., 2006; Ryden et al., 1996; Thonney et al., 2010), % weight loss, and absolute weight loss. However, intuitively, it might seem reasonable to believe that the worse the baseline depression, the harder it might be for one to adjust to the new post-surgical life, and hence the worse the weight loss outcome. It has been shown that as baseline BMI increases, the more prevalent depression results after surgery (Thonney et al., 2010). However, depression, like many other psychological problems, is a very complex disorder, to which many factors could contribute. In addition, there are many individually related issues, which even the most robust statistical tool could not capture.

There is limited evidence with regard to the effect of pre-surgical anxiety on surgery outcomes. A number of studies showed that anxiety levels before the surgery were not predictive of weight loss at 1-5.7 years post-surgically (Dixon et al., 2001; Kinzl et al., 2006; Powers et al., 1997; Thonney et al., 2010; van Hout & van Heck, 2009). The statistical analyses of our study revealed that pre-surgical anxiety does not help predict % EWL, % weight loss, or absolute weight loss after surgery. Taken together, the results of our study suggest that pre-surgical psychological characteristics such as depression and anxiety are not predictors of % EWL, % weight loss, and absolute weight loss after surgery. This study is in line with previous research (Thonney et al., 2010). However, an interesting result is that lower baseline anxiety is a significant and positive predictor of total post-surgical quality of life, post-surgical sexual life, and post-surgical public distress and work, which represent most of the quality of life measures in the current study, in other words, the lower the baseline anxiety score (the better the baseline anxiety), the higher the post-surgical scores in quality of life measures (better post-surgical

quality of life). However, baseline depression does not help predict this same set of outcome measures. This shows that even though depression and anxiety usually tend to co-exist in the bariatric population, they do not possess the same level of capacity to predict post-surgical quality of life. This finding indicates that pre-surgical anxiety should be carefully assessed, and if possible, needs to be treated or monitored. It has been found that participation in a treatment program prior to surgery when the presence of psychological conditions were noticed would have a positive impact on weight loss after surgery (Clark et al., 2003). Hence, the current study supports the concept that, when psychological conditions, specifically anxiety, are noticed, participation in a treatment program either in individual or group counseling session, should be strongly encouraged or even mandated as part of the surgical program clearance process. This is, however, assuming that these treatments or counseling sessions are effective in improving psychopathological conditions.

Little research has been on predictors of post-surgical depression, anxiety, and quality of life because weight loss is still the focus in most studies. However, post-surgical outcomes other than weight loss are also important. For instance, quality of life impairment has been found as the most serious concomitant of their disease among the obese population (Kral et al., 1992). Thus, not only weight loss but also quality of life demands more research attention. The current study found that lower baseline BMI and better baseline anxiety status are predictors of improvement in quality of life after surgery. Given that lower baseline BMI predicts greater weight loss, and that greater impairments in quality of life are associated with greater degrees of obesity (Kolotkin, Meter et al., 2001), this result is not surprising.

Further, the current study found that baseline BMI is inversely related to % EWL but directly related to absolute weight loss after surgery. This shows that although those with lower baseline BMI lose less absolute weight after surgery, they are actually doing better because of a higher % EWL. This makes sense because those with lower baseline BMI have less weight to lose after surgery, but when interpreted in terms of percentage, it reflects greater weight loss. Finally, the current study was not able to show that lower baseline BMI would significantly predict greater % weight loss.

In line with previous research addressing predictors of post-surgical psychological wellbeing (van Hout & Hagendoren et al., 2009), the current study revealed that post-surgical psychological values were best predicted by their pre-surgical values, namely depression, public distress, anxiety, social anxiety, and performance anxiety. Self-esteem and physical function were borderline significant. After surgery, one's psychopathology improves as confirmed by this and other studies, so the results seem reasonable since those with worse baseline depression or baseline anxiety would have worse post-surgical depression and anxiety compared to those with better baseline depression or anxiety status.

Effect of Surgery Type

Even though gastric bypass results in greater weight loss, it has been associated with more perioperative and late complications such as stricture with a higher 30-day readmission rate (Nguyen, Slone, Nguyen, Hartman, & Hoyt, 2009). The current study found that, compared to banding, bypass shows more improvement in post-surgical total quality of life, post-surgical self-esteem, post-surgical public distress, post-surgical work, post-surgical % weight loss, post-surgical % EWL, and post-surgical absolute weight loss. Consistent with findings from previous

studies (Nguyen et al., 2009; Sugerman et al., 1992), results from the current study indicate that gastric bypass surgery is more effective than lap-banding surgery in terms of weight loss. This is not surprising given that gastric bypass surgery is a more aggressive weight loss surgery than lap-banding surgery and it anatomically alters the patient's body more drastically to restrict and alter absorption.

Greater weight loss resulting from gastric bypass compared to lap-banding gives reason to believe that improvement in quality of life could be greater for those who undergo gastric bypass since they see more weight loss compared to those who undergo lap-banding. Whether improvement in quality of life leads to more weight loss or vice versa, or simultaneously, is not clear, but the positive association between weight loss and improvement in quality of life (total, physical function, self-esteem, and public distress) was found in the current study. Similar to past literature findings, psychosocial functioning, a term often used to reflect quality of life, and mental health, have been found to follow post-surgical weight reduction (Karlsson, Taft, Sjostrom, Torgerson, & Sullivan, 2003) or have positive association with post-surgical weight loss, that is, the greater the weight reduction, the greater the quality of life improvement (Karlsson et al., 1998). A further analysis done in the current study also confirmed that after adding weight change to the model, the only outcome that showed significant difference between the two surgeries is the work component of the quality of life measure. The previously found significant differences in total quality of life, physical function, self-esteem, and public distress between the two surgeries no longer existed after controlling for weight change in the model. This showed that it seems to be the weight loss rather than the surgery itself that resulted in such differences.

Difference in complications specific to each surgery should also be kept in mind when selecting the optimal type of surgery. For instance, lap-banding patients tend to show more issues of frequent vomiting and band slippage while bypass patients are more likely to have dumping syndromes and nutrient deficiencies (Weight Control Information Network [WIN], 2004). It is challenging and possibly unfair to state which quality of life compromising complications, specific to a particular type of surgery, are more challenging than the other due to different reactions and expectations from one patient to the next. Hence, when a candidate is considering bariatric surgery, consultation on surgery selection should not solely focus on weight loss outcome but should take into account the complications that a given patient might be willing to endure.

According to joint medical guidelines created by American Association of Clinical Endocrinologists (AACE), The Obesity Society (TOS), and American Society for Metabolic & Bariatric Surgery (ASMBS), even though various bariatric procedures are currently available, minimal scientific data exist for establishing which procedure should be performed for which patient (Mechanick et al., 2009). Ultimately patients have the final say on their surgery type under the guidance of their team of health care providers. Currently, RYGB has been recommended as the bariatric procedure of choice in the United States due to its effective weight loss outcome (Tice et al., 2008). Undisputedly, weight loss is effective in reducing obesity-related comorbidities such as diabetes and hypertension; however, besides weight loss, post-surgical psychological health is crucial to patients' quality of life. Although there is no standardized pre-screening protocol, the pre-surgical evaluation for surgery usually involves multiple disciplines, from a general internist, to the endocrinologist, to the bariatric surgeon, to

the registered dietitian, and to the licensed psychologist/psychiatrist (Mechanick et al., 2009). However, "It appears that some evaluators recommend virtually all of the candidates they see for surgery, whereas others have much more stringent criteria that candidates must meet before they receive psychological clearance"(Walfish et al., 2007). Hence, it is crucial to mandate a standardized protocol to ensure that patients are fairly and well-assessed for greater surgical outcomes. However, organizations that serve and treat obese patients provide a long list of evidence-based recommendations such as how patients should be managed pre- and post-surgically, due to a lack of standardization, different surgical clinics across the country can have very different standards of care, some of which might not be ideal.

Demographic Factors as Predictor

Weight loss success is expected and essential after bariatric surgery. Post-surgical weight loss has been shown in previous research to improve many medical and psychological complications such as diabetes, social functioning and quality of life (Tice et al., 2008). From a weight loss standpoint, in accordance with previous studies, results of the current study indicate that younger age (Ma et al., 2006; Sczepaniak et al., 2012) and lower baseline BMI (Ma et al., 2006; Sczepaniak et al., 2012) are significant predictors of post-surgical extent of weight loss (% EWL and absolute weight loss). Those who are younger and have a lower baseline BMI probably show greater post-surgical weight loss because of fewer pre- and post-comorbidities. Due to lack of information on pre- and post-surgical comorbidities, the current study did not confirm this reasoning. However, a study comparing older patients to those under 60 years of age found that older patients had more pre- and post-surgical comorbidities and also lost less weight than younger patients (Sugerman et al., 2004). If younger patients do have fewer pre-

and post-surgical comorbidities in the current study, this may suggest that they are relatively healthier, and might be able to heal and adjust to their new body more quickly.

Age is not a modifiable factor before surgery, but the impact of lower baseline BMI as a predictor of a greater post-surgical weight loss success needs to be emphasized to surgical candidates. Although prior to surgery, bariatric candidates are supposed to demonstrate failure in their effort to have at least one 'good faith attempt' to lose weight through non-surgical methods, it is hard to assess how much effort was put in during their 'good faith attempt', especially when they are already determined to undergo surgery. It is possible that many bariatric surgical patients decide to undergo surgery purely for medical reasons, but many of them might also select this weight loss method as a quick fix for cosmetic reasons without any intention to change their less-than-ideal pre-surgical lifestyle after surgery. A stricter monitoring system to assess the 'good faith attempt' should be in place. The benefits of lower baseline BMI such as greater weight loss outcome and greater improvement in quality of life should be clearly explained to surgical candidates. Bariatric candidates might face the possibility of losing too much weight prior to surgery and become unqualified for surgery, which could explain why a certain subset of bariatric candidates do not try as hard as they can to lose weight prior to surgery.

However, younger age and lower BMI were not significant predictors of % weight loss in the current study. This might be because % weight loss is a stricter parameter to look at weight loss compared to % EWL and absolute weight loss. Percent weight loss is a useful weight loss indicator from a surgeon's perspective because it represents the percentage of weight loss the surgery is able to achieve. However, % EWL is a more meaningful weight loss indicator for patients because their goal is to lose 100% of their excess weight. Other than weight loss,

variables such as gender, race, education, and type of surgery were also analyzed and gender, race, education found to be non-significant predictors for % EWL, % weight loss, and absolute weight loss. Past studies have found male gender to be a positive predictor of % EWL (Ma et al., 2006), a positive predictor of weight loss failure (< 20% EWL) (Busetto et al., 2002), and a non-predictor of weight loss (Averbukh et al., 2003). Female gender has been found to be a positive predictor of weight loss success (> 50% EWL) (Busetto et al., 2002). In the current study, similar to most of the previous studies (Dixon et al., 2001; Powers et al., 1997; van Hout et al., 2005), gender was not predictive of post-surgical weight loss outcome. Gender was also not predictive of the other post-surgical outcomes examined in the current study, which could be due to the fact that there are not sufficient male participants for analysis. In terms of the work aspect in quality of life, compared to those with the highest educational background (completed college), the study found that the group who only had some high school education showed significantly poorer quality of life at work ($t = -3.0$, $p = 0.004$). This might be because those in the highest education group possess more confidence and more competencies. Poor job satisfaction or poor quality of life at work may also be the result of lack of opportunities for growth, repetitive nature of the types of jobs available to those without higher education and lack of power within the social structure in the work setting overall.

Overall Surgery Effect

This study found, similar to other study findings (van Hout et al., 2006), that after bariatric surgery, weight decreases and psychological disorders such as depression, improve. Typically, post-surgical weight loss represents around one-third of pre-surgical weight, which corresponds to 55% to 65% of excess weight (Herpertz et al., 2004). One year post-surgery,

participants in the current study lost an average of 39.3 kg (131.3 kg -92.0 kg), which makes a 29.9% weight loss, close to the one-third of pre-surgical weight loss found in previous studies. This amount of weight loss represents 52.6% of excess weight. The current study confirms the norm that there is a general tendency for psychopathology to decrease and normalize following bariatric surgery (Green et al., 2004; Thonney et al., 2010). However, it is worth noting that some studies reported no substantial post-surgical change in psychopathology, and some report moderate to severe psychological problems after surgery, "even after adequate weight loss, such as hypersensitivity to criticism and difficulties in the expression of aggressive feelings" (van Hout et al., 2006). In addition, some studies failed to find any difference between pre- and post-surgical depressive symptoms while some studies report patients dealing with depression and anxiety after surgery, and even patients attempting and committing suicide (van Hout et al., 2006). It is challenging to compare study results due to differences in study design, including different assessment instruments, treatment factors (surgery type), and statistical analyses implemented. However, most research did show that depression related to weight tends to decrease after surgery (Maddi et al., 2001; Masheb et al., 2007; van Hout et al., 2006) with a significant minority not being able to benefit psychologically from surgery (van Hout et al., 2006).

Strengths

The current study possesses several strengths. The regression analyses when considering depression, anxiety and weight as dependent variables, take into account their corresponding baseline status as a covariate to strengthen the predictability of the variables of interest. These analyses also take into account confounders such as gender, age, education, and ethnicity. These

confounders are associated with some baseline comorbidities and thus could help reduce their confounding effect. The study uses repeated measures, meaning that the questionnaire was administered to the same group of people pre- and post-surgery, so inter-subject bias is minimized.

Instruments used to measure the outcomes of interest have been validated. In addition, questionnaire scoring and data entry onto the SPSS database were both double-checked by two different research assistants to ensure potential human error. Participants were all recruited from the same bariatric surgical center, and therefore were exposed to the same or at least similar clinical environment regardless of surgery type. In addition, one surgeon performed approximately 80% of the surgeries.

Limitations

There could be potential confounders that the current study did not address due to a lack of data, such as psychopathological drug usage, caloric intake, physical activity and comorbidities. Examples of baseline comorbidities, such as type II diabetes and hypertension were not controlled. However, it is well known that age (> 45 years), being overweight/obese, and race/ethnicity are associated with type II diabetes. Thus, although diabetes was not controlled in the statistical model, age, race/ethnicity, and baseline BMI were and probably captured some, if not all, of the variability of the mean value of the variables of interest for diabetes and hypertension. In addition, gender and education, in addition to age and race/ethnicity and some other baseline psychopathologies, were also controlled in the model, of which many of them can reduce much confounding effect for variables that might have been overlooked by the statistical model such as diabetes and hypertension. Furthermore, gastric

bypass, which tends to be more effective in weigh loss compared to banding and is often recommended to patients with diabetes and hypertension, is also controlled in the model. Finally, a past study has shown that surgical outcome variability appears to be explained more by physiological factors (sex, age, baseline BMI), which were controlled in the study, than by the presence of diabetes in the medical history (Busetto et al., 2002).

Although the participants were screened for depression before the surgery, they were evaluated very close to the surgery date. Therefore, pre-surgery data on a subject's depression status could be biased. The subject could be depressed due to anxiety or stress induced by the excitement and uncertainty about going into the surgery rather than the surgery itself. On the other hand, patients could be less depressed due to upcoming surgery. Either way, baseline depression is controlled in the study.

The follow-up rate was around 30%. However, like most other studies of similar nature, loss to follow-up is common. For instance, Schauer and colleagues have reported a 1-year follow-up rate of 38% (Schauer et al., 2000), and Benotti and colleagues have reported a 1-year follow-up rate of 43% (Benotti, Wood, Rodriguez, Carnevale, & Liriano, 2006). Past literature has shown that patient follow-up plays a significant role in the amount of weight lost after LAGB and that patient motivation and surgeon commitment for long-term follow-up is critical for weight loss success post-surgically (Shen et al., 2004). To ensure that the group with follow-up data is representative, their baseline characteristics were compared to the group without the follow-up data. There were no significant differences between the two groups regarding their baseline weight, baseline BMI, baseline age, baseline education, baseline race/ethnicity, baseline depression, baseline anxiety (total, performance, and social), baseline self-life, and baseline

public distress. However, there was a significant difference between the two groups in total quality of life, physical function, self-esteem, and work. Since the loss to follow-up group scored lower in some of the quality of life measures than the remained group, the remained group was then divided at the medium score into a lower baseline and a higher baseline quality of life group. The purpose of this was to use the lower quality of life group as the loss to follow-up group and compare it to the higher total quality of life group to see if there is a different effect between them on pre- to post-surgical changes in the outcome measures such as weight, depression, and anxiety (total, performance, and social). The results showed that there was no difference in changes in pre- to post-surgical weight, depression, anxiety (total, performance, and social) between the low QOL group and the high QOL group. It is however not surprising to see that there was a difference between the two groups in changes in pre- to post-surgical quality of life measures because the higher the baseline quality of life, the less room there is for improvement after surgery. The baseline differences in some of the quality of life measures also indicated that those with lower baseline quality of life might be less likely to come back for follow-up visits.

Table 10: ***Changes in Outcomes (Low Baseline QOL vs. Baseline High QOL)***

Change in pre- to post-outcomes		N	Mean	Std. Deviation	*P*-value (Δ)
Weight	Low QOL	40	41.4	21.7	0.53
	High QOL	42	38.5	18.8	
Depression	Low QOL	39	6.8	10.8	0.21
	High QOL	42	4.0	9.6	
Total QOL	Low QOL	35	40.5	21.7	**<0.001***
	High QOL	37	17.0	14.0	
Physical Function	Low QOL	39	47.2	25.4	**<0.001***
	High QOL	42	23.6	21.3	
Self-esteem	Low QOL	39	40.2	31.4	**<0.001***

Change in pre- to post-outcomes		N	Mean	Std. Deviation	*P*-value (Δ)
	High QOL	42	18.0	18.9	
Sexual Life	Low QOL	36	36.1	35.2	**<0.001***
	High QOL	39	9.1	17.8	
Public Distress	Low QOL	37	43.8	30.1	**<0.001***
	High QOL	40	16.3	19.3	
Work	Low QOL	36	31.4	29.4	**<0.001***
	High QOL	38	6.4	12.5	
Total Anxiety	Low QOL	39	3.1	13.5	0.26
	High QOL	42	0.14	9.5	
Performance Anxiety	Low QOL	39	1.0	7.2	0.44
	High QOL	42	-0.095	5.8	
Social Anxiety	Low QOL	39	2.0	7.2	0.17
	High QOL	42	0.17	4.5	

Note. Δ represents difference. *$p < 0.05$.

Although the psychological scales given to patients are validated instruments, psychopathology was not diagnosed formally by a licensed psychologist or psychiatrist. The Zung Depression Scale in the current study is not widely used in most other studies, which assess depression either by utilizing depression scales, such as BDI, CES-D, HADS or through the use of structured psychiatric interviews (Composite International Diagnostic Interview). Thus, the results could be difficult to compare to those of other studies. However, research questions of the current study were to examine whether different types of surgery would have different effects on depression after surgery while controlling for baseline measures, in which both groups were administered the same depression assessment instrument, thus, internal validity was not compromised.

Although the study followed the participants up to 1 year, many participants were still adjusting long after such time point, so a longer follow-up is necessary.

Conclusion and Implications

Compared to banding, gastric bypass shows greater improvement in the following post-surgical measures: total of quality of life, self-esteem, public distress, work, % weight loss, % EWL, and absolute weight loss (kg). Although more complications are associated with gastric bypass surgery, this study's findings indicate that patients should be recommended to receive bypass surgery due to its effective weight loss and greater improvement in quality of life after surgery, compared to lap-banding surgery. However, complications associated with each surgery need to be taken into account on an individual basis. For instance, lap-banding patients lose weight more gradually (O'Brien et al., 2006), and achieve sustained weight loss by limiting food intake, reducing appetite, and slowing digestion (WIN, 2004). On the other hand, gastric bypass has more surgical complications (Parikh, Laker, Weiner, Hajiseyedjavadi, & Ren, 2006) and nutritional complications (Poitou et al., 2007).

Psychological factors, especially when severe, have been considered as exclusion criteria for bariatric surgery candidacy due to the belief that such factors will hinder the patients from adhering to the necessary post-surgery regime. However, there are mixed results and, therefore, no consensus has been firmly established. Even though in some studies, pre-surgical psychological risks, such as depression and anxiety, have been seen as negative predictors of surgical success, such as weight loss and other health indicators, for example, quality of life, some argue that with proper management, even those with depression can still benefit from the surgery (Buddeberg-Fischer et al., 2004). Other studies have found that younger age, older age, limited functional status, poor social support, self-pay, and public insurance were associated with decreased odds of surgical admission whereas BMI and comorbidity criteria influenced the

magnitude of these effects (Santry et al., 2007). This study shows that those who scored better on the pre-surgical depression and anxiety scales did not necessarily achieve greater weight loss.

