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Preoperative Factors Associated with Weight Loss Following Bariatric Surgery

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PREOPERATIVE FACTORS ASSOCIATED WITH WEIGHT LOSS FOLLOWING BARIATRIC SURGERY

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DISSERTATION APPROVAL

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Abstract

Obesity is a major health issue in the United States. More than two thirds of the adult population is considered to be either overweight or obese. It is the fifth leading cause of mortality in the world, with 3.4 million deaths a year. Obesity is associated with numerous medical and psychological comorbidities. There are various types of treatments for obesity, such as diets, exercise and pharmacological agents; however, bariatric surgery is one of the most effective and proven treatments for morbidly obese patients. Although the bariatric surgery success rates are high, up to 30% percent of individuals do not achieve successful weight loss after surgery. The major predictors of weight loss success for bariatric surgery are often dependent on presurgical variables. This study investigated five preoperative variables associated with weight loss following bariatric surgery: overeating behaviors, cravings, social isolation, affect disturbance, and preoperative weight loss. No significant differences were found, but the results were congruent with previous findings that an individual's age and BMI were negatively correlated with successful postoperative weight loss. Recommendations for future studies are provided to explore the importance of preoperative factors in long-term success following bariatric surgery.

Chapter 1: Introduction

Statement of the Problem

In the United States, over the past 30 years, obesity among adults has substantially increased (Martin et al., 2010; Young et al., 2016). Around 1/3 of the adult population is considered to be either obese or morbidly obese (Flegal et al., 2016; Young et al., 2016). Obesity is defined as a body mass index (BMI) of 30 kg/m^2 or over (Bastien et al., 2014). Obesity is a major health issue that impacts every aspect of the health care system (Martin et al., 2010). Individuals with obesity are more at risk of developing other medical conditions, psychological disorders, hospitalizations, increase of outpatient visits, and mortality (Martin et al., 2010).

Obesity increases the risk of developing comorbidities, especially cardiovascular diseases (Apovian & Gokce, 2012). Individuals living with obesity are two times more likely to experience heart failure compared to individuals within the normal weight range (Bastien et al., 2014). Obesity can cause alterations in the cardiovascular structures and disturb the functioning of the inflammation system (Bastien et al., 2014). These disturbances of proper functioning can increase the development of other medical conditions such as sleep apnea, diabetes, gastroesophageal reflux disease, hypercholesterolemia, hypertension, gall bladder disease, and joint pain, among others (Bastien et al., 2014).

Research indicates that individuals with obesity are at a higher risk of developing psychological disorders and at a greater risk of mortality (Martin et al., 2010). Depression is prominent in individuals living with obesity with estimations that over 40% suffer from depression (Pratt & Brody, 2014). This population is also at a greater risk of developing anxiety and anxiety related symptoms (Gariepy et al., 2010). Obesity is a major contributing factor in the development of many of the medical and psychological conditions that have shown to increase the risk of mortality (Masters et al., 2013). From 1986 to 2006, estimates reveal that obesity accounted for 18% of all deaths among individuals from ages 40 to 85 years old (Masters et al., 2013). Obesity is one of the leading causes of death in the United States and around the world (Smith & Smith, 2016).

There are several treatment approaches for obesity, which include lifestyle modification, pharmacological agents, and bariatric surgery (Gloy et al., 2013). However, bariatric surgery, such as Roux-en-Y gastric bypass (RYGB) and laparoscopic sleeve gastrectomy (LSG), are the most effective and proven long-term treatments for patients who are morbidly obese (Peterli et al., 2013; Libeton et al., 2004). Bariatric surgery is a procedure that reduces the size of the stomach to a pouch, limiting the amount of food a person can consume (Colquitt et al., 2014; DiTomasso et al., 2009; Shah et al. 2016). Meta-analyses have shown that bariatric surgery patients tend to have greater overall weight loss compared to patients in non-surgical treatments (Gloy et al., 2013). Surgical patients have higher remission rates for type 2 diabetes and metabolic syndromes (Gloy et al., 2013). Surgical patients additionally experience greater improvements in their quality of life and have a greater reduction in the use of medications (Gloy et al., 2013). Bariatric surgery also improves their comorbidities such as heart disease, hypertension, hyperlipidemia, sleep apnea and debilitating joint disease (Martin et al., 2010).

Although bariatric surgery is very effective, the outcomes of surgery can vary greatly from patient to patient (Courcoulas et al., 2013;Van Hout et al., 2005). Much of the postsurgery outcomes appear to be associated on the preoperative factors (Hübner et al., 2015). Age can affect the amount of weight loss an individual can achieve (Contreras et al., 2013; Parri et al., 2015; Still et al., 2014). Some studies show that younger individuals who underwent bariatric surgery had better outcomes and lost more excessive body weight compared to individuals who were older in age (Contreras et al., 2013; Still et al., 2014).

Psychosocial factors also play a role in the amount of weight loss one can achieve after surgery (Kinzl et al., 2006). Affective disturbances, such as depression, anxiety or stress, can impair an individual's ability to lose weight (Kinzl et al., 2006). Some studies show that individuals that had affective disturbances lost significantly less weight compared to individuals who had no affective disturbances (Legenbauer et al., 2009; de Zwaanet al., 2011). Individuals with affective disturbances were also at a greater risk of relapsing on their diets and had increased risk of weight regain (Elfhag & Rössner, 2005). However, other studies show that affective disturbances are positive predictor of weight loss in bariatric surgery patients (Herpertz et al., 2004; Gerbrand et al., 2005). These studies found that individuals who had greater severity of affective disturbances had better long term weight loss maintenances and were at a lesser risk of postoperative weight regain (Herpertz et al., 2004; Odom et al., 2010).

Other studies demonstrated that increases in physical exercise before bariatric surgery improved the chances of having successful long-term weight loss and maintenance of weight loss long term compared to exercise started after surgery (Van Hout et al., 2005; Livhits et al, 2009). This preoperative weight loss helped ease patients into the postoperative lifestyle transition (Van Hout et al., 2005). However, some studies have found that preoperative weight loss does not influence the rate of postoperative weight loss (Mrad et al., 2008; Riess et al., 2008). Other studies demonstrated that preoperative weight loss had a negative association with postoperative weight loss (Limbach et al., 2014; Pekkarinen et al., 2016). A better understanding of preoperative weight loss and other factors is needed to better understand the impact on weight loss after bariatric surgery (Still et al., 2014).

Purpose of the Study

The main purpose of this study was to examine which preoperative factors are associated with excessive weight loss at 6 months postsurgery. Preoperative factors were (a) overeating behaviors (eating excessive amounts of food even after hunger is satisfied), including eating disorders, (b) craving (intense desire to eat a certain specific or type of food), (c) social isolation (lack of social interactions with others), (d) affective disturbance (mood issues, such as depression, anxiety and stress), and (e) amount of weight loss before bariatric surgery. The need to identify preoperative factors that relate to weight loss following surgery is important for practitioners to help patients lose the optimal weight for their body. Examining weight loss success at 6 months postsurgery could help identify early signs that a patient might be at risk of unsuccessful weight loss and contribute to the literature on early intervention.

Research Questions and Hypotheses

The research question is: What preoperative factors are associated with excessive weight loss at 6 months postsurgery? The preoperative predictor variables variables were: (a) overeating behaviors, (b) cravings, (c) social isolation, (d) affect disturbance, and (e) preoperative weight loss.

Hypothesis 1

The first hypothesis examined the relationships between eating scores before surgery and weight loss 6 months postsurgery. It was hypothesized that as overeating and craving T scores increased, the overall 6-month postsurgery excessive weight loss would decrease.

Hypothesis 2

The second hypotheses examined the relationship between psychosocial functioning and weight loss 6 months postsurgery. It was hypothesized that as affective disturbance and social isolation T scores increased, overall 6-month postsurgery excessive weight loss would decrease.

Hypothesis 3

The third hypotheses examined whether percentage of weight loss before surgery would predict the 6-month postsurgery excessive weight loss, after controlling for age, gender, and presurgical BMI. It was hypothesized that the more weight lost before surgery, the more 6-month postsurgery excessive weight loss there would be.

Chapter 2: Review of the Literature

Over the past 30 years, the rate of obesity among adults in the United States has more than doubled, from 15% to 35.7% (Young et al., 2016). Obesity is a major health issue in the United States with more than 2/3 of the adult population considered to be either overweight or obese (Afonso et al., 2010; Fung et al., 2016). Worldwide, more than 2.1 billion people who are overweight or obese and it is the fifth leading cause of death in the world with 3.4 million a year (Smith & Smith, 2016). Obesity has been on a steady incline in the United States and studies show that the rates will continue to grow (Colquitt et al., 2014; Kelly et al., 2008; Young et al., 2016). Obesity correlates with all causes of mortality and is associated with numerous medical and psychological conditions (Di Angelantonio et al., 2016).