In terms of pre-surgical psychopathology, more research that can help explain the relationship between pre-surgical depression and postsurgical weight loss success is crucial. Understanding this relationship can not only help strengthen the exclusion/inclusion criteria for admitting bariatric candidates, but also give health care providers ideas about who should be counseled more intensively prior to surgical admission. Information on factors that contribute to pre-surgical psychopathology might be helpful to help health care providers improve patients' psychological conditions prior to surgery since the most common reasons for delaying or denying surgery were significant psychopathology (including psychosis or bipolar disorder), untreated or undertreated depression, and lack of understanding about the risks and post-surgical requirements of surgery, which were reported by 51, 39, and 30% of respondents, respectively (Walfish et al., 2007). The current study found that baseline anxiety helps predict post-surgical quality of life, depression, and anxiety. Thus, bariatric patients should be carefully monitored for anxiety disorders, and if possible, should be treated before undergoing surgery.

Besides weight change, it is essential to examine the psychological wellbeing post-surgically because it may reflect an increase of pre-existing distress, or there may be an emergence or reemergence of symptoms (Segal, Libanori, & Azevedo, 2002). Most studies on bariatric surgery focus on finding predictors for post-surgical weight loss outcomes but not on post-surgical psychological disorders. Furthermore, the relationship between weight and depression is intricate. It might be intuitive that once someone loses weight, improvement in

depression might be observed. However, even after surgery, some might develop or have more severe depression, although the current study, along with other studies (Green et al., 2004; Sarwer et al., 2005) shows that on average, a patient's psychological profile improves. However, various explanations are suggested for this worsening psychopathology. First, patients may find their weight stabilizing or they may begin to regain some weight, meaning that their weight does not continue to drop as they would have hoped. Secondly, it may be that initial improvements after surgery are in part due to positive comments and frequent clinic visits in the first period after surgery (Hildebrandt, 1998; Shai, Henkin, Weitzman, & Levi, 2003). Thus, once the frequent visits and support ceases or lessens, one would feel isolated or depressed again. Further, when the obesity problem is resolved, other problems may surface or patients have to deal with life problems that are faced by everyone (Hildebrandt, 1998). Moreover, patients may no longer be able to blame their obesity for their negative life-events. The lower level of self-esteem found in populations (Abilés et al., 2010) might not necessarily go away after weight loss. These are all possible explanations as to why depression might not go away even when weight loss has been deemed successful.

Finally, patients may have difficulty in adapting psychologically to the consequences of bariatric surgery, including limitations as well as new possibilities, such as their changing shape and size (Delin, Watts, & Bassett, 1995), and the positive attention they get (Papageorgiou, Papakonstantinou, Mamplekou, Terzis, & Melissas, 2002). In order to better assist patients who are considering the surgery and those who have received the surgery and need post-surgical support, studies similar to the current study which help identify predictors of surgical success is only one of the many essential steps. Given that the study has found that post-surgical

psychological values were best predicted by their pre-surgical value and that psychological characteristics are not good predictors of weight loss after surgery but are predictive of post-surgical psychological status, it is essential to examine post-surgical outcomes other than weight. In addition, it is important to pay more effort in motivating patients to lose weight before the surgery rather than relying on the surgery as a quick fix because data exist suggesting that those patients who lose weight pre-surgically are more motivated and compliant, and therefore, lose more weight post-surgically when they have to follow a diet and exercise program (Alvarado et al., 2005). In addition, weight loss prior to surgery was associated with a decrease in the operating room time and an improved percentage of excess weight loss (Alami et al., 2007). However, in reality some patients whose BMI status is close to the cutoff point for surgery might be afraid of being denied surgery if they were to lose weight to the degree that is out of the surgical inclusive BMI range. On the other hand, there is a subset of patients with higher pre-surgical BMI (e.g. BMI > 50 kg/m^2), and even after losing 10% of their pre-surgical weight, their BMI status would still qualify them for surgery. In this case, they should be more motivated than those with BMI closer to 40 kg/m^2 and therefore should be encouraged to lose weight prior to surgery. It is also important to keep in mind that pre-surgical counseling can differ from site to site and from one insurance plan to another. For example, some medical centers may require participation in a certain number of classes or counseling sessions for a specific period of time, while others are less stringent. Hence, mandating stronger national requirements for both weight loss and psychological counseling pre- and post-surgery might need to be enforced. In addition, the current study has found that having a lower baseline BMI will result in greater total quality of

life and weight loss, which is related to either improvement or complete resolution in certain medical comorbidities.

A statistical trend has shown more weight loss in surgery patients who attended group therapy as compared to patients who did not attend group therapy post-surgically (Glinski et al., 2001). Thus, post-surgical psychosocial support needs to be available to those who want or need it. In addition, for group attenders, the more often they attended group meetings, the more weight they lost (Glinski et al., 2001). Surgery candidates perhaps should be asked to sign a document indicating that they will participate in post-surgery counseling. Unfortunately, even when services are available, participation might still be poor. In future studies, it might be useful to compare those who agree to mandatory post-surgery counseling with those who receive the current standard of care, such as the current optional or no counseling provided option.

It is also worth noting that problems after weight loss can manifest in different ways. For instance, jealousy from a spouse when the patient starts to get more attention (Papageorgiou et al., 2002), dissatisfaction resulting from the skin surplus due to quick weight loss (Dixon et al., 2002), and loss of food as emotional comfort, might impair quality of life or even result in other psychological issues. Insurance companies would cover for surgeries that remove the surplus skin but only when it is causing medical problems. Thus, it is important to monitor and support patients, preparing them for a new set of challenges that they might encounter. Alcoholism, bulimia and certain eating disturbances can develop after surgery (Hsu et al., 1998). It might not be surprising to find substance abuse in this cohort because they need substitutes to replace the emotional comfort that food used to provide.

Future Research

In future research, it will be important to investigate substitute behaviors that bariatric populations might develop, such as behaviors that replace food as an emotional coping mechanism. In addition, it will be crucial to address the macro-environment, meaning the policy and institutional factors with potential effects on body weight in people with mental disorders. For instance, how can income level or governmental regulations have an impact on food choices and purchasing power of healthy foods for those with psychological disorders who are suffering with obesity. A review article looking at obese individuals with psychological disorders concluded that obesity is a serious problem among patients with depression and schizophrenia, especially women and that the level of obesity among such populations increases at a rate similar to or greater than that of the general population (Allison et al., 2009). To help this population, the article suggests that well-established and effective treatments for weight control in the general population could be adapted and evaluated for use in those with mental disorders, and that there is a need for more empirically based interventions to address the increasing prevalence of obesity for this population. The CDC stated on its website that, "The causes of obesity in the United States are complex and numerous, and they occur at social, economic, environmental, and individual levels. American society has become characterized by environments that promote physical inactivity and increased consumption of less healthy food. Public health approaches that can reach large numbers of people in multiple settings—such as in child care facilities, workplaces, schools, communities, and health care facilities—are needed to help people make healthier choices" (CDC, 2011b). In response, the CDC has created a division called Division of Nutrition, Physical Activity, and Obesity (DNPAO) and state programs called State-Based

Nutrition and Physical Activity Program to Prevent Obesity and Other Chronic Diseases (NPAO) as its endeavor to combat obesity. NPAO currently "funds 25 states to work with partners across multiple settings—such as child care facilities, workplaces (including hospitals), schools, and communities—to implement policy, system, and environmental strategies that have been proven to work." However, concrete, specific, and effective research recommendations are often difficult to come by.

It is also crucial to carefully examine effective and sustainable lifestyle or behavior modification methodology and to promote them to those in need. In behavioral treatment programs, weekly homework assignments have been found to be a critical component of lifestyle modification, and patients' completion of daily food records is a consistent predictor of initial weight loss (Wadden, Butryn, & Wilson, 2007). Wadden and colleagues reviewed the short- and long-term results of lifestyle modification programs and stated that a comprehensive lifestyle modification program induces a loss of approximately 10% of initial weight in 16 to 26 weeks of group or individual treatment, delivered on-site, and when delivered through the internet, these comprehensive programs also induce a loss of approximately 5% of initial weight. The review article also states that factors associated with long-term weight control included continued patient–practitioner contact on a weekly basis (whether on-site or by e-mail), high levels of physical activity (i.e., energy expenditure of 2500 kcal per week or the equivalent of walking 25–30 miles a week), and the long-term (> 2 years or at least 6 months) use of pharmacotherapy combined with lifestyle modification. There is also some evidence suggesting that lifestyle activity might be superior than programmed activity in terms of weight loss and preventing weight regain (Wadden et al., 2007). Programmed activity, traditionally referred to as exercise,

is typically planned and completed in a discrete period of time (i.e., 30 to 60 minutes) at a relatively high-intensity level (i.e., 60% to 80% of maximum heart rate). On the other hand, lifestyle activity involves increasing energy expenditure throughout the course of the day, without concern for the intensity or duration of the activity. Examples of lifestyle activity include parking further away from store entrances, taking stairs rather than escalators, or getting off the bus 3 stops early and walking the remainder of the way. Although lifestyle and behavioral modification is not the focus of this paper, it is important to note that within 2 years after bariatric surgery, about 50 % of the patients regained some of their weight, especially among those with BMI > 50 (Magro et al., 2008). Therefore, lifestyle or behavior modification is still crucial and relevant to those undergoing surgery.

Another area of research that warrants further investigation is to compare the psychological effects following different weight loss approaches in obese subjects. Bariatric surgery has been associated with improved self-esteem and positive emotions, and subjects generally report reduced feelings of depression and anxiety following VLCD (Nieman, Custer, Butterworth, Utter, & Henson, 2000). Although the method of weight loss may have a differential effect on psychosocial function, few data exist on this issue (Nieman et al., 2000), especially on the comparison between that of bariatric surgery and that of other so-called conventional treatments, such as diet, physical activity, drug therapy, and lifestyle/behavior modification interventions. On the other hand, diet and physical activity are often compared. For instance, physical activity has been consistently linked to elevated mood and self-esteem, and may enhance the effects of diet alone (Nieman et al., 2000). The combination of diet and exercise has been found to reduce BDI scores significantly more than diet alone in an 8-week

study of 65 moderately obese men and women (Geliebter et al., 1997). Wadden and colleagues showed that either through diet alone or in combination with exercise, there was a decrease in depression and fatigue, and an increase in vigor were experienced by all obese groups following weight loss (Wadden et al., 1997).

Findings in obesity research similar to those of the current study point to the idea that psychological interventions targeting improved outcomes after the surgery should be individualized (Kinzl et al., 2006). For instance, a surgical candidate's age, gender, baseline BMI, and even marital satisfaction (van Hout et al., 2005) could all indicate the likelihood of success after surgery. Busetto and colleagues found that weight loss variability appears to be explained more by physiological factors (sex, age, baseline BMI) than by the presence of depression in the medical history (Busetto et al., 2002). Similarly, the current study found that baseline BMI, baseline anxiety condition and age, but not depression, are more likely to predict surgical success such as weight loss and quality of life. In addition, choosing the right surgery for the right candidate is also crucial because surgery type could make a difference in affecting surgical success, not only in weight loss but also in other constituents of health. Results of this research may provide bariatric surgery candidates with more information on potential post-surgical risks, but also help health care providers evaluate different cases when consulting and educating bariatric surgery patients. Given that psychosocial factors and individual characteristics, such as demographic information and psychopathology, could affect surgical patient's ability to cope with post-surgical conditions, understanding the relationship between potential predicting variables of surgical outcome may ensure surgical success and help develop

necessary post-surgical support and intervention. Care does not end with surgery because obesity is a chronic disease that requires lifelong therapy (O'Brien et al., 2006).

Reference

Abiles, V., Rodriguez-Ruiz, S., Abiles, J., Mellado, C., Garcia, A., Perez de la Cruz, A., & Fernandez-Santaella, M. C. (2008). Psychological Characteristics of Morbidly Obese Candidates for Bariatric Surgery. *Obesity Surgery*. doi: 10.1007/s11695-008-9726-1

Alami, R. S., Morton, J. M., Schuster, R., Lie, J., Sanchez, B. R., Peters, A., & Curet, M. J. (2007). Is there a benefit to preoperative weight loss in gastric bypass patients? A prospective randomized trial. [Randomized Controlled Trial]. *Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery, 3*(2), 141-145; discussion 145-146. doi: 10.1016/j.soard.2006.11.006

Alexander, C.L. (2008). Depression after Bariatric Surgery: Triggers, Identification, Treatment, and Prevention. *Bariatric Times*. Retrieved from http://bariatrictimes.com/2008/05/09/depression-after-bariatric-surgery-triggers-identification-treatment-and-prevention/

Allison, D. B., Mentore, J. L., Heo, M., Chandler, L. P., Cappelleri, J. C., Infante, M. C., & Weiden, P. J. (1999). Antipsychotic-induced weight gain: a comprehensive research synthesis. *American Journal of Psychiatry, 156*(11), 1686-1696.

Allison, D. B., Newcomer, J. W., Dunn, A. L., Blumenthal, J. A., Fabricatore, A. N., Daumit, G. L., . . . Alpert, J. E. (2009). Obesity among those with mental disorders: a National Institute of Mental Health meeting report. *American Journal of Preventive Medicine, 36*(4), 341-350. doi: S0749-3797(09)00024-5 [pii]10.1016/j.amepre.2008.11.020

Almogy, G., Crookes, P. F., & Anthone, G. J. (2004). Longitudinal gastrectomy as a treatment for the high-risk super-obese patient. *Obesity Surgery, 14*(4), 492-497.

Alvarado, R., Alami, R. S., Hsu, G., Safadi, B. Y., Sanchez, B. R., Morton, J. M., & Curet, M. J. (2005). The impact of preoperative weight loss in patients undergoing laparoscopic Roux-en-Y gastric bypass. *Obesity Surgery, 15*(9), 1282-1286. doi: 10.1381/096089205774512429

APA (American Psychology Association). (2012). Women And Depression. Retrieved from http://www.apa.org/about/gr/issues/women/depression.aspx

Armstrong, S. N., Anderson, M., Le, E. T., & Nguyen, L. H. (2009). Application of the Health Belief Model to bariatric surgery. *Gastroenterology Nursing, 32*(3), 171-178. doi: 10.1097/SGA.0b013e3181a7cf5a00001610-200905000-00002 [pii]

Assimakopoulos, K., Karaivazoglou, K., Panayiotopoulos, S., Hyphantis, T., Iconomou, G., & Kalfarentzos, F. (2011). Bariatric Surgery is Associated with Reduced Depressive

Symptoms and Better Sexual Function in Obese Female Patients: A One-Year Follow-Up Study. *Obesity Surgery, 21*(3), 362-366. doi: 10.1007/s11695-010-0303-z

Averbukh, Y., Heshka, S., El-Shoreya, H., Flancbaum, L., Geliebter, A., Kamel, S., . . . Laferrère, B. (2003). Depression Score Predicts Weight Loss following Roux-en-Y Gastric Bypass. *Obesity Surgery, 13*(6), 833-836. doi: 10.1381/096089203322618605

Baker, S. L., Heinrichs, N., Kim, H. J., & Hofmann, S. G. (2002). The liebowitz social anxiety scale as a self-report instrument: a preliminary psychometric analysis. *Behavior Research and Therapy, 40*(6), 701-715.

Barefoot, J. C., Heitmann, B. L., Helms, M. J., Williams, R. B., Surwit, R. S., & Siegler, I. C. (1998). Symptoms of depression and changes in body weight from adolescence to mid-life. *International Journal of Obesity and Related Metabolic Disorders, 22*(7), 688-694.

Batsis, J. A., Lopez-Jimenez, F., Collazo-Clavell, M. L., Clark, M. M., Somers, V. K., & Sarr, M. G. (2009). Quality of life after bariatric surgery: a population-based cohort study. [Comparative Study Research Support, Non-U.S. Gov't]. *The American journal of medicine, 122*(11), 1055 e1051-1055 e1010. doi: 10.1016/j.amjmed.2009.05.024

Bauchowitz, A. U., Gonder-Frederick, L. A., Olbrisch, M. E., Azarbad, L., Ryee, M. Y., Woodson, M., . . . Schirmer, B. (2005). Psychosocial evaluation of bariatric surgery candidates: a survey of present practices. *Psychosomatic Medicine, 67*(5), 825-832. doi: 67/5/825 [pii]10.1097/01.psy.0000174173.32271.01

Bean, M. K., Stewart, K., & Olbrisch, M. E. (2008). Obesity in America: implications for clinical and health psychologists. *Journal of Clinical Psychology in Medical Settings, 15*(3), 214-224. doi: 10.1007/s10880-008-9124-9

Benotti, P. N., Wood, G. C., Rodriguez, H., Carnevale, N., & Liriano, E. (2006). Perioperative outcomes and risk factors in gastric surgery for morbid obesity: a 9-year experience. *Surgery, 139*(3), 340-346. doi: 10.1016/j.surg.2005.08.017

Black, D. W., Goldstein, R. B., & Mason, E. E. (1992). Prevalence of Mental Disorder in 88 Morbidly Obese Bariatric Clinic Patients. *American Journal of Psychiatry, 149*(2), 227-234.

Blackburn, G. L., Bistrian, B. R., & Hoag, C. (1977). Hair loss with rapid weight loss. *Archives of Dermatology, 113*(2), 234.

Bloomston, M., Zervos, E., Camps, M., Goode, S., & Rosemurgy, A. (1997). Outcome Following Bariatric Surgery in Super versus Morbidly Obese Patients: Does Weight Matter? *Obesity Surgery, 7*(5), 414-419. doi: 10.1381/096089297765555395

Bowne, W. B., Julliard, K., Castro, A. E., Shah, P., Morgenthal, C. B., & Ferzli, G. S. (2006). Laparoscopic gastric bypass is superior to adjustable gastric band in super morbidly obese patients: A prospective, comparative analysis. [Comparative Study]. *Archives of surgery, 141*(7), 683-689. doi: 10.1001/archsurg.141.7.683

Branson, R., Potoczna, N., Brunotte, R., Piec, G., Ricklin, T., Steffen, R., & Horber, F. F. (2005). Impact of age, sex and body mass index on outcomes at four years after gastric banding. *Obesity Surgery, 15*(6), 834-842.

Brethauer, S. A., Chand, B., & Schauer, P. R. (2006). Risks and benefits of bariatric surgery: current evidence. *Cleveland Clinical Journal of Medicine, 73*(11), 993-1007.

Brolin, R. E. (2002). Bariatric surgery and long-term control of morbid obesity. [Review]. *JAMA : the journal of the American Medical Association, 288*(22), 2793-2796.

Buchwald, H., Avidor, Y., Braunwald, E., Jensen, M. D., Pories, W., Fahrbach, K., & Schoelles, K. (2004). Bariatric surgery: a systematic review and meta-analysis. *JAMA, 292*(14), 1724-1737. doi: 292/14/1724 [pii]10.1001/jama.292.14.1724

Buchwald, H., & Williams, S. E. (2004). Bariatric surgery worldwide 2003. *Obesity Surgery, 14*(9), 1157-1164. doi: 10.1381/0960892042387057

Buddeberg-Fischer, B., Klaghofer, R., Sigrist, S., & Buddeberg, C. (2004). Impact of Psychosocial Stress and Symptoms on Indication for Bariatric Surgery and Outcome in Morbidly Obese Patients. *Obesity Surgery, 14*(3), 361-369. doi: 10.1381/096089204322917891

Bult, M. J. F., van Dalen, T., & Muller, A. F. (2008). Surgical treatment of obesity. *European Journal of Endocrinology, 158*(2), 135-145. doi: Doi 10.1530/Eje-07-0145

Burgmer, R., Petersen, I., Burgmer, M., de Zwaan, M., Wolf, A. M., & Herpertz, S. (2007). Psychological outcome two years after restrictive bariatric surgery. *Obesity Surgery, 17*(6), 785-791.

Busetto, L., Segato, G., De Luca, M., De Marchi, F., Foletto, M., Vianello, M., . . . Enzi, G. (2005). Weight Loss and Postoperative Complications in Morbidly Obese Patients with Binge Eating Disorder Treated by Laparoscopic Adjustable Gastric Banding. *Obesity Surgery, 15*(2), 195-201. doi: 10.1381/0960892053268327

Busetto, L., Segato, G., De Marchi, F., Foletto, M., De Luca, M., Caniato, D., . . . Enzi, G. (2002). Outcome predictors in morbidly obese recipients of an adjustable gastric band. *Obesity Surgery, 12*(1), 83-92.

Busetto, L., Segato, G., De Marchi, F., Foletto, M., De Luca, M., Favretti, F., & Enzi, G. (2003). Postoperative management of laparoscopic gastric banding. *Obesity surgery, 13*(1), 121-127. doi: 10.1381/096089203321136719

Carpenter, K. M., Hasin, D. S., Allison, D. B., & Faith, M. S. (2000). Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study. *American Journal of Public Health, 90*(2), 251-257.