Weight Measurements

The body mass index (BMI) is an anthropometric tool that measures and classifies individuals into different weight categories (Bastien et al., 2014). BMI is measured by the ratio of the total body weight over the individual's height squared (Bastien et al., 2014). The BMI <18.5 kg/m^2 is classified as being under weight, with BMI between 18.5 to 24.9 kg/m^2 is considered to normal or average weight (Bastien et al., 2014). BMI of 25-29.9 kg/m^2 is considered to be overweight and anything ≥ 30 kg/m^2 are considered obese (Bastien et al., 2014). Obesity is further divided into three categories; class I obesity is a BMI of 30-34.9 kg/m^2, class II obesity is a BMI of 35-39.9 kg/m^2 and class III obesity is BMI ≥ 40 kg/m^2, which is also known as morbidly obese (Bastien et al., 2014).

Weight loss is measured in a number of different ways, but two of the most common , are percentage of excessive weight loss (%EWL) and total weight loss (TWL;

Montero et al., 2011). Percentage of EWL is the most commonly used metric for measuring weight loss in patients, especially in bariatric surgery (Montero et al., 2011). Percentage of EWL is calculated by dividing the patient's weight loss by their ideal body weight (Montero et al., 2011). The ideal body weight is obtained from the Metropolitan Life Insurance Table (1983), which calculates ideal weight by gender, height, and frame (Montero et al., 2011). TWL is calculated by subtracting the initial weight by the current postoperative weight and dividing it by the initial weight (Montero et al., 2011). These two main measurements are frequently used in assessing weight loss progress in patients (Montero et al., 2011).

Comorbidities Associated With Obesity

Obesity is associated with several medical conditions and illnesses (Colquitt et al., 2014; Evangelista et al., 2017). It strongly correlated with cardiovascular diseases, sleep apnea, type 2 diabetes mellitus, gastroesophageal reflux disease, hypertension, hypercholesterolemia, gall bladder disease and joint pains (Bastien et al., 2014; Colquitt et al., 2014; Di Angelantonio et al., 2016; Evangelista et al., 2017; Fung et al., 2016; Master et al., 2016). Obesity is not only shown to affect an individual physically but also has a detrimental effect psychologically (Robinson et al., 2017). Individuals living with obesity are more at risk for developing psychological disorders such as depression, anxiety, and other forms of mental illnesses (Robinson et al., 2017). All these medical and psychological comorbidities are associated with an increased risk of mortality (Di Angelantonio et al., 2016).

Cardiovascular Diseases

One of the most prevalent comorbidities associated with obesity are cardiovascular diseases (Drager 2013; Evangelista et al., 2017). Cardiovascular diseases are conditions that affect the heart and its blood vessels (Bastien et al., 2014; Evangelista et al., 2017). Obesity affects the cardiovascular system both in a direct and indirect way (Evangelista et al., 2017). Obesity can affect the structure of the heart and its functions by increasing its volume of blood in the circulation (Evangelista et al., 2017). The increase of blood volume escalates cardiac output, left ventricular hypertrophy and left ventricular diastolic dysfunction, which all can potentially elevate the risk of cardiovascular diseases such as heart failure (Evangelista et al., 2017). An indirect way obesity affects the cardiovascular system is by causing metabolic changes such as endothelial dysfunction and subclinical inflammation, which elevate the risk factors that contribute to cardiovascular diseases (Bastien et al., 2014). Some studies show that cardiovascular disease along with abdominal obesity increases the risk of mortality by as much as 23% (Bastien et al., 2014). As obesity continues to rise in the United States, the rates of cardiovascular disease will escalate and cause an upsurge of other medical comorbidities (Bastien et al., 2014).

Sleep Apnea

Sleep apnea is a comorbidity that is strongly correlated with obesity (Drager et al., 2013). Between 50% and 60% of individuals with obesity have obstructive sleep apnea (Drager). Obstructive sleep apnea is a sleep disorder that causes breathing to stop intermittently while the individual is asleep due to airflow blockage (Drager et al., 2013). Obesity can cause enlargement of the soft tissue around and within the individuals' airway, which results in the narrowing of the pharyngeal airway (Drager et al., 2013).