CDC. (2010). Depression is Not a Normal Part of Growing Older. Retrieved from http://www.cdc.gov/aging/mentalhealth/depression.htm

CDC. (2009). Differences in Prevalence of Obesity Among Black, White, and Hispanic Adults -- - United States, 2006--2008. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5827a2.htm

CDC. (2011a, March 15). Health-Related Quality of Life (HRQOL). Retrieved from http://www.cdc.gov/hrqol/

CDC. (2011b, May 26). Oebsity, Halting the Epidemic by Making Health Easier At A Glance 2011. Retrieved March 13th, 2012, 2012, from http://www.cdc.gov/chronicdisease/resources/publications/aag/obesity.htm

CDC/NCHS. (2010). Overweight and obesity among adults 20 years of age and over, by sex: United States, 1988-1994 to 2007-2008. Retrieved from http://www.cdc.gov/nchs/data/hus/2010/fig14.pdf

Clark, M., Balsiger, B., Sletten, C., Dahlman, K., Ames, G., Williams, D., . . . Sarr, M. (2003). Psychosocial Factors and 2-Year Outcome Following Bariatric Surgery for Weight Loss. *Obesity Surgery, 13*(5), 739-745. doi: 10.1381/096089203322509318

Mayo Clinic. (2010a, November 5). Dumping Syndrome Causes. Retrieved from http://www.mayoclinic.com/health/dumping-syndrome/DS00715/DSECTION=causes

Mayo Clinic. (2010b, November 5). Dumping Syndrome Symptoms. Retrieved from http://www.mayoclinic.com/health/dumping-syndrome/DS00715/DSECTION=symptoms

NIH. (1998). Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. [Consensus Development Conference Consensus Development Conference, NIH Guideline Practice Guideline Review]. *Obesity research, 6 Suppl 2*, 51S-209S.

Colton, C. W., & Manderscheid, R. W. (2006). Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Preventing Chronic Disease, 3*(2), A42. doi: A42 [pii]

Corsica, J. A., Azarbad, L., McGill, K., Wool, L., & Hood, M. (2010). The Personality Assessment Inventory: clinical utility, psychometric properties, and normative data for bariatric surgery candidates. *Obesity surgery, 20*(6), 722-731. doi: 10.1007/s11695-009-0004-7

Daumit, G. L., Pratt, L. A., Crum, R. M., Powe, N. R., & Ford, D. E. (2002). Characteristics of primary care visits for individuals with severe mental illness in a national sample. *General Hospital Psychiatry, 24*(6), 391-395. doi: Pii S0163-8343(02)00213-X

de Zwaan, M., Mitchell, J. E., Howell, L. M., Monson, N., Swan-Kremeier, L., Crosby, R. D., & Seim, H. C. (2003). Characteristics of morbidly obese patients before gastric bypass surgery. *Comprehensive Psychiatry, 44*(5), 428-434. doi: Doi 10.1016/S0010-440x(03)00092-0

Deitel, M. (2007). Cesar Roux and his contribution. *Obesity Surgery, 17*(10), 1277-1278. doi: 10.1007/s11695-007-9244-6

Deitel, M. (2008). The change in the dumping syndrome concept. [Comment]. *Obesity surgery, 18*(12), 1622-1624. doi: 10.1007/s11695-008-9756-8

Delin, C. R., Watts, J. M., & Bassett, D. L. (1995). An Exploration of the Outcomes of Gastric Bypass Surgery for Morbid Obesity: Patient Characteristics and Indeces of Success. *Obesity Surgery, 5*(2), 159-170.

Devine, B. (1974). Gentamicin Therapy. *Drug Intelligence & Clinical Pharmacy, 8*, 6.

Dixon, J. B., Dixon, M. E., & O'Brien, P. E. (2001). Pre-operative predictors of weight loss at 1-year after Lap-Band (R) surgery. *Obesity Surgery, 11*(2), 200-207.

Dixon, J. B., Dixon, M. E., & O'Brien, P. E. (2002). Body image: appearance orientation and evaluation in the severely obese. Changes with weight loss. *Obesity Surgery, 12*(1), 65-71. doi: 10.1381/096089202321144612

Dixon, J. B., Dixon, M. E., & O'Brien, P. E. (2003). Depression in association with severe obesity: changes with weight loss. *Archives of Internal Medicine, 163*(17), 2058-2065. doi: 10.1001/archinte.163.17.2058163/17/2058 [pii]

Doherty, C., Benotti, P., Butler, M., Clare, M., Dillinger, E., Goodman, G., . . . Zemel, R. (1993). Rationale for the Surgical Treatment of Severe Obesity. *Obesity surgery, 3*(4), 430-433.

Dor A., F. C., Langwith C., Tan E. . (2010). A Heavy Burden: The Individual Costs of Being Overweight and Obese in the United States. Retrieved from http://www.gwumc.edu/sphhs/departments/healthpolicy/pdf/HeavyBurdenReport.pdf

Dugan, W., McDonald, M. V., Passik, S. D., Rosenfeld, B. D., Theobald, D., & Edgerton, S. (1998). Use of the Zung Self-Rating Depression Scale in cancer patients: feasibility as a screening tool. *Psychooncology, 7*(6), 483-493. doi: 10.1002/(SICI)1099-1611(199811/12)7:6<483::AID-PON326>3.0.CO;2-M

Duval, K., Marceau, P., Perusse, L., & Lacasse, Y. (2006). An overview of obesity-specific quality of life questionnaires. *Obesity Reviews, 7*(4), 347-360. doi: OBR244 [pii]10.1111/j.1467-789X.2006.00244.x

Dymek, M. P., le Grange, D., Neven, K., & Alverdy, J. (2001). Quality of life and psychosocial adjustment in patients after Roux-en-Y gastric bypass: a brief report. *Obesity Surgery, 11*(1), 32-39.

Elkins, G., Whitfield, P., Marcus, J., Symmonds, R., Rodriguez, J., & Cook, T. (2005). Noncompliance with behavioral recommendations following bariatric surgery. *Obesity Surgery, 15*(4), 546-551. doi: 10.1381/0960892053723385

Engel, S. G., Crosby, R. D., Kolotkin, R. L., Hartley, G. G., Williams, G. R., Wonderlich, S. A., & Mitchell, J. E. (2003). Impact of weight loss and regain on quality of life: mirror image or differential effect? *Obesity Research, 11*(10), 1207-1213. doi: 10.1038/oby.2003.166

Evans, S., Newton, R., & Higgins, S. (2005). Nutritional intervention to prevent weight gain in patients commenced on olanzapine: a randomized controlled trial. *Australian and New Zealand Journal of Psychiatry, 39*(6), 479-486. doi: ANP1607 [pii]10.1111/j.1440-1614.2005.01607.x

Fabricatore, A. N., & Wadden, T. A. (2006). Obesity. *Annual Review of Clinical Psychology, 2*, 357-377. doi: 10.1146/annurev.clinpsy.2.022305.095249

Fielding, G. A. (2003). Laparoscopic adjustable gastric banding for massive superobesity (> 60 body mass index kg/m2). *Surgical Endoscopy, 17*(10), 1541-1545. doi: 10.1007/s00464-002-8921-8

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: payer-and service-specific estimates. *Health Affairs (Millwood), 28*(5), w822-831. doi: hlthaff.28.5.w822 [pii]10.1377/hlthaff.28.5.w822

Fisher, B. L., & Schauer, P. (2002). Medical and surgical options in the treatment of severe obesity. *American Journal of Surgery, 184*(6B), 9S-16S. doi: Pii S0002-9610(02)01173-X

Flancbaum, L., Belsley, S., Drake, V., Colarusso, T., & Tayler, E. (2006). Preoperative nutritional status of patients undergoing Roux-en-Y gastric bypass for morbid obesity. *Journal of Gastrointestinal Surgery, 10*(7), 1033-1037. doi: S1091-255X(06)00148-X [pii]10.1016/j.gassur.2006.03.004

Flegal, K. M., Carroll, M. D., Kuczmarski, R. J., & Johnson, C. L. (1998). Overweight and obesity in the United States: prevalence and trends, 1960-1994. [Comparative Study]. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 22*(1), 39-47.

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Curtin, L. R. (2010). Prevalence and Trends in Obesity Among US Adults, 1999-2008. *Jama-Journal of the American Medical Association, 303*(3), 235-241. doi: DOI 10.1001/jama.2009.2014

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Johnson, C. L. (2002). Prevalence and trends in obesity among US adults, 1999-2000. *JAMA : the journal of the American Medical Association, 288*(14), 1723-1727.

Flynn, T. J., & Walsh, M. F. (1993). Thirty-month evaluation of a popular very-low-calorie diet program. [Clinical Trial]. *Archives of family medicine, 2*(10), 1042-1048.

Folope, V., Hellot, M. F., Kuhn, J. M., Teniere, P., Scotte, M., & Dechelotte, P. (2008). Weight loss and quality of life after bariatric surgery: a study of 200 patients after vertical gastroplasty or adjustable gastric banding. *European Journal of Clinical Nutrition, 62*(8), 1022-1030. doi: 1602808 [pii]10.1038/sj.ejcn.1602808

Geliebter, A., Maher, M. M., Gerace, L., Gutin, B., Heymsfield, S. B., & Hashim, S. A. (1997). Effects of strength or aerobic training on body composition, resting metabolic rate, and peak oxygen consumption in obese dieting subjects. [Clinical Trial Randomized Controlled Trial Research Support, U.S. Gov't, P.H.S.]. *The American journal of clinical nutrition, 66*(3), 557-563.

Glinski, J., Wetzler, S., & Goodman, E. (2001). The psychology of gastric bypass surgery. [Review]. *Obesity surgery, 11*(5), 581-588. doi: 10.1381/09608920160557057

Goldfeder, L. B., Ren, C. J., & Gill, J. R. (2006). Fatal complications of bariatric surgery. *Obesity Surgery, 16*(8), 1050-1056. doi: 10.1381/096089206778026325

Green, A. E., Dymek-Valentine, M., Pytluk, S., Le Grange, D., & Alverdy, J. (2004). Psychosocial outcome of gastric bypass surgery for patients with and without binge eating. *Obesity Surgery, 14*(7), 975-985. doi: 10.1381/0960892041719590

Griffin, P. T., & Kogut, D. (1988). Validity of orally administered Beck and Zung Depression Scales in a state hospital setting. *Journal of Clinical Psycholoy, 44*(5), 756-759.

Grilo, C. M., Masheb, R. M., Brody, M., Burke-Martindale, C. H., & Rothschild, B. S. (2005). Binge eating and self-esteem predict body image dissatisfaction among obese men and women seeking bariatric surgery. *International Journal of Eating Disorders, 37*(4), 347-351. doi: Doi 10.1002/Eat.20130

Grilo, C. M., Masheb, R. M., Brody, M., Toth, C., Burke-Martindale, C. H., & Rothschild, B. S. (2005). Childhood maltreatment in extremely obese male and female bariatric surgery candidates. *Obesity Research, 13*(1), 123-130.

Grothe, K. B., Dubbert, P. M., & O'Jile J, R. (2006). Psychological assessment and management of the weight loss surgery patient. *American Journal of Medical Sciences, 331*(4), 201-206. doi: 00000441-200604000-00006 [pii]

Guisado, J., Vaz, F., Alarcón, J., López-Ibor, J., Rubio, M., & Gaite, L. (2002). Psychopathological Status and Interpersonal Functioning Following Weight Loss in Morbidly Obese Patients Undergoing Bariatric Surgery. *Obesity Surgery, 12*(6), 835-840. doi: 10.1381/096089202320995664

Hafner, R. J., Rogers, J., & Watts, J. M. (1990). Psychological Status before and after Gastric Restriction as Predictors of Weight-Loss in the Morbidly Obese. *Journal of Psychosomatic Research, 34*(3), 295-302.

Hagedorn, J. C., Encarnacion, B., Brat, G. A., & Morton, J. M. (2007). Does gastric bypass alter alcohol metabolism? *Surgery for Obesity and Related Diseases, 3*(5), 543-548. doi: DOI 10.1016/j.soard.2007.07.003

Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA, 291*(23), 2847-2850. doi: 10.1001/jama.291.23.2847291/23/2847 [pii]

Heinlein, C. R. (2009). Dumping Syndrome in Roux-en-Y Bariatric Surgery Patients: Are They Prepared? *Bariatric Nursing and Surgical Patient Care, 4*(1), 39-47. doi: DOI 10.1089/bar.2009.9992

Heneghan, H. M., Heinberg, L., Windover, A., Rogula, T., & Schauer, P. R. (2012). Weighing the evidence for an association between obesity and suicide risk. *Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery, 8*(1), 98-107. doi: 10.1016/j.soard.2011.10.007

Heo, M., Pietrobelli, A., Fontaine, K. R., Sirey, J. A., & Faith, M. S. (2006). Depressive mood and obesity in US adults: comparison and moderation by sex, age, and race. *International Journal of Obesity (London), 30*(3), 513-519. doi: 0803122 [pii]10.1038/sj.ijo.0803122

Herpertz, S., Kielmann, R., Wolf, A. M., Hebebrand, J., & Senf, W. (2004). Do psychosocial variables predict weight loss or mental health after obesity surgery? A systematic review. *Obesity Research, 12*(10), 1554-1569. doi: 12/10/1554 [pii]10.1038/oby.2004.195

Herpertz, S., Kielmann, R., Wolf, A. M., Langkafel, M., Senf, W., & Hebebrand, J. (2003). Does obesity surgery improve psychosocial functioning? A systematic review. *International Journal of Obesity, 27*(11), 1300-1314. doi: DOI 10.1038/sj.ijo.0802410

Hildebrandt, S. (1998). Effects of Participation in Bariatric Support Group After Roux-en-Y Gastric Bypass. *Obesity Surgery, 8*(5), 535-542. doi: 10.1381/096089298765554115

Hospital, C. f. B. S. a. M. D. a. S. L. s. R. (2010). What can I expect after bariatric surgery? Retrieved from http://www.wehealny.org/services/slr_bariatricsurgery/postsurgery.html

Hsu, L. K., Benotti, P. N., Dwyer, J., Roberts, S. B., Saltzman, E., Shikora, S., . . . Rand, W. (1998). Nonsurgical factors that influence the outcome of bariatric surgery: a review. [Research Support, U.S. Gov't, P.H.S. Review]. *Psychosomatic medicine, 60*(3), 338-346.

Hudson, S., Dixon, J., & O'Brien, P. (2002). Sweet Eating is not a Predictor of Outcome after Lap-Band® Placement. Can we Finally Bury the Myth? *Obesity Surgery, 12*(6), 789-794. doi: 10.1381/096089202320995565

Jamal, M. K., DeMaria, E. J., Johnson, J. M., Carmody, B. J., Wolfe, L. G., Kellum, J. M., & Meador, J. G. (2005). Impact of major co-morbidities on mortality and complications after gastric bypass. *Surgery for Obesity and Related Diseases, 1*(6), 511-516. doi: S1550-7289(05)00741-0 [pii]10.1016/j.soard.2005.08.010

Jamal, M. K., DeMaria, E. J., Johnson, J. M., Carmody, B. J., Wolfe, L. G., Kellum, J. M., & Meador, J. G. (2006). Insurance-mandated preoperative dietary counseling does not improve outcome and increases dropout rates in patients considering gastric bypass surgery for morbid obesity. *Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery, 2*(2), 122-127. doi: 10.1016/j.soard.2006.01.009

Jan, J. C., Hong, D., Pereira, N., & Patterson, E. J. (2005). Laparoscopic adjustable gastric banding versus laparoscopic gastric bypass for morbid obesity: a single-institution comparison study of early results. [Comparative Study Research Support, Non-U.S. Gov't]. *Journal of gastrointestinal surgery : official journal of the Society for Surgery of the Alimentary Tract, 9*(1), 30-39; discussion 40-31. doi: 10.1016/j.gassur.2004.09.043

Kalarchian, M. A., Marcus, M. D., Levine, M. D., Courcoulas, A. P., Pilkonis, P. A., Ringham, R. M., . . . Rofey, D. L. (2007). Psychiatric disorders among bariatric surgery candidates: relationship to obesity and functional health status. *American Journal of Psychiatry, 164*(2), 328-334; quiz 374. doi: 164/2/328 [pii]10.1176/appi.ajp.164.2.328

Kalarchian, M. A., Marcus, M. D., Levine, M. D., Soulakova, J. N., Courcoulas, A. P., & Wisinski, M. S. (2008). Relationship of psychiatric disorders to 6-month outcomes after gastric bypass. *Surgery for Obesity and Related Diseases, 4*(4), 544-549. doi: S1550-7289(08)00165-2 [pii]10.1016/j.soard.2008.03.003

Kaplan, L. M. (2005). Pharmacological therapies for obesity. *Gastroenterology Clinics of North America, 34*(1), 91-+.

Karlsson, J., Sjostrom, L., & Sullivan, M. (1998). Swedish obese subjects (SOS)--an intervention study of obesity. Two-year follow-up of health-related quality of life (HRQL) and eating behavior after gastric surgery for severe obesity. [Clinical Trial Comparative Study Controlled Clinical Trial Research Support, Non-U.S. Gov't]. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 22*(2), 113-126.

Karlsson, J., Taft, C., Ryden, A., Sjostrom, L., & Sullivan, M. (2007). Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *International Journal of Obesity (London), 31*(8), 1248-1261. doi: 0803573 [pii]10.1038/sj.ijo.0803573

Karlsson, J., Taft, C., Sjostrom, L., Torgerson, J. S., & Sullivan, M. (2003). Psychosocial functioning in the obese before and after weight reduction: construct validity and responsiveness of the Obesity-related Problems scale. [Research Support, Non-U.S. Gov't]. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 27*(5), 617-630. doi: 10.1038/sj.ijo.0802272

Kerner, S. A., & Jacobs, K. W. (1983). Correlation between scores on the Beck Depression Inventory and the Zung Self-rating Depression Scale. *Psychological reports, 53*(3 Pt 1), 969-970.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 593-602. doi: 62/6/593 [pii]10.1001/archpsyc.62.6.593

Ketchum, E. S., & Morton, J. M. (2007). Disappointing weight loss among shift workers after laparoscopic gastric bypass surgery. *Obesity surgery, 17*(5), 581-584.

Khan, N. U., Babb, J. D., Kaul, S., Williams, J. M., & Miller, M. J. (2009). A novel complication of bariatric surgery. *American Heart Hospital Journal, 7*(1), 69-71. doi: ahhj.2009.7.1.69 [pii]

Khwaja, H. A., & Bonanomi, G. (2010). Bariatric surgery: techniques, outcomes and complications. *Current Anaesthesia & Critical Care, 21*(1), 31-38.

Kinzl, J., Schrattenecker, M., Traweger, C., Mattesich, M., Fiala, M., & Biebl, W. (2006). Psychosocial Predictors of Weight Loss after Bariatric Surgery. *Obesity Surgery, 16*(12), 1609-1614. doi: 10.1381/096089206779319301

Kodama, K., Noda, S., Murakami, A., Azuma, Y., Takeda, N., Yamanouchi, N., . . . Kawamura, I. (1998). Depressive disorders as psychiatric complications after obesity surgery. *Psychiatry and Clinical Neurosciences, 52*(5), 471-476.

Kolotkin, R. L., & Crosby, R. D. (2002). Psychometric evaluation of the impact of weight on quality of life-lite questionnaire (IWQOL-lite) in a community sample. *Quality of Life Research, 11*(2), 157-171.

Kolotkin, R. L., Crosby, R. D., Gress, R. E., Hunt, S. C., Engel, S. G., & Adams, T. D. (2008). Health and health-related quality of life: differences between men and women who seek gastric bypass surgery. [Comparative Study Research Support, N.I.H., Extramural]. *Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery, 4*(5), 651-658; discussion 658-659. doi: 10.1016/j.soard.2008.04.012

Kolotkin, R. L., Crosby, R. D., Kosloski, K. D., & Williams, G. R. (2001). Development of a brief measure to assess quality of life in obesity. *Obesity Research, 9*(2), 102-111. doi: 10.1038/oby.2001.13

Kolotkin, R. L., Crosby, R. D., & Williams, G. R. (2002). Health-related quality of life varies among obese subgroups. [Comparative Study Research Support, Non-U.S. Gov't]. *Obesity research, 10*(8), 748-756. doi: 10.1038/oby.2002.102

Kolotkin, R. L., Meter, K., & Williams, G. R. (2001). Quality of life and obesity. *Obesity Reviews, 2*(4), 219-229.

Kral, J. G., Sjostrom, L. V., & Sullivan, M. B. (1992). Assessment of quality of life before and after surgery for severe obesity. [Review]. *The American journal of clinical nutrition, 55*(2 Suppl), 611S-614S.

Krukowski, R. A., Friedman, K. E., & Applegate, K. L. (2010). The utility of the Beck Depression Inventory in a bariatric surgery population. *Obesity surgery, 20*(4), 426-431. doi: 10.1007/s11695-008-9717-2

Kruseman, M., Leimgruber, A., Zumbach, F., & Golay, A. (2010). Dietary, weight, and psychological changes among patients with obesity, 8 years after gastric bypass. *Journal of American Dietetic Association, 110*(4), 527-534. doi: S0002-8223(09)02098-7 [pii]10.1016/j.jada.2009.12.028

Kwon, J. S., Choi, J. S., Bahk, W. M., Yoon Kim, C., Hyung Kim, C., Chul Shin, Y., . . . Geun Oh, C. (2006). Weight management program for treatment-emergent weight gain in olanzapine-treated patients with schizophrenia or schizoaffective disorder: A 12-week randomized controlled clinical trial. *Journal of Clinical Psychiatry, 67*(4), 547-553.

Legenbauer, T., de Zwaan, M., Benecke, A., Muhlhans, B., Petrak, F., & Herpertz, S. (2009). Depression and Anxiety: Their Predictive Function for Weight Loss in Obese Individuals. *Obesity Facts, 2*(4), 227-234. doi: Doi 10.1159/000226278

Liebowitz, M. R. (1987). Social phobia. *Modern Problems of Pharmacopsychiatry, 22*, 141-173.

Loannidis, J. P. A. (2005). Why Most Published Research Findings Are False. *PLoS medicine, 2*.

Ma, Y., Pagoto, S. L., Olendzki, B. C., Hafner, A. R., Perugini, R. A., Mason, R., & Kelly, J. J. (2006). Predictors of weight status following laparoscopic gastric bypass. *Obesity Surgery, 16*(9), 1227-1231. doi: 10.1381/096089206778392284

MacDonald, K. G., Jr., Long, S. D., Swanson, M. S., Brown, B. M., Morris, P., Dohm, G. L., & Pories, W. J. (1997). The gastric bypass operation reduces the progression and mortality of non-insulin-dependent diabetes mellitus. *Journal of Gastrointestinal Surgery, 1*(3), 213-220; discussion 220. doi: S1091255X97801126 [pii]

Maddi, S. R., Fox, S. R., Khoshaba, D. M., Harvey, R. H., Lu, J. L., & Persico, M. (2001). Reduction in psychopathology following bariatric surgery for morbid obesity. *Obesity Surgery, 11*(6), 680-685.

Magro, D. O., Geloneze, B., Delfini, R., Pareja, B. C., Callejas, F., & Pareja, J. C. (2008). Long-term weight regain after gastric bypass: a 5-year prospective study. *Obesity surgery, 18*(6), 648-651. doi: 10.1007/s11695-007-9265-1

Mahony, D. (2008). Psychological Gender Differences in Bariatric Surgery Candidates. *Obesity Surgery, 18*, 607-610.

Mamplekou, E., Komesidou, V., Bissias, C., Papakonstantinou, A., & Melissas, J. (2005). Psychological condition and quality of life in patients with morbid obesity before and after surgical weight loss. *Obesity Surgery, 15*(8), 1177-1184. doi: 10.1381/0960892055002356

Martin, M., Beekley, A., Kjorstad, R., & Sebesta, J. (2010). Socioeconomic disparities in eligibility and access to bariatric surgery: a national population-based analysis. *Surgery for Obesity and Related Diseases, 6*(1), 8-15. doi: S1550-7289(09)00585-1 [pii]10.1016/j.soard.2009.07.003

Masheb, R. M., White, M. A., Toth, C. M., Burke-Martindale, C. H., Rothschild, B., & Grilo, C. M. (2007). The prognostic significance of depressive symptoms for predicting quality of life 12 months after gastric bypass. *Comprehensive Psychiatry, 48*(3), 231-236. doi: S0010-440X(07)00014-4 [pii]10.1016/j.comppsych.2007.01.005

Mather, A. A., Cox, B. J., Enns, M. W., & Sareen, J. (2009). Associations of obesity with psychiatric disorders and suicidal behaviors in a nationally representative sample. *Journal of Psychosomatic Research, 66*(4), 277-285.

Mathus-Vliegen, E. M., de Weerd, S., & de Wit, L. T. (2004). Health-related quality-of-life in patients with morbid obesity after gastric banding for surgically induced weight loss. *Surgery, 135*(5), 489-497. doi: 10.1016/j.surg.2004.01.007S0039606004000406 [pii]

McGuire, M. T., Wing, R. R., Klem, M. L., Seagle, H. M., & Hill, J. O. (1998). Long-term maintenance of weight loss: do people who lose weight through various weight loss methods use different behaviors to maintain their weight? *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 22*(6), 572-577.

McLaren, S., Gomez, R., Bailey, M., & Van Der Horst, R. K. (2007). The association of depression and sense of belonging with suicidal ideation among older adults: applicability of resiliency models. *Suicide and Life-Threatening Behavior, 37*(1), 89-102. doi: 10.1521/suli.2007.37.1.89

Mechanick, J. I., Kushner, R. F., Sugerman, H. J., Gonzalez-Campoy, J. M., Collazo-Clavell, M. L., Spitz, A. F., . . . Guven, S. (2009). American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery medical guidelines for clinical practice for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient. [Practice Guideline]. *Obesity, 17 Suppl 1*, S1-70, v. doi: 10.1038/oby.2009.28

Miller, W. C. (1999). How effective are traditional dietary and exercise interventions for weight loss? *Medicine and science in sports and exercise, 31(8)*, 6.

Mitchell, J. E., Lancaster, K. L., Burgard, M. A., Howell, L. M., Krahn, D. D., Crosby, R. D., Wonderlich, S. A., Gosnell, B. A. (2001). Long-term follow-up of patients' status after gastric bypass. *Obesity surgery, 11*(4), 464-468. doi: 10.1381/096089201321209341

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *Jama-Journal of the American Medical Association, 291*(10), 1238-1245.

Monteforte, M. J., & Turkelson, C. M. (2000). Bariatric surgery for morbid obesity. [Meta-Analysis]. *Obesity surgery, 10*(5), 391-401. doi: 10.1381/096089200321594246

Muscelli, E., Mingrone, G., Camastra, S., Manco, M., Pereira, J. A., Pareja, J. C., & Ferrannini, E. (2005). Differential effect of weight loss on insulin resistance in surgically treated obese patients. [Research Support, Non-U.S. Gov't]. *The American journal of medicine, 118*(1), 51-57. doi: 10.1016/j.amjmed.2004.08.017

Nguyen, N. T., Goldman, C., Rosenquist, J., Arango, A., Cole, C. J., Lee, S. J., & Wolfe, B. M. (2001). Laparoscopic versus open gastric bypass: A randomized study of outcomes, quality of life, and costs. *Annals of Surgery, 234*(3), 279-289.

Nguyen, N. T., Ho, H. S., Palmer, L. S., & Wolfe, B. M. (2000). A comparison study of laparoscopic versus open gastric bypass for morbid obesity. *Journal of the American College of Surgeons, 191*(2), 149-155; discussion 155-147. doi: S1072-7515(00)00276-3 [pii]

Nguyen, N. T., Masoomi, H., Magno, C. P., Nguyen, X. M., Laugenour, K., & Lane, J. (2011). Trends in use of bariatric surgery, 2003-2008. [Research Support, U.S. Gov't, P.H.S.]. *Journal of the American College of Surgeons, 213*(2), 261-266. doi: 10.1016/j.jamcollsurg.2011.04.030

Nguyen, N. T., Slone, J. A., Nguyen, X. M., Hartman, J. S., & Hoyt, D. B. (2009). A prospective randomized trial of laparoscopic gastric bypass versus laparoscopic adjustable gastric banding for the treatment of morbid obesity: outcomes, quality of life, and costs. *Annals of surgery, 250*(4), 631-641. doi: 10.1097/SLA.0b013e3181b92480

Nieman, D. C., Custer, W. F., Butterworth, D. E., Utter, A. C., & Henson, D. A. (2000). Psychological response to exercise training and/or energy restriction in obese women. [Clinical Trial Randomized Controlled Trial Research Support, Non-U.S. Gov't]. *Journal of psychosomatic research, 48*(1), 23-29.

NIH. (1998). Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. *Obesity Research, 6 Suppl 2*, 51S-209S.

NIMH. (2009, Januray 21). What are the different forms of depression? Retrieved from http://www.nimh.nih.gov/health/publications/women-and-depression-discovering-hope/what-are-the-different-forms-of-depression.shtml

NIMH. (2011, March 16). Anxiety Disorders. Retrieved from http://www.nimh.nih.gov/health/topics/anxiety-disorders/index.shtml

O'Brien, P. E. (2010). Bariatric surgery: mechanisms, indications and outcomes. *Journal of Gastroenterology Hepatology, 25*(8), 1358-1365. doi: JGH6391 [pii]10.1111/j.1440-1746.2010.06391.x

O'Brien, P. E., & Dixon, J. B. (2003). Lap-band: outcomes and results. *Journal of Laparoendoscopic & Advanced Surgical Techniques, 13*(4), 265-270. doi: 10.1089/109264203322333593

O'Brien, P. E., Dixon, J. B., Laurie, C., & Anderson, M. (2005). A prospective randomized trial of placement of the laparoscopic adjustable gastric band: comparison of the perigastric and pars flaccida pathways. *Obesity Surgery, 15*(6), 820-826. doi: 10.1381/0960892054222858

O'Brien, P. E., McPhail, T., Chaston, T. B., & Dixon, J. B. (2006). Systematic review of medium-term weight loss after bariatric operations. [Meta-AnalysisReview]. *Obesity surgery, 16*(8), 1032-1040. doi: 10.1381/096089206778026316

O'Brien, R. M. (2007). A Caution Regarding Rules of Thumb for Variance Inflation Factors. [Journal Article]. *Quality & Quantity, 41*.

Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Jama-Journal of the American Medical Association, 295*(13), 1549-1555.

Omalu, B. I., Ives, D. G., Buhari, A. M., Lindner, J. L., Schauer, P. R., Wecht, C. H., & Kuller, L. H. (2007). Death rates and causes of death after bariatric surgery for Pennsylvania residents, 1995 to 2004. *Archives of Surgery, 142*(10), 923-928; discussion 929. doi: 142/10/923 [pii]10.1001/archsurg.142.10.923

Onyike, C. U., Crum, R. M., Lee, H. B., Lyketsos, C. G., & Eaton, W. W. (2003). Is obesity associated with major depression? Results from the Third National Health and Nutrition Examination Survey. *American Journal of Epidemiology, 158*(12), 1139-1147.

Oria, H., & Moorehead, M. (1998). Bariatric Analysis and Reporting Outcome System (BAROS). *Obesity Surgery, 8*(5), 487-499. doi: 10.1381/096089298765554043

Palinkas, L. A., Wingard, D. L., & Barrett-Connor, E. (1996). Depressive symptoms in overweight and obese older adults: a test of the "jolly fat" hypothesis. *Journal of Psychosomatic Research, 40*(1), 59-66. doi: 0022399995005420 [pii]

Papageorgiou, G., Papakonstantinou, A., Mamplekou, E., Terzis, I., & Melissas, J. (2002). Pre- and Postoperative Psychological Characteristics in Morbidly Obese Patients. *Obesity Surgery, 12*(4), 534-539. doi: 10.1381/096089202762252307

Parikh, M. S., Laker, S., Weiner, M., Hajiseyedjavadi, O., & Ren, C. J. (2006). Objective comparison of complications resulting from laparoscopic bariatric procedures. [Comparative Study Research Support, Non-U.S. Gov't]. *Journal of the American College of Surgeons, 202*(2), 252-261. doi: 10.1016/j.jamcollsurg.2005.10.003

Parkes, E. (2006). Nutritional management of patients after bariatric surgery. [Review]. *The American journal of the medical sciences, 331*(4), 207-213.

Poitou, B. C., Ciangura, C., Coupaye, M., Czernichow, S., Bouillot, J. L., & Basdevant, A. (2007). Nutritional deficiency after gastric bypass: diagnosis, prevention and treatment. [Review]. *Diabetes & metabolism, 33*(1), 13-24. doi: 10.1016/j.diabet.2006.11.004

Pories, W. J. (2008). Bariatric surgery: risks and rewards. [Evaluation Studies Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't Review]. *The Journal of clinical endocrinology and metabolism, 93*(11 Suppl 1), S89-96. doi: 10.1210/jc.2008-1641

Pories, W. J., Dohm, L. G., & Mansfield, C. J. (2010). Beyond the BMI: The Search for Better Guidelines for Bariatric Surgery. *Obesity, 18*(5), 865-871. doi: Doi 10.1038/Oby.2010.8

Powers, P. S., Rosemurgy, A., Boyd, F., & Perez, A. (1997). Outcome of gastric restriction procedures: Weight, psychiatric diagnoses, and satisfaction. *Obesity Surgery, 7*(6), 471-477.

Prachand, V. N. (2011). The Evolution of Minimally Invasive Bariatric Surgery. *World Journal of Surgery*. doi: 10.1007/s00268-011-1033-7

Pull, C. B. (2010). Current psychological assessment practices in obesity surgery programs: what to assess and why. *Current Opinion in Psychiatry, 23*(1), 30-36. doi: 10.1097/YCO.0b013e328334c817

Puzziferri, N., Austrheim-Smith, I. T., Wolfe, B. M., Wilson, S. E., & Nguyen, N. T. (2006). Three-year follow-up of a prospective randomized trial comparing laparoscopic versus open gastric bypass. [Comparative Study Randomized Controlled Trial]. *Annals of surgery, 243*(2), 181-188. doi: 10.1097/01.sla.0000197381.01214.76

Quality of Life and Psychosocial Adjustment in Patients after Roux-en-Y Gastric Report Bypass: A Brief Report. (2001). *Obesity Surgery, 11*, 32-39.

Regan, J. P., Inabnet, W. B., Gagner, M., & Pomp, A. (2003). Early experience with two-stage laparoscopic Roux-en-Y gastric bypass as an alternative in the super-super obese patient. *Obesity Surgery, 13*(6), 861-864. doi: 10.1381/096089203322618669

Roberts, R. E., Deleger, S., Strawbridge, W. J., & Kaplan, G. A. (2003). Prospective association between obesity and depression: evidence from the Alameda County Study. *International Journal of Obesity, 27*(4), 514-521. doi: DOI 10.1038/sj.ijo.08022204

Rosik, C. H. (2005). Psychiatric symptoms among prospective bariatric surgery patients: Rates of prevalence and their relation to social desirability, pursuit of surgery, and follow-up attendance. *Obesity Surgery, 15*(5), 677-683.

Rothman, K. J. (1990). No Adjustments Are Needed for Multiple Comparisons. *Epidemiology, 1*(1).

Ryden, A., Karlsson, J., Sullivan, M., Torgerson, J. S., & Taft, C. (2003). Coping and distress: what happens after intervention? A 2-year follow-up from the Swedish Obese Subjects (SOS) study. [Clinical Trial Controlled Clinical Trial Multicenter Study]. *Psychosomatic medicine, 65*(3), 435-442.

Ryden, A., & Torgerson, J. S. (2006). The Swedish Obese Subjects Study--what has been accomplished to date? [Review]. *Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery, 2*(5), 549-560. doi: 10.1016/j.soard.2006.07.006

Ryden, O., Hedenbro, J. L., & Frederiksen, S. G. (1996). Weight loss after vertical banded gastroplasty can be predicted: A prospective psychological study. *Obesity Surgery, 6*(3), 237-243.

Ryden, O., Olsson, S. A., Danielsson, A., & Nilsson-Ehle, P. (1989). Weight loss after gastroplasty: psychological sequelae in relation to clinical and metabolic observations. *Journal of the American College of Nutrition, 8*(1), 15-23.

SAGES. SAGES guideline for clinical application of laparoscopic bariatric surgery. (2008). [Practice Guideline]. *Surgical endoscopy, 22*(10), 2281-2300. doi: 10.1007/s00464-008-0170-z

Santry, H. P., Gillen, D. L., & Lauderdale, D. S. (2005). Trends in bariatric surgical procedures. *JAMA, 294*(15), 1909-1917. doi: 294/15/1909 [pii]10.1001/jama.294.15.1909

Santry, H. P., Lauderdale, D. S., Cagney, K. A., Rathouz, P. J., Alverdy, J. C., & Chin, M. H. (2007). Predictors of patient selection in bariatric surgery. [Research Support, N.I.H., Extramural Research Support, Non-U.S. Gov't]. *Annals of surgery, 245*(1), 59-67. doi: 10.1097/01.sla.0000232551.55712.b3

Saris, W. H. (2001). Very-low-calorie diets and sustained weight loss. [Research Support, Non-U.S. Gov't Review]. *Obesity research, 9 Suppl 4*, 295S-301S. doi: 10.1038/oby.2001.134

Sarwer, D. B., Wadden, T. A., & Fabricatore, A. N. (2005). Psychosocial and behavioral aspects of bariatric surgery. [Research Support, N.I.H., Extramural Research Support, U.S. Gov't, P.H.S. Review]. *Obesity research, 13*(4), 639-648. doi: 10.1038/oby.2005.71

Schauer, P. R., Ikramuddin, S., Gourash, W., Ramanathan, R., & Luketich, J. (2000). Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Annals of surgery, 232*(4), 515-529.

Sczepaniak, J. P., Owens, M. L., Garner, W., Dako, F., Masukawa, K., & Wilson, S. E. (2012). A Simpler Method for Predicting Weight Loss in the First Year after Roux-en-Y Gastric Bypass. *Journal of obesity, 2012*, 195251. doi: 10.1155/2012/195251

Segal, A., Libanori, H., & Azevedo, A. (2002). Bariatric Surgery in a Patient with Possible Psychiatric Contraindications. *Obesity Surgery, 12*(4), 598-601. doi: 10.1381/096089202762252424

Shai, I., Henkin, Y., Weitzman, S., & Levi, I. (2003). Determinants of Long-Term Satisfaction after Vertical Banded Gastroplasty. *Obesity Surgery, 13*(2), 269-274. doi: 10.1381/096089203764467199

Shen, R., Dugay, G., Rajaram, K., Cabrera, I., Siegel, N., & Ren, C. J. (2004). Impact of patient follow-up on weight loss after bariatric surgery. [Research Support, Non-U.S. Gov't]. *Obesity surgery, 14*(4), 514-519. doi: 10.1381/096089204323013523

Siefert, K., Heflin, C. M., Corcoran, M. E., & Williams, D. R. (2001). Food insufficiency and the physical and mental health of low-income women. *Women Health, 32*(1-2), 159-177.

Sjostrom, L., Narbro, K., Sjostrom, C. D., Karason, K., Larsson, B., Wedel, H., . . . Carlsson, L. M. (2007). Effects of bariatric surgery on mortality in Swedish obese subjects. [Research Support, Non-U.S. Gov't]. *The New England journal of medicine, 357*(8), 741-752. doi: 10.1056/NEJMoa066254

Song, A., & Fernstrom, M. H. (2008). Nutritional and psychological considerations after bariatric surgery. *Aesthetic Surgery Journal, 28*(2), 195-199. doi: S1090-820X(08)00027-7 [pii]10.1016/j.asj.2008.01.005

Stunkard, A. J., Faith, M. S., & Allison, K. C. (2003). Depression and obesity. *Biological Psychiatry, 54*(3), 330-337. doi: S0006322303006085 [pii]

Sturm, R. (2007). Increases in morbid obesity in the USA: 2000-2005. *Public health, 121*(7), 492-496. doi: 10.1016/j.puhe.2007.01.006

Sugerman, H. J., DeMaria, E. J., Kellum, J. M., Sugerman, E. L., Meador, J. G., & Wolfe, L. G. (2004). Effects of bariatric surgery in older patients. [Comparative Study]. *Annals of surgery, 240*(2), 243-247.

Sugerman, H. J., Kellum, J. M., Engle, K. M., Wolfe, L., Starkey, J. V., Birkenhauer, R., . . . Sawyer, M. J. (1992). Gastric bypass for treating severe obesity. [Research Support, U.S. Gov't, P.H.S. Review]. *The American journal of clinical nutrition, 55*(2 Suppl), 560S-566S.

ASMBS (American Society for Metabolic & Bariatric Surgery). (2009). NEW STUDY FINDS SOCIAL AND ECONOMIC FACTORS PLAY MAJOR ROLE IN DETERMININGWHO GETS BARIATRIC SURGERY. Retrieved from http://www.asmbs.org/Newsite07/resources/asmbs_soc_release.pdf

Tack, J., Arts, J., Caenepeel, P., De Wulf, D., & Bisschops, R. (2009). Pathophysiology, diagnosis and management of postoperative dumping syndrome. [Review]. *Nature reviews. Gastroenterology & hepatology, 6*(10), 583-590. doi: 10.1038/nrgastro.2009.148

Thompson, W. G., Cook, D. A., Clark, M. M., Bardia, A., & Levine, J. A. (2007). Treatment of obesity. *Mayo Clinic Procedings, 82*(1), 93-101; quiz 101-102.