The excessive fat mass around the abdominal area and recumbent posture can indirectly cause reduced lung volume (Drager et al., 2013). The reduced lung volume may induce a decrease in longitudinal tracheal traction and pharyngeal wall tension, which also contributes to narrowing the air pathways (Drager et al., 2013). The narrowing of the pathways causes the individual to stop breathing while they are asleep (Drager et al., 2013). Sleep apnea can create severe problems, such as increased the risk of cardiometabolic dysfunctions, nonalcoholic fatty liver disease, deregulation of sympathetic activity, endothelial dysfunction, hypertension, heart disease, and when left untreated, death (Drager et al., 2013).

Gastroesophageal Reflux Disease

Gastroesophageal reflux disease (GERD) is another disease that is strongly associated with obesity (Soricelli et al., 2013). The prevalence of GERD in individuals with obesity is significant, with a 70% diagnosis rate among those who undergo bariatric surgery (Soricelli et al., 2013). GERD is a digestive disorder that affects the lower esophageal sphincter, which can cause stomach content to flow back through the esophagus (Soricelli et al., 2013). Obesity affects the antireflux barrier by increased abdominal pressure causing delays in gastric emptying, which can result in the development of hiatal hernia (Soricelli et al., 2013). Hiatal hernia causes the stomach to push through the diaphragm muscle, which causes symptoms of heartburn (Chang & Friedenberg, 2014). GERD can induce severe physical pain to patients and when left untreated, it can increase the risk of esophageal cancer and in many cases even death (Chang & Friedenberg, 2014).

Type 2 Diabetes Mellitus

Obesity substantially increases the risk of developing type 2 diabetes (Carbonell et al., 2008). Diabetes mellitus is a disorder of the endocrine system that impairs the body's ability to produce or respond to insulin, which causes abnormal metabolism and elevated glucose levels within the blood stream (DiTomasso et al., 2009). Diabetes mellitus is divided into type 1 (insulin dependent) and type 2 (noninsulin dependent) diabetes (DiTomasso et al., 2009). Obesity elevates the risk of type 2 diabetes by two major factors; severity of the obesity and duration of the obesity (Tanamas et al., 2016). Individuals with higher BMIs are at significant risk of developing type 2 diabetes (Tanamas et al., 2016). Women who have a BMI over 35 kg/m^2 have 93 times more at risk of developing diabetes and men are 42 times more at risk when compared to people who have a BMI less than 23 kg/m^2 (Carbonell et al., 2008). The longer the individual has been obese, the chances increases for the risk of developing insulin resistance, which contributes to development of type 2 diabetes (Tanamas et al., 2016). Diabetes increases the risk of vision loss, amputation, cardiovascular diseases, atherosclerotic disease, end-stage renal disease and, when left untreated, death (Vijan, 2010).

Hypertension

Obesity is a significant risk factor in the development of hypertension in individuals (Kurukulasuriya et al., 2011). Hypertension, also known as high blood pressure is defined as having constant high level of systolic blood and diastolic blood pressure (DiTomasso et al., 2009; Kurukulasuriya et al., 2011). Obesity elevates the risk of hypertension by inducing higher levels of activation of renin-angiotensin-aldosterone system, increased sympathetic nervous system activity, insulin resistance, renal sodium reabsorption, volume expansion and impaired pressure natriuresis (Kurukulasuriya et al., 2011). Obesity can increase the chances of developing enlarged heart, narrowing of the arteries, aneurysm, heart failure, hemorrhagic stroke, and transient ischemic attack (Evangelista et al., 2017; DiTomasso et al., 2009; Kurukulasuriya et al., 2011). Obesity can also induce structural changes in the kidneys, as well as endothelial dysfunction and systemic inflammation and alterations in adipokines free fatty acids, which all contribute to the development of hypertension (Kurukulasuriya et al., 2011). When left untreated, hypertension can cause severe damaged to the body and can escalate the risk of mortality (Evangelista et al., 2017; DiTomasso et al., 2009; Kurukulasuriya et al., 2011).