Thonney, B., Pataky, Z., Badel, S., Bobbioni-Harsch, E., & Golay, A. (2010). The relationship between weight loss and psychosocial functioning among bariatric surgery patients. *American Journal of Surgery, 199*(2), 183-188. doi: DOI 10.1016/j.amjsurg.2008.12.028

Thurber, S., Snow, M., & Honts, C. R. (2002). The Zung Self-Rating Depression Scale: convergent validity and diagnostic discrimination. *Assessment, 9*(4), 401-405.

Tice, J. A., Karliner, L., Walsh, J., Petersen, A. J., & Feldman, M. D. (2008). Gastric banding or bypass? A systematic review comparing the two most popular bariatric procedures. [Comparative Study Research Support, Non-U.S. Gov't Review]. *The American journal of medicine, 121*(10), 885-893. doi: 10.1016/j.amjmed.2008.05.036

Tolonen, P., Victorzon, M., & Makela, J. (2004). Impact of laparoscopic adjustable gastric banding for morbid obesity on disease-specific and health-related quality of life. *Obesity Surgery, 14*(6), 788-795. doi: 10.1381/0960892041590755

Torquati, A., Lutfi, R. E., & Richards, W. O. (2007). Predictors of early quality-of-life improvement after laparoscopic gastric bypass surgery. *American Journal of Surgery, 193*(4), 471-475. doi: DOI 10.1016/j.amjsurg.2006.08.065

van Gemert, W. G., Severeijns, R. M., Greve, J. W., Groenman, N., & Soeters, P. B. (1998). Psychological functioning of morbidly obese patients after surgical treatment. *International Journal of Obesity and Related Metabolic Disorders, 22*(5), 393-398.

van Hout, G., & van Heck, G. (2009). Bariatric psychology, psychological aspects of weight loss surgery. *Obesity Facts, 2*(1), 10-15. doi: 000193564 [pii]10.1159/000193564

van Hout, G., Verschure, S., & Van Heck, G. (2005). Psychosocial Predictors of Success following Bariatric Surgery. *Obesity Surgery, 15*(4), 552-560. doi: 10.1381/0960892053723484

van Hout, G. C., Boekestein, P., Fortuin, F. A., Pelle, A. J., & van Heck, G. L. (2006). Psychosocial functioning following bariatric surgery. *Obesity Surgery, 16*(6), 787-794. doi: 10.1381/096089206777346808

van Hout, G. C., Hagendoren, C. A., Verschure, S. K., & van Heck, G. L. (2009). Psychosocial predictors of success after vertical banded gastroplasty. *Obesity Surgery, 19*(6), 701-707. doi: 10.1007/s11695-008-9446-6

van Hout, G. C., Verschure, S. K., & van Heck, G. L. (2005). Psychosocial predictors of success following bariatric surgery. *Obesity Surgery, 15*(4), 552-560. doi: 10.1381/0960892053723484

Virji, A., & Murr, M. M. (2006). Caring for patients after bariatric surgery. *American Family Physician, 73*(8), 1403-1408.

Wadden, T. A., Butryn, M. L., Sarwer, D. B., Fabricatore, A. N., Crerand, C. E., Lipschutz, P. E., . . . Williams, N. N. (2006). Comparison of psychosocial status in treatment-seeking women with class III vs. class I-II obesity. *Surgery for Obesity and Related Diseases, 2*(2), 138-145. doi: S1550-7289(06)00256-5 [pii]10.1016/j.soard.2006.03.016

Wadden, T. A., Butryn, M. L., & Wilson, C. (2007). Lifestyle modification for the management of obesity. [Research Support, N.I.H., Extramural Review]. *Gastroenterology, 132*(6), 2226-2238. doi: 10.1053/j.gastro.2007.03.051

Wadden, T. A., Sarwer, D. B., Womble, L. G., Foster, G. D., McGuckin, B. G., & Schimmel, A. (2001). Psychosocial aspects of obesity and obesity surgery. *Surgical Clinics of North America, 81*(5), 1001-1024.

Wadden, T. A., Vogt, R. A., Andersen, R. E., Bartlett, S. J., Foster, G. D., Kuehnel, R. H., . . . Steen, S. N. (1997). Exercise in the treatment of obesity: effects of four interventions on body composition, resting energy expenditure, appetite, and mood. [Clinical Trial Randomized Controlled Trial Research Support, U.S. Gov't, P.H.S.]. *Journal of consulting and clinical psychology, 65*(2), 269-277.

Walfish, S., Vance, D., & Fabricatore, A. N. (2007). Psychological evaluation of bariatric surgery applicants: procedures and reasons for delay or denial of surgery. *Obesity Surgery, 17*(12), 1578-1583. doi: 10.1007/s11695-007-9274-0

Waters, G. S., Pories, W. J., Swanson, M. S., Meelheim, H. D., Flickinger, E. G., & May, H. J. (1991). Long-term studies of mental health after the Greenville gastric bypass operation for morbid obesity. *American Journal of Surgery, 161*(1), 154-157; discussion 157-158.

Watkins, B. M., Montgomery, K. F., & Ahroni, J. H. (2005). Laparoscopic adjustable gastric banding: Early experience in 400 consecutive patients in the USA. *Obesity Surgery, 15*(1), 82-87.

Werrij, M. Q., Mulkens, S., Hospers, H. J., & Jansen, A. (2006). Overweight and obesity: the significance of a depressed mood. [Research Support, Non-U.S. Gov't]. *Patient education and counseling, 62*(1), 126-131. doi: 10.1016/j.pec.2005.06.016

White, M. A., O'Neil, P. M., Kolotkin, R. L., & Byrne, T. K. (2004). Gender, race, and obesity-related quality of life at extreme levels of obesity. *Obesity Research, 12*(6), 949-955.

Weight Control Information Network (WIN). National Institute of Diabetes and Digestive and Kidney Diseases. (December, 2004). Gastrointestinal Surgery for Severe Obesity. National Institute of Health Publication No. 04-4006. Retrieved from http://discoveryhealthcme.discovery.com/bariatricsurgery/reference/gastricsurg.pdf

Wing, R. R. (1992). Behavioral treatment of severe obesity. [Research Support, U.S. Gov't, P.H.S. Review]. *The American journal of clinical nutrition, 55*(2 Suppl), 545S-551S.

Wittgrove, A. C., & Clark, G. W. (2000). Laparoscopic gastric bypass, Roux en-Y - 500 patients: Technique and results, with 3-60 month follow-up. *Obesity Surgery, 10*(3), 233-239.

Woodard, G. A., Downey, J., Hernandez-Boussard, T., & Morton, J. M. (2011). Impaired alcohol metabolism after gastric bypass surgery: a case-crossover trial. [Research Support, Non-U.S. Gov't]. *Journal of the American College of Surgeons, 212*(2), 209-214. doi: 10.1016/j.jamcollsurg.2010.09.020

Woodward, B. G. (2003). Bariatric surgery options. *Critical Care Nursing Quarterly, 26*(2), 89-100.

Zalesin, K., Franklin, B., Miller, W., Janosz, K., Veri, S., Odom, J., & McCullough, P. (2010). Preventing Weight Regain After Bariatric Surgery: An Overview of Lifestyle and Psychological Modulators. *American Journal of Lifestyle Medicine, 4*, 113.

Zung, W. W., Richards, C. B., & Short, M. J. (1965). Self-rating depression scale in an outpatient clinic. Further validation of the SDS. *Archives of General Psychiatry, 13*(6), 508-515.

APPENDICES

Appendix A: Obesity-related Diseases

Cardiovascular Congestive heart failure Coronary artery disease Hyperlipidemia Hypertension Left ventricular hypertrophy Venous stasis ulcers, thrombophlebitis	**Gastrointestinal and hepatobiliary** Abdominal hernia Gallstones Gastro-esophageal reflux disease Nonalcoholic fatty liver disease **Hematopoietic** Deep venous thrombosis Pulmonary embolism
Musculo-skeletal Carpal tunnel syndrome Degenerative joint disease Gout Plantar fasciitis	**Neurologic and psychiatric** Anxiety Depression Pseudotumor cerebri Stroke
Endocrine Insulin resistance Polycystic ovary syndrome Type 2 diabetes	**Genitourinary** Stress urinary incontinence Urinary tract infections
Obstetric and gynecologic Fetal abnormalities and infant mortality Gestational diabetes Infertility Miscarriage	**Pulmonary** Asthma Obesity hypoventilation syndrome Obstructive sleep apnea Pulmonary hypertension

Note. Source: (Brethauer et al., 2006).

Appendix B: Dumping Syndrome

What is Dumping Syndrome?

Dumping Syndrome can occur after any surgery that changes the normal way in which food leaves the stomach. It occurs when food passes too quickly ("dumped") from the stomach into the small intestine.

In response, water from the surrounding blood vessels is drawn into the small intestine, usually resulting in a combination of the following symptoms: abdominal fullness, nausea, light-headedness, sweating, cramping, rapid heartbeat and diarrhea. Symptoms can occur 10-20 minutes after eating a meal and/or 1-3 hours after eating. Dumping syndrome occurs with gastric bypass surgery, but not with gastric banding surgery.

What causes Dumping Syndrome?

Refined sugars, overeating and drinking liquids with meals are the usual culprits. Dumping Syndrome symptoms have also been reported with high fat food consumption. Dumping syndrome does not occur with gastric banding, but it is still best to avoid sweets and fried foods in order to maximize weight loss and the nutritional value of your diet.

How can Dumping Syndrome be avoided?

- Avoid refined sugars/sugar alcohols (see list below)
- Avoid all foods/liquids with added sugar listed as one of the first three ingredients on the food label.
- Eat small, frequent meals
- Eat slowly and rest a little after eating
- Do not drink liquids with meals

- Avoid Caffeine and very hot or very cold liquids/foods.

Refined Sugars/Sugar alcohols to avoid:

Barley Malt, Brown Sugar, Cane Sugar, Confectioners Sugar, Corn Syrup, Corn sweeteners, Dextrose, Fructose, Glucose, Granulated Sugar, Honey, High Fructose Corn, Invert Sugar, Isomalt, Lactose, Lactitol, Levulose, Maltose, Mannitol, Maple Syrup, Molasses, Raw Sugar, Sorghum, Sucrose, Sorbitol, Turbinado, Table sugar, Xylitol

Note. Source: St. Luke's – Roosevelt Hospital Center, Center for Bariatric Surgery and Metabolic Disease, Your Guidelines for Food Choices and Nutrition.

Appendix C: Diet Guidelines following Gastric Bypass Surgery and Gastric Banding Surgery

These guidelines are to help you choose, prepare and eat foods after gastric bypass and gastric banding surgery. There will be certain foods you will need to avoid and your portion sizes will be much smaller than before because the new pouch will hold only a small amount of food. Although it will take several weeks, you will be able to eat regular foods again.

The Gastric Bypass procedure creates a very small gastric pouch with a narrow connection to a bypassed segment of the small intestine. Because the size of your functioning stomach is much smaller and the opening from the stomach to the small intestine is narrower than before surgery, you will need to make changes in the way you eat.

The Gastric Banding procedure places an adjustable band around the upper part of your stomach, dividing the stomach into two sections, creating a new small stomach pouch above the band with a narrow outlet (stoma) into the lower stomach below the band.

After Surgery

- Initially, your stomach will only be able to hold 2-3 ounces of food at a time.
- Start slowly and introduce one new food at a time.
- Eat slowly. It should take at least 30 minutes to eat a meal.
- STOP eating if you feel pain, fullness, discomfort, nausea, or vomiting. Occasional vomiting is common and food intolerances vary on an individual basis. If a food is not tolerated, reintroduce it a week later.

- You may experience changes in taste and appetite. You may not feel hungry or want to eat, but it is important to eat at regular intervals in order to recover from surgery and stay healthy.
- Large pieces of food will not easily pass through the narrow connection. You will need to choose soft foods and chew foods very well when your diet progresses to regular texture.
- Food will pass through the stomach at a much slower rate than before the surgery. Consequently, you will feel full sooner and will stay satisfied longer.
- Avoid high fat foods and foods with added sugar. Patients that undergo gastric bypass surgery may experience an adverse side effect known as Dumping syndrome (pg 14). Gastric banding patients usually do not experience this syndrome; however these foods should still be avoided.
- Drink at least 6-8 cups (48-64 oz) of fluids daily to prevent dehydration.
- Do not drink beverages with your meals.

Gastric Bypass: You will need to supplement your diet with a multivitamin, calcium and iron daily for the rest of your life.

Gastric Band: You will need to supplement your diet with a multivitamin for the rest of your life.

Diet Progression following Gastric Bypass Surgery and Gastric banding Surgery

The gastric bypass and lap band surgery diets are designed to provide adequate fluids and nourishment while promoting weight loss after surgery. The diet is divided into three stages:

Stage I: Clear liquid diet and protein supplement

- **Gastric Bypass:** Begins the day after surgery, and last for at least 1 week. If no problems are experienced with clear liquids, your surgeon will add a high protein liquid supplement to your diet when you go home from the hospital.
- **Gastric Banding:** Begins the day of surgery, and last for at least 2 weeks. If no problems are experienced with clear liquids, your surgeon will add a high protein liquid supplement to your diet when you go home from the hospital.
- **Please do not advance the diet without speaking to the surgeon, nurse practitioner, or dietitian.**

Stage II: No Concentrated Sweets, Low-fat Puree diet

- **Gastric Bypass:** Lasts up to approximately 3 week after surgery. During this stage the surgeon will progress your diet to pureed foods. All foods are blended to the consistency of applesauce.
- **Gastric Banding:** Lasts up to approximately 2 weeks after surgery. During this stage the surgeon will progress your diet to pureed foods. All foods are blended to the consistency of applesauce.
- **Please do not advance the diet without speaking to the surgeon, nurse practitioner, or dietitian.**

Stage III: No Concentrated Sweets, Low-fat diet

- **Gastric Bypass and Gastric Banding:** Depending on your progress, approximately one month after surgery, your diet will be advanced to a *regular* texture no concentrated sweets low-fat diet.

- **Please do not advance the diet without speaking to the surgeon, nurse practitioner, or dietitian.**

Note. Source: St. Luke's – Roosevelt Hospital Center, Center for Bariatric Surgery and Metabolic Disease, Your Guidelines for Food Choices and Nutrition

Appendix D: Literature Review Summary on Predictors Of Post-Surgical Outcomes

Title & authors	Surgery	Sample	Mean follow-up period	Assessment methods and measures	Outcomes	Predictors
A Simpler Method for Predicting Weight Loss in the First Year after Roux-en-Y Gastric Bypass. (Sczepaniak et al., 2012)	Roux-en-Y Gastric Bypass (laparoscopic versus open)	224 (1551) (women, 191; men, 33) gastric bypass patients (85.9% female); ma, 40.5 years (range 15.4 to 71.8 years); dor, 85.6%	12	Medical records	38% weight change	Positive predictor: initial weight African American women are more resistant to weight loss than their white counter parts. Males lose significantly more weight than females do at 6 and 12 months post operation.
Predicting outcome of gastric bypass surgery utilizing personality scale elevations, psychosocial factors, and diagnostic group membership. (Belanger et al., 2010)	Laparoscopic Roux-en-Y Gastric Bypass (119, 83.2%), open Roux-en-Y gastric bypass (10, 7.0%), and converted from Laparoscopic to open Roux-en-Y Gastric Bypass (13, 9.1%)	115 (143; women 120; men, 23); dor, 17.9% Group 1: surgical candidate, no reservation from a psychological standpoint. Group 2: surgical candidate, psychological services may be useful but not necessary.	6	Minnesota Multiphasic Personality Inventory, The Millon Clinical Multiaxial Inventory-III (175-item true–false self-report measure of axes I and II psychopathology), Semi-structured Interview	Group 1: BMI, 35.45±6.64, Weight, 222.74±48.15, n=19□ Group 2: BMI, 34.37±7.39, Weight, 217.03±60.13, n=68 Group 3: BMI, 35.81±7.22, Weight, 228.30±47.92, n=27 Group 4: BMI, □26.60, Weight,	Positive predictor of weight loss: lower MCMI compulsivity scale scores, higher MCMI schizotypal scores, and lower MMPI-2 K scale scores, higher baseline BMI

		Group 3: surgical candidate after appropriate psychological services are in place. If treatment is established and verified, surgery can proceed without delay. Group 4: surgical candidate after appropriate psychological services are in place. Surgery should be delayed to evaluate the efficacy of psychological and/or psychiatric treatment. Reevaluation of the patient after a period of treatment is likely necessary before proceeding with surgery			151.00, □n=1 All groups: BMI, 34.784±7.18, Weight, 219.72± 33.35, n=115	

The relationship between weight loss and psychosocial functioning among bariatric surgery patients. (Thonney, 2010)	Gastric Bypass	43 women (ma, 39.3±1.4 years)	12 and 24	The Beck Depression Inventory and the Hospital Anxiety and Depression Scale	1-year period was de- creased compared with baseline (119.9 ±1.8 vs. 81.3±1.7 kg; P< .0001). Weight loss at 1 year (32.1±1.1%) was comparable with that at 2 years (33.3±1.1%) (P=0.11). % EWL was also comparable at 1 year (74.9±2.8%) and 2 years (76.1±3.4%) (P=0.55).	Depression and anxiety AFTER surgery are predictive of weight loss. Positive predictor of depression: lower baseline BMI and higher ΔBMI, higher EWL (2nd year)
Relationship of psychiatric disorders to 6-month outcomes after gastric bypass. (Kalarchian et al., 2008)	Gastric Bypass	207; women, 172, men, 35; ma, 45.8±9.5 years	6	The Structured Clinical Interview	Axis I disorder was associated with a smaller decrease in BMI ($t = -3.7$, $df = 205$, $P<0.001$) at 6 months after surgery, adjusting for baseline BMI and covariates.	Negative predictor of weight loss: baseline mood or baseline anxiety disorder compared those who don't. Not a predictor of weight loss: substance and eating disorders
The prognostic significance of depressive symptoms for predicting quality of life 12 months after gastric bypass.	Gastric Bypass	137; women, 122; men, 15; ma, 42.3 years±10.2 years	12	To assess quality of life (SF-36), depression (BDI)	BMI reduced by 35.7%. Mean BDI score improved from depressed to non-depressed range and SF-36 scores improved both physically	Positive predictor of post-quality of life: Preoperative BDI, Postoperative BDI, lower baseline weight

(Masheb et al., 2007)					and mentally aspects.	
Predictors of early quality-of-life improvement after laparoscopic gastric bypass surgery. (Torquati et al., 2007)	Gastric Bypass	171; 147 women, 24 men; ma, 43.1 years	3	(SF-36) questionnaire	% EWL, 37.4%± 9.2%, BMI, 10.1	Positive predictor of post-surgical quality of life improvement: women with type 2 diabetes
Psychosocial Predictors of Weight Loss after Bariatric Surgery. (Kinzl et al., 2006)	Gastric restrictive surgery (laparoscopic Swedish adjustable gastric banding (SAGB).	140 women; ma, 44 years	30+	Clinical interview, A self-administered questionnaire	42 kg, BMI, 14.6	Positive predictor of weight loss: no psychiatric disorder, an atypical eating disorder, positive childhood experience. Negative predictor of weight loss: psychiatric disorders (particularly adjustment disorders, depression and/or personality disorders). No predictor of weight loss: age, onset of obesity, socioeconomic status, preoperative weight and preoperative physical activity
Predictors of Weight Status following Laparoscopic Gastric Bypass. (Ma et al., 2006)	Laparoscopic Gastric Bypass	377 (494); Ma, 44±9.6 years; dor, 23.7%	12	Center for Epidemiological Studies-Depression Scale (CES- D) and Beck Depression Inventory (BDI).	% EWL, 65±15.2%	Positive predictor of % EWL: younger age, male gender, and lower baseline weight. Negative predictor of % EWL: diabetes at one year. Not a predictor of % EWL: presence of elevated depressive symptoms
The impact of preoperative weight loss in patients undergoing laparoscopic Roux-en-Y gastric bypass.	Roux-en-Y Gastric Bypass	90; women, 81; 9 men; ma, 42; dor, 12% for 1 year	6-18	Bariatric Analysis and Reporting Outcome System (BAROS)	At 12, % EWL, 74.4%	Positive predictor of weight loss: lower initial BMI by preoperative dieting might be.

(Alvarado et al., 2005)						
Impact of age, sex and body mass index on outcomes at four years after gastric banding. (Branson et.al, 2005)	Gastric Banding	404 (410); 318 women; 86, men; ma, 42±0.5 years; dor, 1.4%	48	Bariatric Analysis and Reporting Outcome System (BAROS)	% weight loss, 26.0± 0.5% BMI, 11.5± 0.2	Positive predictor of weight loss: higher baseline BMI
Depression Score Predicts Weight Loss following Roux-en-Y Gastric Bypass. (Averbukh et al., 2003)	Roux-en-Y Gastric Bypass	47 (145); women, 40; men, 7; ma, 40.4±12.3 years; dor, 68%	12	Medical charts (Beck Depression Inventory)	% EWL	Positive predictor of weight loss: baseline BDI and BMI. Negative predictor: age. Not a predictor: Gender, ethnicity, family history of obesity, diagnosis of diabetes or hypothyroidism or psychiatric medication
Outcome predictors in morbidly obese recipients of an adjustable gastric band. (Busetto et al., 2002)	Laparoscopic Adjustable Gastric Banding	260 (838); women, 188; men, 72; ma, 37.6 ±10.8 years; dor, 69%	36	Clinical interview	% EWL, 43.0±22.3%, BMI, 9.8	Positive predictor of weight loss: age < 40 years, BMI <50 kg/m^2; negative predictor: male sex, non-sweet eating behavior
Impact of gastric banding on eating behavior and weight. (Lang et al., 2002)	Laparoscopic Adjustable Gastric Banding	66 (97); gender not indicated; ma, 38.1 years; dor, 32%)	12	Standardized questionnaire	% EWL, 31.6%, BMI, 8.4	No predictor of weight loss: pre-surgical eating behavior
Quality of life after Lap-Band placement: influence of time, weight loss, and comorbidities. (Dixon et al., 2001)	Laparoscopic Adjustable Gastric Banding	320; women, 459; men, 398; ma, 71; 41±9.8 years; dor, 30.3%	12	Clinical interview, standardized questionnaire, self-made questionnaire	BMI, ≥ 10	Predictor of improved quality of life: age, comorbidity (especially arthritis/joint pain, depression); predictor of low quality of life: younger age, developing a weight problem at a later stage in life; % EWL was not a major predictor of quality of life
Pre-operative predictors of weight loss at 1-year after	Laparoscopic Adjustable Gastric Banding	440 (730); women, 383; men, 57; ma,	12	Clinical interview, standardized questionnaire (SF-	BMI, ≥ 10	Positive predictor of weight loss: moderate alcohol consumption; negative predictor: increasing

Lap-Band Surgery. (Dixon et al., 2001)		40.0±9.5 years; dor, 29.7%		36), self-made questionnaire		age, higher initial BMI, poor physical ability; no predictor: gender, family history of obesity, age at onset of obesity, history of medical, mental illness
Psychologic assessment of morbidly obese patients undergoing gastric bypass: a comparison of preoperative and post-operative adjustment. (Gentry et al., 1984)	Gastric Bypass	33 (33); women, 32; men, 1; ma, 32 years; dor, 0%	24	Standardized interview, standardized questionnaires	83% lost >50% of excess weight	Positive predictor of weight loss: eating in response to pleasant feelings or a sense of accomplishment, realizing preoperatively that overeating was the cause of obesity; high levels of optimism were not associated with weight loss
Quality of life after gastric bypass for morbid obesity. (Hafner et al., 1991)	Gastric Bypass	71 (118); women, 83; men, 35; ma, not indicated; dor, 39.8%	12	Standardized questionnaires	35.4 kg; BMI, 13.1	Positive predictor of weight loss: marital dissatisfaction, increase in phobia scores; negative predictor: generalized anxiety, increase in extrapunitiveness
Psychosocial function before and after gastric banding surgery for morbid obesity: a prospective psychiatric study. (Larsen, 1990)	Horizontal gastric banding	90 (95); women, 66; men, 24; ma, 35.4 years; dor, 7%	36	Structured interview, standardized questionnaires	31.5 kg	Positive predictor of weight loss: higher initial weight and younger age; negative predictor: pre-surgical personality disorder; no predictor of weight loss: overweight in parents, degree of juvenile obesity and effect of pre-surgical dieting; preoperative psychiatric help-seeking was associated with negative psychosocial reaction despite sufficient weight loss
Personality changes after gastric banding surgery for morbid obesity: a prospective study. (Larsen & Torgerson, 1989)	Gastric Banding	89 (97); women, 65; men, 24; ma, 35.4±9.4 years; dor, 8.2%	36	Semi-structured interview (DSM-III), standardized questionnaire	31.4 kg	No correlation between scores of the personality questionnaire and weight loss

Weight change in relation to intake of sugar and sweet foods before and after weight reducing gastric surgery. (Lindroos et al., 1996)	Vertical Banded Gastroplasty, Gastric Banding, Gastric Bypass	Gastroplasty, 365 (375; women, 248; men, 127); gastric bypass, 34 (men, 12; women, 22; ma, 46±6 years; dor, 13%); gastroplasty, 0% gastric bypass	24	Self-made questionnaire	Gastroplasty, ~26 kg; gastric bypass, ~38 kg	No association between intake of sugar and sweet foods before surgery and weight loss 2 years after gastroplasty, inverse association between weight change and relative intake of sugar and sweet foods: subjects with a high proportion of their intake from sweets lost more weight. They reduced energy intake from sweets less than from ordinary food
Outcome of gastric restriction procedures: weight, psychiatric diagnoses, and satisfaction. (Powers et al., 1997)	Gastric restrictive surgery	81 [131; women, 111; men, 20; five deaths (one suicide); ma, 39.4 years]; dor: 38.2%	68.4	Clinical interview, standardized questionnaires, self-made questionnaire	41 kg; BMI, 14.0	No predictor of weight loss: age, gender, presence, or absence of a pre-surgical psychiatric diagnosis; no relationship between the presence or absence of a pre-surgical psychiatric diagnosis and various mental health parameters
Eating pathology before and after bariatric surgery: a prospective study. (Powers et al., 1999)	Gastric restrictive surgery	77 (116; five deaths, one suicide); women, 64; men, 13; ma, 39.6±9.3 years, dor, 33.6%	66	Clinical interview, standardized questionnaire, self-made questionnaire	BMI, 13.8 kg/m^2	No relationship between pre-surgical eating pathology and weight loss or presence of vomiting at follow-up
Do psychosocial factors predict weight loss following gastric surgery for obesity? (Schrader et al., 1990)	Gastroplasty, Gastric Bypass, GastrogaStrostomy	39 (72; women, 66; men, 6, ma, 41 years); dor, 45.8%	36	Semi-structured interview	33 kg	No predictor of weight loss: age, gender, marital status, socioeconomic status, past psychiatric history, parental/spouse support for surgery, violent parents/spouse
A randomized prospective trial of gastric bypass versus vertical banded gastroplasty for	Vertical Banded Gastroplasty (A) and Roux-en-Y Gastric Bypass (B) randomized	A, 16 (20; women, 18; men, 2); ma, 38 ± 9 years (one death); dor,	36	Clinical interview, 24-hour recall, 2-day diary food frequency check	A, 41.3±12.7 kg; B, 27.2±14.5 kg	VBGP: "sweets eaters" lost significantly less excess weight than "non-sweets eaters"; RYGBP: no significant difference between sweets and non-sweets

morbid obesity and their effects on sweets versus non-sweets eaters. (Sugerman et al., 1987)	prospective trial	20%; B, 18 (20; women, 18; men, 2; ma, 38±11 years; two deaths); dor, 10%				eaters
Weight loss with vertical banded gastroplasty and Roux-Y gastric bypass for morbid obesity with selective versus random assignment. (Sugerman et al., 1989)	Sweet eaters (A) → Gastric Bypass non-sweet eaters (B) → Vertical Banded Gastroplasty	222 (age and gender not indicated); A, 182 (82%); B, 40 (18%); dor, 15%	36	Dietary history (24-hour recall, 2-day food diary, food frequency checklist)	Weight loss, A, 35±11%; B, 27±13%	Sweets eating is a negative predictor for weight loss in the frame of restrictive surgery but not in the frame of bypass surgery procedures
Psychological functioning of morbidly obese patients after surgical treatment. (van Gemert et al., 1998)	Gastric Bypass, Vertical Banded Gastroplasty	62 (68); women, 44; men, 18; ma, 33.1+9.4 years; dor, 10%	85.9 ± 4.8	Standardized questionnaire	45 kg	Positive predictor of weight loss: self-esteem; no predictor: intelligence, personality features, interpersonal behavior
Post-surgery assessment only (months after operation)						
An exploration of the outcomes of gastric bypass surgery for morbid obesity: patient characteristics and indices of success. (Delin et al., 1995)	Gastric Bypass	20; women, 16; men, 4; ma, 42.5±9.4 years; dor, not indicated	24 42 ± 9.13	Semi-structured interview, standardized questionnaires	% EWL, 89.57±23.88%	Positive predictor of weight loss: self-esteem; valuing of food and eating, personality features; negative predictor: depression, disinhibition (EI subscale), personality features; no predictor: age, anxiety, social support, employment status
Sweet eating is not a predictor of outcome after Lap-Band	Laparoscopic Adjustable Gastric Banding	200; women, 163; men, 37; ma, 41.5±9.9	At least 12	Standardized questionnaire, self-made questionnaire	0 Indicated	No predictor of weight loss: preoperative sweets eating

placement: can we finally bury the myth? (Hudson et al., 2002)	, normal weight community controls	years; controls, 40; women, 26; men, 14; 37.0±10				
Long-term follow-up of patients' status after gastric bypass. (Mitchell et al., 2001)	Roux-en-Y Gastric Bypass	78 (100; eight deaths, two died from a psychiatric-related condition; women, 65; men, 13); ma, 56.8 years; dor, 22%	156 to 195	Standardized questionnaires	49.7 kg; BMI, 10	Redeveloping problems with binge eating disorder after surgery led to tendency to regain weight
Cross-sectional assessment						
Health related quality of life in morbidly obese patients: effect of gastric bypass surgery. (de Zwaan et al., 2002)	Postoperative group, Roux-en-Y Gastric Bypass (Mitchell et al. sample)	78 (100; eight deaths, two died from a psychiatric-related condition); women, 65; men, 13; ma, 56.8 years; dor, 22%; preoperative group, 110 (164; women, 96; men, 14); ma, 39.6 years	156 to 195	Structured interview, standardized questionnaires,	BMI: postoperative: 10 preoperative: 4.6	Negative predictor of weight loss: binge eating disorder; negative predictor of mental well-being: binge eating disorders; no predictor of physical well-being: age and BMI at follow-up
Review Article						
Bariatric Psychology, Psychological Aspects of Weight Loss Surgery (van Hout & van Heck,	All surgeries	N/A	N/A	N/A	N/A	Few systematic studies on the influence of psychosocial factors upon bariatric surgery outcomes, and no consistent and reproducible predictors have been

2009)						found. Until now, there are no absolute psychosocial criteria for exclusion of candidates from obesity surgery. No psychosocial predictors of weight loss are found, it appears that changes in psychosocial functioning, eating behavior, and health related quality of life can be predicted by preoperative psychosocial characteristics.
Psychosocial and Behavioral Aspects of Bariatric Surgery (Sarwer et al., 2005)	All Bariatric Surgeries	N/A	N/A	N/A	Sustained postoperative weight loss and improvements in obesity-related health problems make bariatric surgery the most effective treatment for this population. Nevertheless, most experts agree that psychosocial and behavioral factors contribute to successful postoperative outcomes.	Positive predictor of weight loss: being white, Predictor of weight loss: operative weight, height, age, and type of operation Negative predictor of weight loss: Regular intake of high-sugar foods and beverages, and preoperative binge eating
Psychosocial Predictors of Success following Bariatric Surgery (Van Hout et	All Bariatric Surgeries	N/A	N/A	PubMed: systematic lit review, using the keywords morbid	Preoperative weight may predict the amount of weight loss but	Positive predictor of weight loss success: young and female, and have a high self-esteem, good mental health, a satisfactory

al., 2005)				obesity, bariatric surgery, predictors, weight loss, and quality of life. In addition, the online articles of OBESITY SURGERY were searched. Further articles, missed by the initial search, were identified from the inspection of the reference lists of relevant articles.	not postoperative psycho- logical success. heavier patients lose greater absolute amounts of weight,49 they tend to remain obese, and experience more co-morbidities, because they lose a smaller percentage of their excess weight compared to patients who were less obese initially.	marriage, and high socio-economic status, who are self-critical and cope in a direct and active way, are not too obese, were obese before the age of 18, suffer from and are concerned about their obesity, have realistic expectations and undisturbed eating behaviors. Occasionally, these variables may have poor or no predictive value. Conclusion: The existing literature about potential predictors of success after bariatric surgery is far from conclusive; it is still uncertain which factors can predict success. Even where psychosocial functioning does not predict outcome, it is important to identify patients' characteristics, which may be linked to their prognosis and to provide necessary pre- and postoperative psychosocial interventions.
Do psychosocial variables predict weight loss or mental health after obesity surgery? (Herpertz et al., 2004)	Gastric Banding, Gastroplasty and Gastric bypass	29 articles	+12	All controlled and non-controlled trials of the last 2 decades with either a retrospective or prospective design and a follow-up period of at least 1 year, identified by a search of computerized	For 12, BMI, 16.4	Positive predictors of weight loss: depressive and anxiety symptoms as correlates of psychological stress Negative predictor of weight loss: pre-surgical personality disorders and redevelopment of binge eating disorder after surgery Predictor of quality of life: apart

				databases (MEDLINE and PSYCHLIT). All articles published in English and German between 1980 and 2002 were reviewed. Exclusion: Studies that did not exactly indicate the diagnostic procedure or that had methodologic flaws such as high drop-out rates or the risk of considerable selection bias were excluded		from serious psychiatric disorders, psychiatric comorbidity seems to be of more predictive value for mental and physical well-being than for weight loss after surgery The majority of studies could not identify psychiatric comorbidity as a negative predictor for weight loss.

Note: ma represents mean age, dor represents drop out rate, EWL represents excess weight loss, BMI represents body mass index.
The table is a modified and updated table based on (Herpertz et al., 2004). Herpertz, S., Kielmann, R., Wolf, A. M., Hebebrand, J., & Senf, W. (2004). Do psychosocial variables predict weight loss or mental health after obesity surgery? A systematic review. Obes Res, 12(10), 1554-1569.

Appendix E: Health-Related Quality of Life Instruments

Type of health-related quality of life instrument	Uses	Examples (reference)
Generic (Health Profile)	• Applicable to any population • Assesses generic aspects of treatment outcome • Allows for comparisons across disorders, treatments, providers, health plans • May not be specific enough to measure change in a particular disease state • National norms have been developed for some (e.g. SF-36)	SF-36 Nottingham Health Profile Sickness Impact Profile
Disease-specific	• Items and domains reflect the characteristics and complaints most relevant to a particular disease • More sensitive to change in clinical trials than generic measures • Clinically sensible • Good face validity & relevance for patients • No cross condition comparisons	Weight reduction has been associated with improved quality of life on both the impact of weight on quality of life questionnaire (IWQOL) and the IWQOL-Lite
Preference-based	• Provides a single number index score representing net impact on quantity and quality of life • Allows for cost-utility analysis • Useful to study economic implications of an intervention • Incorporates death • May not be specific enough to measure change in a particular disease state	EuroQoL Health Utilities Index Quality of Well-Being Scale

Note. Source: (Kolotkin, Meter et al., 2001).

Appendix F: Procedure for Surgical Admission

When someone is considering bariatric surgery, a packet of information sheets is distributed. The contents of the packet include the following:

a. A welcome letter: The letter indicates that surgery should be the last resort for weight loss. Any potential candidate for choosing such approach ought to demonstrate significant medically supervised attempts to lose weight. "As you begin the process of considering surgery, be sure to start a supervised diet and exercise program with your primary care doctor and document monthly weight-ins. Absence of a documented consecutive 6 month medically supervised program can significantly delay your surgery." In this welcome letter, patients are also informed that before the first consultation with the MD, one must attend the orientation seminar and a minimum of two patient support groups in order to develop a realistic understanding of life after bariatric surgery.
b. How do I get a surgery date: time requirement for the whole process, what to expect and prepare for the first visit, where to call and so on.
c. Nutrition slide presentation
d. Facts on bariatric surgery: such as surgery details, post-surgical health outcome, surgical morality rate and so on.
e. Bariatric Surgery: Your Guidelines for Food Choices and Nutrition: After the surgery, diet is divided into 3 different stages. The diet progression is the following. During stage 1, only clear liquids are allowed. Patients are advised to avoid sweetened, caffeinated, carbonated, and alcoholic beverages, and to slip slowly and to stop drinking when feeling full. During stage 2, a puree diet is prescribed. During stage 3, candidates are advised to continue eating blended food, adding one new solid food at a time. In addition, eating diced meats, chewing slowly, prioritizing protein rich foods, gradually increasing meal size by 5 oz, and taking MVI are recommended.
   a. For Gastric bypass surgery, stage 1 will be clear liquids and protein supplement for 1 week. Stage 2 will be no concentrated sweets, low fat puree diet for 3 weeks. Stage 3 will be regular texture reduction diet. During stage 1, candidates are required to take daily multivitamin, calcium, and iron supplementation for the rest of his/her life.
   b. For lap-band surgery, the regime for the 3 stages is the same, but the duration varies. Stage 1, 2 will both be 2 weeks. During stage 1, candidates are required to take daily a multivitamin with minerals and it might be necessary to take additional calcium, iron, B1, B12 and folate supplementation for the rest of his/her life.
   c. Patient information form

f. New Patient History Questionnaire
g. Nutrition assessment form
h. How to make an appointment for the psychological evaluation: Candidates are advised to read an online brochure, which will help answer any questions regarding psychological evaluation for bariatric candidates. Once a candidate is ready to take the required tests (4 of them in total), he/she should call a number provided in the packet and then will receive a CODE, which will grant them access to their 4 tests. Once the 4 tests are completed, one can schedule an interview with the psychologist.
i. Lap Band Support Group Schedule
j. Gastric Bypass Support Group Schedule
k. Spanish Support Group Schedule
l. Sample Letter 1: A letter of support by your primary doctor to recommend that you should be receiving bariatric surgery.
m. Sample Letter 2: Another letter of support by your primary doctor to recommend that you should be receiving bariatric surgery.
n. Food Fitness First Flyer: A program that helps bariatric candidates to incorporate diet and lifestyle changes prior to surgery.
o. First Visit Checklist: To avoid any delays in meeting the Medical Doctor, the checklist includes the following as a reminder for potential candidates: your insurance card, a referral sheet if applicable (if no referral form, appointment will need to be rescheduled), co-payments if required, completed patient information sheet, completed new patient questionnaire, completed nutrition assessment form.
p. Research participation opportunities at St. Luke's-Roosevelt Hospital: This is where the parent study comes in. Candidates who attend their orientation will be asked to participate in the study. Those who are willing to participate will then be entered into a database for future contact. A packet of questionnaires, mentioned previously, will be administered to the patients three weeks prior the surgery and 1, 3, 6, 12 months after the surgery during follow-up-visits in the surgeon's office.
q. Resources

After the potential candidate reads all the information provided in the packet and decides to meet with an MD, he/she would need to make sure that he/she finishes what is required for the first visit as mentioned above. A telephone number is provided in the packet for candidates to make an appointment for the first visit. The time required for the entire process starting from orientation to the post-surgical follow-ups are the following:

a. Orientation seminar (4 hrs)
b. First office visit, including nutrition evaluation: have a private consultation with the surgeon/nurse practitioner and the dietitian. During this visit, the surgeon will determine if surgery is appropriate for the candidate. A second visit will be scheduled.
c. Pre-surgical tests, including a psychological evaluation
d. Minimum of two support groups (1 hr each)
e. Second visit (1hr)
f. Mandatory pre-surgical review session, including pre-testing (up to 4.5 hrs)
g. Two post-surgical nutrition classes
h. Regular follow-up visit with the physician

Once the candidate is ready for surgery, a packet of questionnaires for the parent study will be administered about three weeks before surgery, which collects basic personal information and evaluates their status of binge eating, depression, anxiety, eating pattern, compulsive behaviors, smoking, self-esteem, night-eating, quality of life, disordered eating behaviors, and body image.

Appendix G: ZSDS, LSAS-SR, and IWQOL-Lite

Scale 1: Zung Self-rating Depression Scale (ZSDS)

Please read each statement and decide how much of the time the statement describes how you have been feeling during the past several days.

Make check mark (✓) in appropriate column.	A little of the time	Some of the time	Good part of the time	Most of the time
1. I feel down-hearted and blue				
2. Morning is when I feel the best				
3. I have crying spells or feel like it				
4. I have trouble sleeping at night				
5. I eat as much as I used to				
6. I still enjoy sex				
7. I notice that I am losing weight				
8. I have trouble with constipation				
9. My heart beats faster than usual				
10. I get tired for no reason				
11. My mind is as clear as it used to be				
12. I find it easy to do the things I used to				
13. I am restless and can't keep still				
14. I feel hopeful about the future				
15. I am more irritable than usual				
16. I find it easy to make decisions				
17. I feel that I am useful and needed				
18. My life is pretty full				
19. I feel that others would be better off if I were dead				
20. I still enjoy the things I used to do				

Adapted from Zung, A self-rating depression scale, *Arch Gen Psychiatry*, 1965;12:63-70.