Hypercholesterolemia

Hypercholesterolemia, also known as high cholesterol is defined as a condition where an individual has high levels of fat or lipids within the blood stream (DiTomasso et al., 2009; Rashid & Genest, 2007). Obesity has demonstrated to be a high risk factor for developing hypercholesterolemia (DiTomasso et al., 2009; Kurukulasuriya et al., 2011; Rashid & Genest, 2007). Obesity induces the body to increase levels lower density lipoprotein (LDL) and triglycerides in the blood circulation (Kurukulasuriya et al., 2011; Rashid & Genest, 2007). These increases in LDL in the blood stream can cause buildup of plaque around the artery walls which can reduce the blood flow and elevate the risk of heart attack and stroke (Rashid & Genest, 2007). Obesity can alter the degree and distribution of high-density lipoproteins (HDL) cholesterol in the body (Rashid & Genest, 2007). It overall reduces levels of HDL in the blood stream, which increases the risk of developing cardiovascular issues (Rashid & Genest, 2007). When left untreated, hypercholesterolemia can cause severe cardiovascular issues and even death (Rashid & Genest, 2007)

Gallbladder Disease

Obesity is strongly associated with gallbladder diseases such as gallstones and cholecystitis (Aune et al., 2015). Gallbladder disease is a condition that affects and interferes with the function of the gallbladder, which is an organ that stores bile that is used to help with the digestion system (Aune et al., 2015). Individuals with obesity are up to five times more at risk of developing gallbladder disease when compared to individuals within normal weight range (Aune et al., 2015). Obesity increases abdominal fatness, which is strongly associated with the insulin resistance and one of the major risk factor for developing gallbladder diseases (Aune et al., 2015). A gallbladder disease often requires surgery for treatment and when left untreated, there is a high risk for infection, tearing of the gallbladder and even the death of tissues of the gallbladder (Aune et al., 2015).

Joint Pain

Obesity has a negative impact the human musculoskeletal system (Zdziarski et al.,, 2015). Obesity can increase mechanical stress on the tissue of the body, joints and induces limitation on physical movements (Zdziarski et al., 2015). Excessive amount of mechanical stress can cause pain and discomfort (Zdziarski et al., 2015). Most of the joint pain symptoms are attributed to axial and load-bearing segments of the body such has back, legs and feet (Zdziarski et al., 2015). The symptom of pain not only limits the functionality of the body but it cause decline in fitness and affect the individual's quality of life (Zdziarski et al., 2015). Obesity substantially elevates the risk of developing arthritis and can increase the risk receiving joint replacement surgery (Zdziarski et al., 2015).

Depression

Obesity has been strongly correlated with depression (Robinson et al., 2017). Studies have demonstrated that obesity has a bidirectional relationship with depression, in which obesity increases the risk developing depression and depression increases the risk of obesity (Pratt & Brody, 2014; Robinson et al., 2017). It is estimated that 43% of people living with obesity have depression (Pratt & Brody, 2014). The risk of depression elevate by 55% over time for individuals with obesity (Luppino et al., 2010). Obese individuals also tend to have higher severity of depression with symptoms ranging from moderate to severe (Pratt & Brody, 2014). Obesity also might have some biological links to depression (Luppino et al., 2010). Obesity increases the levels of inflammatory state in the body and depression has been associated with inflammation, which could be the link that connects both these conditions (Luppino et al., 2010). Another biological association with obesity and depression is the role of hypothalamic-pituitary-adrenal axis (HPA axis; Luppino et al., 2010). Obesity can induces dysregulation with HPA axis, which has been shown to be strongly associated with depression (Luppino et al., 2010). Depression can elevate the risk of other psychological issues such as anxiety, stress and increase the risk of mortality in individuals (Atlantis & Baker, 2008).

Stress

Obesity impacts the levels of stress in the human body (Lasikiewicz et al., 2013). Individuals with obesity that have excessive amount of abdominal fat, also known as central obesity, have higher rates of adipose tissues which has been associated with glucocorticoid excess (Lasikiewicz et al., 2013). Excess of glucocorticoid can lead to elevated cortisol response in the body, which is the stress hormone (Lasikiewicz et al., 2013). The elevated level of cortical response can produce imbalance in cortisol basal diurnal rhythm, which causes impairments on how individuals react to psychological stress (Lasikiewicz et al., 2013). The imbalance of cortisol can also cause the body to become prone to developing stress related illness and disease such as high blood pressure, heart disease and other cardiovascular issues (Lasikiewicz et al., 2013).