Scale 2: Liebowitz Social Anxiety Scale- Self Report version (LSAS-SR)

Fill out the following scale with the most suitable answer provided below.

Fear or Anxiety:

0 = None

1 = Mild

2 = Moderate

3 = Severe

	Fear or Anxiety
1. Telephoning in public. (P)	
2. Participating in small groups. (P)	
3. Eating in public places. (P)	
4. Drinking with others in public places. (P)	
5. Talking to people in authority. (S)	
6. Acting, performing or giving a talk in front of an audience. (P)	
7. Going to a party. (S)	
8. Working while being observed. (P)	
9. Writing while being observed. (P)	
10. Calling someone you don't know very well. (S)	
11. Talking with people you don't know very well. (S)	
12. Meeting strangers. (S)	
13. Urinating in a public bathroom. (P)	
14. Entering a room when others are already seated. (P)	
15. Being the center of attention. (S)	
16. Speaking up at a meeting. (P)	
17. Taking a test. (P)	
18. Expressing a disagreement or disapproval to people you don't know very well. (S)	
19. Looking at people you don't know very well in the eyes. (S)	
20. Giving a report to a group. (P)	
21. Trying to pick up someone. (P)	
22. Returning goods to a store. (S)	
23. Giving a party. (S)	
24. Resisting a high pressure salesperson. (S)	

Note. Source: Liebowitz MR. Social Phobia. Modern Problems of Pharmacopsychiatry 1987;22:141-173.

Scale 3: Quality of Life-Lite (IWQOL-Lite)

Please answer the following statements by circling the number that best applies to you in the past week. Be as open as possible. There are no right or wrong answers.

Physical Function		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I have trouble picking up objects.	5	4	3	2	1
2.	Because of my weight I have trouble tying my shoes.	5	4	3	2	1
3.	Because of my weight I have difficulty getting up from chairs.	5	4	3	2	1
4.	Because of my weight I have trouble using stairs.	5	4	3	2	1
5.	Because of my weight I have difficulty putting on or taking off my clothing.	5	4	3	2	1
6.	Because of my weight I have trouble with mobility.	5	4	3	2	1
7.	Because of my weight I have trouble crossing my legs.	5	4	3	2	1
8.	I feel short of breath with only mild exertion.	5	4	3	2	1
9.	I am troubled by painful or stiff joints.	5	4	3	2	1
10.	My ankles and lower legs are swollen at the end of the day.	5	4	3	2	1
11.	I am worried about my health.	5	4	3	2	1
Self-esteem		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I am self-conscious.	5	4	3	2	1
2.	Because of my weight my self-esteem is not what it could be.	5	4	3	2	1
3.	Because of my weight I feel unsure of myself.	5	4	3	2	1
4.	Because of my weight I don't like myself.	5	4	3	2	1
5.	Because of my weight I am afraid of being rejected.	5	4	3	2	1
6.	Because of my weight I avoid looking in mirrors or seeing myself in photographs.	5	4	3	2	1
7.	Because of my weight I am embarrassed to be seen in public places.	5	4	3	2	1

Sexual Life		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I do not enjoy sexual activity.	5	4	3	2	1
2.	Because of my weight I have little or no sexual desire.	5	4	3	2	1
3.	Because of my weight I have difficulty with sexual performance.	5	4	3	2	1
4.	Because of my weight I avoid sexual encounters whenever possible.	5	4	3	2	1

Public Distress		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I experience ridicule, teasing, or unwanted attention.	5	4	3	2	1
2.	Because of my weight I worry about fitting into seats in public places (e.g. theaters, restaurants, cars, or airplanes).	5	4	3	2	1
3.	Because of my weight I worry about fitting through aisles or turnstiles.	5	4	3	2	1
4.	Because of my weight I worry about finding chairs that are strong enough to hold my weight.	5	4	3	2	1
5.	Because of my weight I experience discrimination by others.	5	4	3	2	1
Work (Note: For homemakers and retirees, answer with respect to your daily activities.)		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I have trouble getting things accomplished or meeting my responsibilities.	5	4	3	2	1
2.	Because of my weight I am less productive than I could be.	5	4	3	2	1
3.	Because of my weight I don't receive appropriate raises, promotions or recognition at work.	5	4	3	2	1
4.	Because of my weight I am afraid to go on job interviews.	5	4	3	2	1

IWQOL-Lite – English (US).

Appendix H: Multi-Collinearity Testing

Coefficients

Dependent Variable: 1 Year Post-Surgical Depression	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	17.2	10.5		1.6	0.11		
Baseline BMI	-0.03	0.1	-0.022	-0.2	0.82	0.9	1.1
Type of Surgery	1.2	2.1	0.055	0.6	0.56	0.9	1.1
Age	.04	0.09	0.042	0.4	0.67	0.9	1.1
Gender	3.2	3.5	0.086	0.9	0.36	1.0	1.1
Race	0.7	1.1	0.061	0.6	0.53	0.9	1.1
Education	.00	1.0	0.000	0.00	1.0	0.9	1.2
Baseline Depression	0.3	0.1	0.260	2.4	0.02	0.7	1.5
Baseline Total Anxiety	0.3	0.08	0.387	3.3	0.001	0.6	1.7

Coefficients

Dependent Variable: 1 Year Post-Surgical Total Quality of Life	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	143.8	25.7		5.6	0.00		
Baseline BMI	-0.5	0.2	-0.2	-2.0	0.04	0.8	1.3
Type of Surgery	-16.0	3.9	-0.4	-4.1	0.00	0.9	1.1
Age	-0.4	0.2	-0.2	-2.2	0.03	0.8	1.2
Gender	4.3	6.2	0.06	0.7	0.5	0.9	1.1
Race	-3.8	1.8	-0.2	-2.1	0.04	0.9	1.1
Education	1.4	1.9	0.07	0.8	0.5	0.8	1.2
Baseline Depression	-0.1	0.2	-0.06	-0.5	0.6	0.6	1.7
Baseline Total Anxiety	-0.4	0.2	-0.3	-2.7	0.01	0.6	1.8
	0.1	0.1	0.1	1.0	0.3	0.5	2.0

Coefficients

Dependent Variable: 1 Year Post-Surgical	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Collinearity Statistics

Physical Function	B	Std. Error	Beta			Tolerance	VIF
(Constant)	139.7	26.9		5.2	0.00		
Baseline BMI	-0.5	0.3	-0.2	-1.8	0.07	0.8	1.3
Type of Surgery	-14.5	4.1	-0.3	-3.5	0.001	0.9	1.1
Age	-0.4	0.2	-0.2	-1.9	0.06	0.8	1.3
Gender	0.9	6.9	0.01	0.1	0.9	0.9	1.1
Race	-2.5	2.1	-0.1	-1.2	0.2	0.9	1.1
Education	2.4	2.1	0.1	1.2	0.2	0.9	1.2
Baseline Depression	-0.3	0.2	-0.2	-1.4	0.2	0.7	1.5
Baseline Total Anxiety	-0.03	0.2	-0.02	-0.2	0.9	0.6	1.7
Baseline Physical function	0.2	0.09	0.2	1.8	0.08	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical Self-esteem	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	122.2	31.3		3.9	0.00		
Baseline BMI	-0.3	0.3	-0.08	-0.9	0.4	0.9	1.1
Type of Surgery	-18.0	5.4	-0.3	-3.3	0.001	0.9	1.1
Age	-0.2	0.2	-0.07	-0.7	0.5	0.9	1.1
Gender	2.5	8.9	0.03	0.3	0.8	0.9	1.1
Race	-6.8	2.7	-0.2	-2.5	0.01	0.9	1.1
Education	-1.1	2.6	-0.04	-0.4	0.7	0.9	1.2
Baseline Depression	0.07	0.3	0.02	0.2	0.8	0.6	1.7
Baseline Total Anxiety	-0.4	0.2	-.02	-1.5	0.1	0.5	2.0
Baseline Self Esteem	0.3	0.1	0.3	2.7	0.01	0.5	2.1

Coefficients

Dependent Variable: 1 Year Post-Surgical Sexual Life	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF

	(Constant)	126.2	30.0		4.2	0.00		
	Baseline BMI	-0.2	0.3	-0.07	-0.6	0.5	0.9	1.2
	Type of Surgery	-6.4	5.5	-0.1	-1.2	0.3	0.9	1.1
	Age (QEWP1)	-0.5	0.2	-0.2	-2.2	0.03	0.9	1.1
	Gender (QEWP1)	7.5	9.2	0.08	0.8	0.4	0.9	1.1
	Race (QEWP1)	-2.5	2.7	-0.1	-1.0	0.3	0.9	1.1
	Education	-1.1	2.7	-0.05	-0.4	0.7	0.8	1.2
	Baseline Depression	0.03	0.3	0.01	0.1	0.9	0.6	1.6
	Baseline Total Anxiety	-0.6	0.2	-0.4	-3.0	0.004	0.6	1.7
	Baseline Sexual Life	0.1	0.09	0.2	1.6	0.1	0.6	1.5

Coefficients

Dependent Variable: 1 Year Post-Surgical Public Distress		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	144.5	28.9		5.0	0.00		
	Baseline BMI	-0.6	0.3	-0.2	-1.8	0.07	0.7	1.5
	Type of Surgery	-19.3	4.7	-0.4	-4.1	0.00	0.9	1.1
	Age	-0.2	0.2	-0.1	-1.3	0.2	0.9	1.2
	Gender	1.1	7.5	0.01	0.1	0.9	1.0	1.0
	Race	-3.0	2.3	-0.1	-1.3	0.2	0.9	1.1
	Education	-0.6	2.4	-0.02	-0.3	0.8	0.8	1.2
	Baseline Depression	0.04	0.3	0.02	0.1	0.9	0.6	1.5
	Baseline Total Anxiety	-0.3	0.2	-0.2	-1.7	0.1	0.5	1.9
	Baseline Public Distress	0.2	0.1	0.3	2.3	0.03	0.5	2.0

Coefficients

Dependent Variable: 1 Year Post-Surgical Work		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
	(Constant)	110.8	20.2		5.5	0.00		
	Baseline BMI	-0.2	0.2	-0.1	-1.2	0.2	0.8	1.3

Type of Surgery	-12.0	3.5	-0.4	-3.4	0.001	0.9	1.1
Age	-0.1	0.1	-0.1	-1.0	0.3	0.9	1.2
Gender	5.8	5.2	0.1	1.1	0.3	0.9	1.1
Race	-2.1	1.6	-0.1	-1.3	0.2	0.9	1.1
Education	4.3	1.7	0.3	2.6	0.01	0.8	1.2
Baseline Depression	-0.2	0.2	-0.06	-0.5	0.6	0.6	1.6
Baseline Total Anxiety	-0.2	0.1	-0.2	-1.9	0.06	0.6	1.7
Baseline work	0.05	0.07	0.09	0.7	0.5	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical Total Anxiety	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-3.8	12.5		-0.3	0.8		
Baseline BMI	0.03	0.1	0.02	0.2	0.8	0.9	1.1
Type of Surgery	3.4	2.5	0.1	1.4	0.2	0.9	1.1
Age	0.01	0.1	0.01	0.1	0.9	0.9	1.1
Gender	-4.5	4.1	-0.1	-1.1	0.3	1.0	1.0
Race	-0.2	1.3	-0.02	-0.2	0.9	0.9	1.1
Education	0.9	1.2	0.06	0.7	0.5	0.9	1.2
Baseline Depression	0.07	0.1	0.05	0.5	0.6	0.7	1.4
Baseline Total Anxiety	0.6	0.1	0.7	6.4	0.00	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical Performance Anxiety	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-1.0	7.3		-0.1	0.9		
Baseline BMI	0.07	0.08	0.08	0.9	0.4	0.9	1.1
Type of Surgery	1.6	1.5	0.09	1.1	0.3	0.9	1.1
Age	-0.02	0.06	-0.02	-0.3	0.8	0.9	1.1
Gender	-3.2	2.4	-0.1	-1.3	0.2	0.9	1.1
Race	-0.07	0.7	-0.01	-0.09	0.9	0.9	1.1
Education	0.08	0.7	0.01	0.1	0.9	0.9	1.2

Baseline Depression Scale	0.03	0.08	0.04	0.4	0.7	0.7	1.4
Baseline Performance Anxiety	0.7	0.1	0.6	6.2	0.0	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical Social Anxiety	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-3.5	5.9		-0.6	0.6		
Baseline BMI	-0.04	0.07	-0.05	-0.6	0.6	0.9	1.1
Type of Surgery	1.7	1.2	0.1	1.4	0.2	0.9	1.1
Age	0.03	0.05	0.06	0.7	0.5	0.9	1.1
Gender	-1.5	2.0	-0.07	-0.8	0.4	1.0	1.0
Race	-0.2	0.6	-0.02	-0.3	0.8	0.9	1.1
Education	0.8	0.6	0.1	1.4	0.2	0.9	1.2
Baseline Depression	0.06	0.07	0.08	0.8	0.4	0.7	1.4
Baseline Social Anxiety	0.6	0.09	0.7	6.4	0.0	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical % Weight Loss	Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
(Constant)		6.0	0.0		
Baseline BMI	0.07	0.9	0.3	0.9	1.1
Type of Surgery	-0.8	-11.3	0.0	0.9	1.1
Age (QEWP1)	-0.2	-2.3	0.02	0.9	1.1
Gender (QEWP1)	-0.02	-0.4	0.7	1.0	1.0
Race (QEWP1)	-0.1	-1.4	0.2	0.9	1.1
Education	0.06	0.9	0.4	0.9	1.1
Baseline Depression	0.02	0.3	0.8	0.7	1.4
Baseline Total Anxiety	0.06	0.7	0.5	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical % EWL	Standardized Coefficients			Collinearity Statistics	
	Beta	t	Sig.	Tolerance	VIF
(Constant)		8.7	0.0		
Baseline BMI	-0.2	-2.5	0.02	0.9	1.1
Type of Surgery	-0.8	-11.5	0.00	0.9	1.1
Age	-0.2	-2.5	0.01	0.9	1.1
Gender	-0.09	-1.3	0.2	1.0	1.0
Race	-0.1	-1.8	0.08	0.9	1.1
Education	0.06	0.8	0.4	0.9	1.1
Baseline Depression	0.00	-0.01	1.0	0.7	1.4
Baseline Anxiety	0.07	0.9	0.4	0.6	1.6

Coefficients

Dependent Variable: 1 Year Post-Surgical Weight Loss	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	78.9	32.0		2.5	0.02		
Baseline BMI	2.2	0.4	0.4	6.1	0.00	0.9	1.1
Type of Surgery	-60.3	6.4	-0.6	-9.4	0.00	0.9	1.1
Age	-0.6	0.3	-0.2	-2.4	0.02	0.9	1.1
Gender	-12.9	10.6	-0.08	-1.2	0.2	1.0	1.0
Race	-3.3	3.2	-0.07	-1.0	0.3	0.9	1.1
Education	2.3	3.1	0.05	0.7	0.5	0.9	1.1
Baseline Depression	0.2	0.4	0.04	0.5	0.6	0.7	1.4
Baseline Anxiety	0.3	0.2	0.09	1.1	0.3	0.6	1.6

Appendix I: GLM Univariate Results with the Following Independent Variables (Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Total Anxiety, and Type of Surgery)

Dependent Variable (Post-Surgical)	Predictor	F	*P*-Value	B	Std. Err	t
Depression	**N=87**					
	Age	0.3	0.61			
	Gender	0.4	0.52			
	Race	2.3	0.07			
	Education	1.8	0.16			
	Baseline BMI	0.8	0.38			
	Baseline Depression	8.4	**0.005***	0.3	0.1	2.0
	Baseline Total Anxiety	13.0	**0.001***	0.3	0.08	3.6
	Type of Surgery	0.03	0.87	-0.4	2.1	-0.2
Total Quality Of life	**N=75**					
	Baseline Quality of Life	0.8	0.37			
	Age	3.5	0.07			
	Gender	0.1	0.75			
	Race	1.6	0.18			
	Education	1.3	0.27			
	Baseline BMI	4.2	**0.046***	-0.5	0.2	-2.0
	Baseline Depression	0.2	0.67			
	Baseline Total Anxiety	8.6	**0.005***	-0.4	0.2	-2.0
	Type of Surgery	12.5	**0.001***			
	Bypass			14.4	4.1	3.5
	Banding			0		
Physical Function	**N=86**					
	Baseline Physical Function	3.7	0.06			

	Age	2.4	0.12			
	Gender	0.04	0.84			
	Race	0.6	0.66			
	Education	2.2	0.09			
	Baseline BMI	4.4	**0.04***	-0.6	0.3	-2.1
	Baseline Depression	1.1	0.30			
	Baseline Total Anxiety	0.1	0.75			
	Type of Surgery	11.2	**0.001***			
	Bypass		**0.001***	14.4	4.3	3.3
	Banding					
Self-Esteem	**N=86**					
	Baseline Self-Esteem	3.5	0.07			
	Age	0.6	0.44			
	Gender	0.08	0.77			
	Race	2.3	0.06			
	Education	0.6	0.63			
	Baseline BMI	1.0	0.31			
	Baseline Depression	0.006	0.94			
	Baseline Total Anxiety	3.5	0.07			
	Type of Surgery	9.5	**0.003***			
	Bypass			17.4	5.6	3.1
	Banding			0		
Sexual Life	**N=79**					
	Baseline Sexual Life	1.6	0.22			
	Age	5.3	**0.03***	-0.6	0.3	-2.3
	Gender	0.3	0.56			
	Race	1.9	0.12			
	Education	1.8	0.15			

	BMI	0.7	0.42			
	Baseline Depression	0.002	0.97			
	Baseline Total Anxiety	11.8	**0.001***	-0.7	0.2	-3.4
	Type of Surgery	0.9	0.35	5.2	5.5	0.9
Public Distress	**N=82**					
	Baseline Public Distress	4.6	**0.04***	.201	.094	2.135
	Age	2.0	0.17			
	Gender	<0.001	0.99			
	Race	1.4	0.23			
	Education	1.5	0.23			
	Baseline BMI	4.2	**0.04***	-0.6	0.3	-2.1
	Baseline Depression	0.03	0.86			
	Baseline Total Anxiety	4.4	**0.04***	-0.4	0.2	-2.1
	Type of Surgery	13.8	**<0.001***			
	Bypass			17.8	4.8	3.7
	Banding			0		
Work	**N=78**					
	Baseline Work	1.4	0.25			
	Age	0.5	0.49			
	Gender	0.8	0.39			
	Race	1.0	0.40			
	Education	3.4	**0.02**			
	Some high School		**0.004**	-18.1	6.1	-3.0
	High school graduate equivalent		0.77	-1.5	5.2	-0.3
	Some college/associate degree		0.11	-6.3	3.9	-1.6
	Completed College			0		
	Baseline BMI	1.5	0.23			

	Baseline Depression	0.1	0.74			
	Baseline Total Anxiety	4.3	**0.04***	-0.3	0.1	-2.1
	Type of Surgery	8.8	**0.004***			
	Bypass			10.7	3.6	3.0
	Banding			0		
Total Anxiety	**N=86**					
	Age	0.2	0.64			
	Gender	1.0	0.33			
	Race	0.5	0.72			
	Education	1.4	0.25			
	Baseline BMI	0.2	0.70			
	Baseline Depression	0.3	0.61			
	Baseline Total Anxiety	43.8	**<0.001***	0.6	0.1	6.6
	Type of Surgery	0.9	0.35	-2.4	2.6	-0.9
Performance Anxiety	**N=86**					
	Baseline Performance Anxiety	39.9	**<0.001***	0.7	0.1	6.2
	Age	0.02	0.89			
	Gender	1.2	0.28			
	Race	0.4	0.78			
	Education	1.1	0.36			
	Baseline BMI	1.0	0.32			
	Baseline Depression	0.2	0.68			
	Type of surgery	0.5	0.47	-1.1	1.5	-0.7
Performance Anxiety	**N=86**					
	Baseline Total Anxiety	37.4	**<0.001***	0.4	0.06	6.1
	Age	0.007	0.93			
	Gender	0.6	0.43			

	Race	0.8	0.51			
	Education	1.4	0.26			
	Baseline BMI	1.0	0.32			
	Baseline Depression	0.1	0.72			
	Type of Surgery	1.0	0.33	-1.5	1.5	-1.0
Social Anxiety	**N=86**					
	Baseline Total Anxiety	38.7	**<0.001***	0.3	0.05	6.2
	Age	11	0.30			
	Gender	1.0	0.31			
	Race	0.5	0.76			
	Education	1.5	0.22			
	Baseline BMI	0.1	0.72			
	Baseline Depression	0.4	0.53			
	Type of Surgery	0.5	0.51	-0.9	1.3	-0.7
Social Anxiety	**N=86**					
	Baseline Social Anxiety	42.9	**<0.001***	0.6	0.09	6.5
	Age	1.4	0.24			
	Gender	0.5	0.50			
	Race	0.6	0.64			
	Education	1.9	0.14			
	BMI	0.08	0.78			
	Baseline Depression	0.7	0.40			
	Type of Surgery	1.0	0.32	-1.2	1.2	-1.0
% Weight Loss	**N=87**					
	Age	3.1	0.08			
	Gender	0.04	0.84			
	Race	1.3	0.29			

	Education	1.9	0.13			
	Baseline BMI	0.8	0.38			
	Baseline Depression	0.2	0.67			
	Baseline Anxiety	0.9	0.34			
	Type of Surgery	126.3	**<0.001***			
	Bypass			22.6	0.02	11.2
	Banding			0		
% EWL	**N=87**					
	Age	4.0	**0.050***	-0.3	0.2	-2.0
	Gender	1.5	0.23			
	Race	1.4	0.25			
	Education	1.1	0.34			
	Baseline BMI	5.8	**0.02***	-0.5	0.2	-2.4
	Baseline Depression	0.02	0.89			
	Baseline Total Anxiety	1.1	0.29			
	Type of Surgery	124.8	**<0.001***			
	Bypass			40.3	3.6	11.2
	Banding			0		
Absolute Weight loss (kg)	**N=87**					
	Age	4.2	**0.04***	-0.3	0.1	-2.1
	Gender	0.8	0.38			
	Race	0.6	0.69			
	Education	2.0	0.12			
	Baseline BMI	33.6	**<0.001***	1.0	0.2	5.8
	Baseline Depression	0.3	0.59			
	Baseline Total Anxiety	1.8	0.19			
	Type of Surgery	87.7	**<0.001***			
	Bypass			28.4	3.0	9.4

	Banding			0		

Note. *$p < 0.05$.

Appendix J: GLM Univariate Results with the Following Independent Variables (Age, Gender, Race, Education, Baseline BMI, Weight Change, Baseline Depression, Baseline Total Anxiety, and Type of Surgery)

Dependent Variable (Post-Surgical)	Predictor	F	*P*-Value	B	Std. Err	t
Total Quality Of Life	**N=75**					
	Baseline Quality of Life	0.6	0.44			
	Age	1.9	0.17			
	Gender	0.07	0.80			
	Race	1.3	0.28			
	Education	2.0	0.13			
	Baseline BMI	8.4	**0.005***	-0.8	0.3	-2.9
	Weight Change (kg)	4.3	**0.04***	0.3	0.2	2.1
	Baseline Depression	0.2	0.622			
	Baseline Anxiety	11.3	**0.001***	-0.5	0.1	-3.4
	Type of Surgery	1.0	0.33			
Physical Function	**N=86**					
	Baseline Physical Function	2.6	0.11			
	Age	1.0	0.31			
	Gender	0.003	0.96			
	Race	0.3	0.87			
	Education	3.5	**0.02***			
	Some high School		**0.04***	-14.6	7.1	-2.1
	High school graduate equivalent		0.24	7.4	6.2	1.2
	Some college/associate degree		0.22	-6.0	4.8	-1.3
	Completed College			0		
	Baseline BMI	13.3	**< 0.001***	-1.1	0.3	-3.7
	Weight Change (kg)	10.2	**0.002***	0.5	0.2	3.2
	Baseline Depression	1.9	0.17			
	Baseline Anxiety	0.8	0.37			

	Type of Surgery	<0.001	0.98			
Self-Esteem	**N=86**					
	Baseline Self-Esteem	4.7	**0.03***	0.3	0.1	2.2
	Age	0.2	0.65			
	Gender	0.2	0.69			
	Race	2.1	0.09			
	Education	0.9	0.46			
	Baseline BMI	2.4	0.13			
	Weight Change (kg)	1.6	0.22			
	Baseline Depression	0.001	0.98			
	Baseline Anxiety	4.2	**0.04***	-0.5	0.2	-2.1
	Type of Surgery	1.4	0.25			
Sexual Life	**N=79**					
	Baseline Sexual Life	1.5	0.23			
	Age	4.2	**0.046***	-0.6	0.3	-2.0
	Gender	0.3	0.57			
	Race	1.9	0.12			
	Education	1.9	0.14			
	Baseline BMI	1.0	0.32			
	Weight Change (kg)	0.3	0.57			
	Baseline Depression	0.004	0.95			
	Baseline Anxiety	12.0	**0.001***	-0.7	0.2	-3.5
	Type of Surgery	0.04	0.85			
Public Distress	**N=82**					
	Baseline Public Distress	4.3	**0.04***	0.2	0.1	2.1
	Age	0.9	0.35			
	Gender	0.04	0.85			

	Race	1.4	0.25			
	Education	2.3	0.09			
	Baseline BMI	7.9	**0.007***	-1.0	0.4	-2.8
	Weight Change (kg)	3.7	0.06			
	Baseline Depression	0.003	0.96			
	Baseline Anxiety	5.7	**0.02***	-0.4	0.2	-2.4
	Type of Surgery	1.6	0.22			
Work	**N=78**					
	Baseline Work	1.3	0.26			
	Age	0.4	0.51			
	Gender	0.8	0.39			
	Race	1.0	0.42			
	Education	3.4	**0.02***			
	Some high School		**0.005**	-18.1	6.2	-2.9
	High school graduate equivalent		0.79	-1.4	5.4	-0.3
	Some college/associate degree		0.12	-6.3	3.9	-1.6
	Completed College			0		
	Baseline BMI	1.0	0.31			
	Weight Change (kg)	0.004	0.95			
	Baseline Depression	0.1	0.74			
	Baseline Anxiety	4.2	**0.045***	-0.3	0.1	-2.0
	Type of Surgery	4.3	**0.04***			
	Bypass			10.5	5.1	2.1
	Banding			0		
Depression	**N=87**					
	Age	0.3	0.59			
	Gender	0.4	0.51			
	Race	2.2	0.07			

	Education	1.7	0.17			
	Baseline BMI	0.7	0.4			
	Weight Change (kg)	0.05	0.83			
	Baseline Depression	8.1	**0.006***	0.3	0.1	2.9
	Baseline Anxiety	12.3	**0.001***	0.3	0.08	3.5
	Type of Surgery	0.08	0.78			
Total Anxiety	**N=86**					
	Age	0.2	0.63			
	Gender	0.9	0.35			
	Race	0.5	0.73			
	Education	1.2	0.31			
	Baseline BMI	0.06	0.80			
	Weight Change (kg)	0.02	0.90			
	Baseline Depression	0.3	0.62			
	Baseline Total Anxiety	41.9	**<0.001***	0.6	0.1	6.5
	Type of Surgery	0.5	0.47			
Performance Anxiety	**N=86**					
	Age	0.01	0.91			
	Gender	1.2	0.29			
	Race	0.4	0.79			
	Education	1.0	0.41			
	Baseline BMI	0.6	0.44			
	Weight Change (kg)	0.005	0.94			
	Baseline Depression	0.2	0.69			
	Baseline Performance Anxiety	37.4	**<0.001***	0.7	0.1	6.1
	Type of Surgery	0.3	0.59			
Social Anxiety	**N=86**					

	Age	1.5	0.23			
	Gender	0.4	0.52			
	Race	0.6	0.66			
	Education	1.6	0.19			
	Baseline BMI	0.1	0.72			
	Weight Change (kg)	0.05	0.82			
	Baseline Depression	0.7	0.41			
	Baseline Social Anxiety	40.9	**<0.001***	0.6	0.1	6.4
	Type of Surgery	0.7	0.40			

Note. *$p < 0.05$.

Appendix K: GLM Univariate Results with the Following Independent Variables (Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Performance Anxiety, and Type of Surgery)

Dependent Variable (Post-Surgical)	Predictor	F	*P*-Value	B	Std. Err	t
Depression	**N=87**					
	Age	0.02	0.88			
	Gender	0.4	0.55			
	Race	1.8	0.15			
	Education	1.8	0.16			
	Baseline BMI	0.3	0.59			
	Baseline Depression	11.0	**<0.001***	0.4	0.1	3.3
	Baseline Performance Anxiety	6.1	**0.02***	0.4	0.2	2.5
	Type of Surgery	0.03	0.86			
Total Quality Of life	**N=75**					
	Baseline Quality of Life	1.0	0.32			
	Age	2.9	0.09			
	Gender	0.2	0.65			
	Race	1.6	0.20			
	Education	1.2	0.33			
	Baseline BMI	4.5	**0.04***	-0.5	0.2	-2.2
	Baseline Depression	0.3	0.58			
	Baseline Performance Anxiety	5.8	**0.02***	-0.7	0.3	-2.4
	Type of Surgery	11.9	**0.001***			
	Bypass			14.4	4.2	3.5
	Banding			0		
Physical Function	**N=86**					
	Baseline Physical Function	4.1	**0.048***	0.2	0.09	2.0

	Age	2.1	0.15			
	Gender	0.06	0.81			
	Race	0.6	0.66			
	Education	2.2	0.10			
	Baseline BMI	4.8	**0.03***	-0.6	0.3	-2.2
	Baseline Depression	1.7	0.20			
	Baseline Performance Anxiety	0.05	8.2			
	Type of Surgery	11.5	**0.001***			
	Bypass			14.7	4.3	3.4
	Banding			0		
Self-Esteem	**N=86**					
	Baseline Self-Esteem	5.4	**0.02***	0.3	0.1	2.3
	Age	0.5	0.48			
	Gender	0.2	0.70			
	Race	2.3	0.07			
	Education	0.5	0.70			
	Baseline BMI	1.1	0.31			
	Baseline Depression	0.004	0.95			
	Baseline Performance Anxiety	3.5	0.07			
	Type of surgery	8.9	**0.004***			
	Bypass			16.9	5.7	3.0
	Banding			0		
Sexual Life	**N=79**					
	Baseline Sexual Life	1.9	0.17			
	Age	4.6	**0.04***	-0.6	0.3	-2.2
	Gender	0.6	0.44			
	Race	1.5	0.20			
	Education	1.6	0.20			

	BMI	0.8	0.37			
	Baseline Depression	0.006	0.94			
	Baseline Performance Anxiety	10.3	**0.002***	-1.2	0.4	-3.2
	Type of Surgery	0.8	0.38			
Public Distress	**N=82**					
	Baseline Public Distress	5.0	**0.03***	0.2	0.1	2.2
	Age	1.5	0.22			
	Gender	0.003	0.96			
	Race	1.3	0.26			
	Education	1.3	0.28			
	Baseline BMI	4.3	0.**04***	-0.7	0.3	-2.1
	Baseline Depression	0.004	0.95			
	Baseline Performance Anxiety	3.0	0.09			
	Type of Surgery	13.3	**0.001***			
	Bypass			17.8	4.9	3.7
	Banding			0		
Work	**N=78**					
	Baseline Work	1.7	0.19			
	Age	0.2	0.63			
	Gender	0.8	0.38			
	Race	1.0	0.44			
	Education	3.2	**0.03***			
	Some high School		0.005	-18.0	6.2	-2.9
	High school graduate equivalent		0.73	-1.8	5.3	-0.3
	Some college/associate degree		0.12	-6.2	4.0	-1.6
	Completed College			0		
	Baseline BMI	1.8	0.19			

	Baseline Depression	0.3	0.61			
	Baseline Performance Anxiety	2.2	0.14			
	Type of Surgery	8.6	**0.005***			
	Bypass			10.7	3.7	2.9
	Banding			0		
Total Anxiety	**N=86**					
	Age	.02	0.89			
	Gender	1.4	0.24			
	Race	0.3	0.89			
	Education	1.0	0.38			
	Baseline BMI	0.2	0.62			
	Baseline Depression	0.6	0.45			
	Baseline Performance Anxiety	36.7	**<0.001***	1.1	0.2	6.1
	Type of Surgery	0.5	0.50			
Performance Anxiety	**N=86**					
	Baseline Performance Anxiety	38.9	**<0.001***	0.7	0.1	6.2
	Age	0.02	0.89			
	Gender	1.2	0.28			
	Race	0.4	0.78			
	Education	1.1	0.36			
	Baseline BMI	1.0	0.32			
	Baseline Depression	0.2	0.68			
	Type of Surgery	0.5	0.47			
Social Anxiety	**N=86**					
	Baseline Performance Anxiety	25.6	**<0.001***	0.5	0.1	5.1
	Age	0.4	0.54			
	Gender	1.3	0.27			

	Race	0.5	0.75			
	Education	1.2	0.33			
	BMI	0.01	0.91			
	Baseline Depression	1.2	0.29			
	Type of surgery	0.2	0.62			
% Weight Loss	**N=87**					
	Age	3.3	0.07			
	Gender	0.07	0.80			
	Race	1.2	0.33			
	Education	1.9	0.13			
	Baseline BMI	0.8	0.39			
	Baseline Depression	0.2	0.69			
	Baseline Performance Anxiety	1.1	0.30			
	Type of Surgery	126.5	**<0.001***			
	Bypass			0.2	0.02	11.2
	Banding			0		
% EWL	**N=87**					
	Age	4.2	**0.04***	-0.3	0.2	-2.1
	Gender	1.6	0.21			
	Race	1.3	0.29			
	Education	1.1	0.34			
	Baseline BMI	5.8	**0.02***	-0.5	0.2	-2.4
	Baseline Depression	0.02	0.89			
	Baseline Performance Anxiety	1.1	0.29			
	Type of Surgery	124.5	**<0.001***			
	Bypass			40.4	3.6	11.2
	Banding			0		

Absolute Weight loss (kg)	**N=87**					
	Age	4.6	**0.04***	-0.3	0.1	-2.1
	Gender	0.9	0.36			
	Race	0.5	0.74			
	Education	1.9	0.13			
	Baseline BMI	34.0	**<0.001***	1.0	.2	5.8
	Baseline Depression	0.3	0.57			
	Baseline Performance Anxiety	1.7	0.20			
	Type of Surgery	87.7	**.000***			
	Bypass			28.5	3.0	9.4
	Banding			0		

Note. *$p < 0.05$.

Appendix L: GLM Univariate Results with the Following Independent Variables (Age, Gender, Race, Education, Baseline BMI, Baseline Depression, Baseline Social Anxiety, and Type of Surgery)

Dependent Variable (Post-Surgical)	Predictor	F	*P*-Value	B	Std. Err	t
Depression	**N=87**					
	Age	0.6	0.44			
	Gender	0.8	0.39			
	Race	3.1	**0.02***			
	Black		0.02	-13.9	6.0	-2.3
	Hispanic		0.04	-12.8	6.2	-2.1
	White		0.002	-20.5	6.3	-3.2
	Asian		0.04	-17.3	8.4	-2.1
	Other			0		
	Education	1.6	0.20			
	Baseline BMI	1.1	0.31			
	Baseline Depression	8.7	**0.004***	0.3	0.1	2.9
	Baseline Social Anxiety	20.2	**<0.001***	0.7	0.1	4.5
	Type of Surgery	.1	0.76			
Total Quality Of life	**N=75**					
	Baseline Quality of Life	1.1	0.29			
	Age	3.6	0.06			
	Gender	0.02	0.90			
	Race	1.7	0.17			
	Education	1.4	0.24			
	Baseline BMI	4.0	**0.049***	-0.5	0.2	-2.0
	Baseline Depression	0.2	0.63			
	Baseline Social Anxiety	10.0	**0.002***	-0.9	0.3	-3.2
	Type of Surgery	13.2	**0.001***			

	Bypass			14.6	4.0	3.6
	Banding			0		
Physical Function	**N=86**					
	Baseline Physical Function	3.3	0.07			
	Age	2.9	0.09			
	Gender	0.05	0.82			
	Race	0.6	0.69			
	Education	2.4	0.08			
	Baseline BMI	4.1	**0.045***	-0.5	0.3	-2.0
	Baseline Depression	0.8	0.38			
	Baseline Social Anxiety	0.7	0.40			
	Type of Surgery	11.3	**0.001***			
	Bypass			14.3	4.3	3.4
	Banding			0		
Self-Esteem	**N=86**					
	Baseline Self-Esteem	6.4	**0.01***	0.3	0.1	2.5
	Age	0.6	0.45			
	Gender	0.04	0.84			
	Race	2.3	0.06			
	Education	0.6	0.61			
	Baseline BMI	1.3	0.27			
	Baseline Depression	<0.001	1.0			
	Baseline Social Anxiety	2.8	0.10			
	Type of Surgery	10.2	**0.002***			
	Bypass			18.0	5.6	3.2
	Banding			0		
Sexual Life	**N=79**					

	Baseline Sexual Life	1.8	0.19			
	Age	5.1	**0.03***	-0.6	0.3	-2.3
	Gender	0.1	0.72			
	Race	2.2	0.08			
	Education	1.9	0.13			
	BMI	0.8	0.38			
	Baseline Depression	0.06	0.82			
	Baseline Social Anxiety	10.8	**0.002***	-1.3	0.4	-3.3
	Type of Surgery	1.1	0.29			
Public Distress	**N=82**					
	Baseline Public Distress	5.0	**0.03***	0.2	0.09	2.2
	Age	2.2	0.14			
	Gender	0.02	0.89			
	Race	1.6	0.20			
	Education	1.6	0.20			
	Baseline BMI	4.2	**0.045***	-0.6	0.3	-2.0
	Baseline Depression	0.02	0.90			
	Baseline Social Anxiety	5.0	**0.03***	-0.8	0.4	-2.2
	Type of Surgery	14.7	**<0.001***			
	Bypass			18.2	4.8	3.8
	Banding			0		
Work	**N=78**					
	Baseline Work	1.3	0.26			
	Age	0.7	0.40			
	Gender	0.6	0.44			
	Race	1.1	0.35			
	Education	3.6	**0.02***			
	Some high School		0.004	-17.8	6.0	-3.0

	High school graduate equivalent		0.85	-0.9	5.1	-0.2
	Some college/associate degree		0.09	-6.6	3.8	-1.7
	Completed College			0		
	Baseline BMI	1.4	0.24			
	Baseline Depression	0.1	0.74			
	Baseline Social Anxiety	6.3	**0.02***	-0.6	0.2	-2.5
	Type of Surgery	9.4	**0.003***			
	Bypass			10.9	3.6	3.1
	Banding			0		
Total Anxiety	**N=86**					
	Age	0.2	0.64			
	Gender	0.3	0.57			
	Race	0.8	0.51			
	Education	1.6	0.19			
	Baseline BMI	0.4	0.54			
	Baseline Depression	0.9	0.34			
	Baseline Social Anxiety	37.7	**<0.001***	1.2	0.2	6.1
	Type of Surgery	1.6	0.21	-3.4	2.7	-1.3
Performance Anxiety	**N=86**					
	Baseline Social Anxiety	26.3	**<0.001***	0.6	0.1	5.1
	Age	<0.001	1.0			
	Gender	0.2	0.69			
	Race	1.1	0.37			
	Education	1.5	0.23			
	Baseline BMI	1.6	0.21			
	Baseline Depression	0.9	0.35			
	Type of Surgery	1.6	0.21	-2.1	1.6	-1.3

Social Anxiety	**N=86**					
	Baseline Social Anxiety	42.9	**<0.001***	0.6	0.09	6.5
	Age	1.4	0.24			
	Gender	0.5	0.50			
	Race	0.6	0.64			
	Education	1.9	0.14			
	Baseline BMI	0.08	0.78			
	Baseline Depression	0.7	0.40			
	Type of Surgery	1.0	0.32	-1.2	1.2	-1.0
% Weight Loss	**N=87**					
	Age	3.2	0.08			
	Gender	0.02	0.89			
	Race	1.3	0.28			
	Education	1.9	0.14			
	Baseline BMI	0.9	0.35			
	Baseline Depression	0.3	0.56			
	Baseline Social Anxiety	0.6	0.45			
	Type of Surgery	125.5	**<0.001***			
	Bypass			0.2	0.02	11.2
	Banding			0		
% EWL	**N=87**					
	Age	3.9	**0.05***	-0.3	0.2	-2.0
	Gender	1.3	0.26			
	Race	1.4	0.23			
	Education	1.1	0.34			
	Baseline BMI	5.6	**0.02***	-0.5	0.2	-2.4
	Baseline Depression	0.07	0.80			
	Baseline Social Anxiety	0.9	0.35			

	Type of Surgery	124.1	**<0.001***			
	Bypass			40.1	3.6	11.1
	Banding			0		
Absolute Weight loss (kg)	**N=87**					
	Age	4.2	**0.045***	-0.3	0.1	-2.0
	Gender	0.6	0.43			
	Race	0.6	0.65			
	Education	2.0	0.12			
	Baseline BMI	34.5	**<0.001***	1.0	0.2	5.9
	Baseline Depression	0.5	0.50			
	Baseline Social Anxiety	1.5	0.22			
	Type of Surgery	86.8	**<0.001***			
	Bypass			28.2	3.0	9.3
	Banding			0		

Note. *$p < 0.05$.