Anxiety

Obesity is strongly associated with anxiety (Gariepy et al., 2010). People with anxiety are 30% more likely to be obese (Gariepy et al., 2010). Obesity can cause anxiety disorders in numerous ways (Gariepy et al., 2010). Studies show that obese individuals tend to experience more weight-related discrimination and have fewer social supports compared to individuals within normal weight (Gariepy et al., 2010). The experience of weight discrimination could cause obese individuals to have anti-fat biases and this can increase psychological distress towards their self-image (Gariepy et al., 2010). Another way obesity can cause anxiety disorder is through environmental and biological factors (Gariepy et al., 2010; Lasikiewicz et al., 2013). Biologically, both obesity and anxiety are heritable diseases and they may share similar genetic basis (Gariepy et al., 2010; Lasikiewicz et al., 2013). Obesity and anxiety are also both associated with environmental endocrine-disruption chemicals (Gariepy et al., 2010). Anxiety can elevate the risk of developing stress related illness, cardiovascular diseases and psychological distress (Gariepy et al., 2010; Lasikiewicz et al., 2013; Suls & Bunde, 2005). Alhough there are numerous treatments for anxiety, research shows that obesity-related comorbidities tend to dissipate once obesity is treated (Colquitt et al., 2014).

Treatments for Obesity

There are several different types of treatments for obesity (Collins et al., 2016). The three major treatment options for individuals with obesity include lifestyle modification (exercise/diets programs), pharmacological treatment and lastly bariatric surgery (Collins et al., 2016; Mann et al., 2007; Yanovski & Yanovski, 2014).

Lifestyle Modification

The most common type of treatment for obesity is lifestyle modification such has dieting (Mann et al., 2007). Research has shown that calorie-restricting diets have not been effective treatments for people with obesity (Mann et al., 2007). Diet studies have found that most weight loss programs help participant's loss an average of 5-10% of their weight (Mann et al., 2007). This loss of weight is often not maintained long term and as many as 2/3 of the individuals tend to regain more weight than they lost while they were on the diets (Mann et al., 2007). About 90% of individuals with obesity will regain all their weight after just dieting (Livingston et al. 2002). Diet alone is not effective at reducing significant weight especially in morbidly obese individuals (Mann et al., 2007).

Another type of lifestyle modification treatment for obesity is exercise (Collins et al., 2016; Johns et al., 2014). Exercise only treatment to be not that effective for individuals with obesity (Johns et al., 2014). One study indicated that that exercise only group lost on average 2.9 kg within the first year but during the second year, those individuals eventually regain majority of the weight back (Skender et al., 1996). In another study, exercise only produced minimal weight loss with an average weight 1.8 to

2.7kg (Villareal et al., 2011). Exercise-only produced overall lower weight loss for individuals with obesity than other types of treatment, but this group tended to have better weight maintenance than diet-only groups (Skender et al., 1996; Villareal et al., 2011).

Pharmacological Treatment

Research is limited on meaningful pharmacological treatment for obesity (Yanovski & Yanovski, 2014), Yanovski and Yanovski (2014) conducted a systematic and clinical review for long-term drug treatments for obesity and found that patients taking most Food and Drug Administration (FDA) approved drug treatments lost an average of 3% percent more than those taking placebo. The newer classes of weight loss drugs, such as orlistat, lorcaserin, and phentermine plus topiramate-extended, help patients lose an average of 9% of their initial weight (Yanovski & Yanovski, 2014). However, any meaningful weight loss (over 5% of initial weight) was seen in only 40% to 70% of people who took new classes of drugs (Yanovski & Yanovski, 2014). The FDA recommends discontinuing specific weight loss drugs if an individuals do not experience at least 3% to 5% weight loss within a 12-week period (Yanovski & Yanovski, 2014). This type of treatment is not often recommended by physicians due to safety concerns of the side effects, costs, and the perception of limited efficiency (Yanovski & Yanovski, 2014). There is limited scientific literature on drug treatments for obesity (Yanovski & Yanovski, 2014). The research that is currently out there often has data that has shorter intervention periods to assess for successful weight loss, has inadequate descriptions on their methodology that is used and have a biased approach in explaining missing data (Yanovski & Yanovski, 2014). Studies show that drug treatments for obesity are not as effective as surgical interventions (Yanovski & Yanovski, 2014).

Surgical Intervention

Bariatric surgery is found to be one of the most effective and proven weight loss treatment methods for morbidly obese patients (Libeton et al., 2004). Surgical treatment patients had greater weight loss outcomes and reduction to weight related comorbidities then any non-surgical interventions (Colquitt et al., 2014). Research demonstrates an average reduction of 50%-80% of excess body weight in patients and significantly reduces the risk of mortality in morbidly obese individuals (Afonso et al., 2010; Fox et al., 2015). Bariatric surgery resolves major medical comorbidities such as hypertension, type 2 diabetes mellitus, metabolic syndromes, cardiovascular diseases, obstructive sleep apnea, hypercholesterolemia and GERD in majority of morbidly obese patients (Athyros et al., 2011).

There are three main types of bariatric surgery that are performed in United States: Roux-en-Y gastric bypass (RYGB), laparoscopic sleeve gastrectomy (LSG), and laparoscopic adjustable gastric band (LAGB; Campos et al. 2008; DiTomasso et al., 2009; Shah et al. 2016). The most common bariatric procedure performed is RYGB, which has been shown to considerably reduce weight and weight-related comorbidities (Sillén & Andersson, 2017). The RYGB procedure consists of making the stomach smaller by creating a pouch and connecting the stomach pouch to the middle section of the small intestine (Colquitt et al., 2014; DiTomasso et al., 2009; Shah et al. 2016). This allows the food to bypasses majority of the stomach and small intestines, which helps restrict the food intake by increasing harmonies such as GLP-1 (DiTomasso et al., 2009).

RYGB is one of the most effective treatments for GERD in individuals living with obesity (Soricelli et al., 2013). It also reduces acid production and esophageal refluxate due to the small gastric pouch created by the RYGB procedure (Soricelli et al., 2013). RYGB is highly effective and it has shown to resolving many of the weight-related medical comorbidities (Sillén & Andersson, 2017).

Laparoscopic sleeve gastrectomy (LSG) is a procedure that has been on the rise in the United States and as many as one out of every three bariatric surgery performed is LSG (Coblijn et al., 2013; Nguyen et al., 2013). LSG is a procedure that consists of permanently removing up to 75% of the stomach, leaving a sleeve-sized stomach that helps reduce the intake of food (Zellmer et al., 2014). The major advantages of LSG are that it tends to be easier to perform, requires shorter operative time, is less invasive, and has a lower risk of leakage (Zellmer et al., 2014). Individuals tend to have comparable weight loss to RYGB procedure and there is no risk of internal hernias or marginal ulcers (Zellmer et al., 2014). It is also very effective in reducing weight related medical comorbidities (Zellmer et al., 2014).

Laparoscopic adjustable gastric band (LAGB) is another procedure that is less common in the United States (Colquitt et al., 2014). LAGB is a procedure that consists of placing a band around the top region of the stomach, which allows the stomach to constrict to a smaller pouch (Colquitt et al., 2014; DiTomasso et al., 2009). The LAGB is adjustable and this restricts the intake of large quantity food consumption (Colquitt et al., 2014; DiTomasso et al., 2009). This procedure has become less common in the United States (Coblijn et al., 2013) because of band-related complications, such as band slippage, band dilation, pouch dilation, esophageal dilatation, food intolerance, and gastric necrosis ,which are reported in 15% to 58% of all patients (Coblijn et al., 2013). Patients who underwent LAGB tended to have inadequate amount of weight loss and, in many cases, would regain some of their weight (Coblijn et al., 2013).

Predictors of Successful Long-Term Weight Loss

As bariatric surgery rates rise, there has been an emphasis at looking at successful predictors of weight loss (Courcoulas et al., 2013; Robinson et al., 2014; Still et al., 2014; Wood et al., 2016). Though the rates of bariatric surgery success are high, up to 30% percent of individuals do not achieve successful weight loss and in some cases, individuals regain all their weight back (Courcoulas et al., 2013; Budak & Thomas, 2009; Robinson et al., 2014). Successful bariatric surgery is measured by ≥ 50% EWL within 1 to 2 years postsurgery (Courcoulas et al., 2013; Robinson et al., 2014). Often one of the major predictors of weight loss success is presurgical variables (Robinson et al., 2014; Still et al., 2014; Wood et al., 2016).

Overeating

Overeating behavior is defined as eating and excessive amount of food, even after hunger is satisfied (O’Donnell & Warren, 2004). Overeating behaviors, which include eating disorders, have been viewed as one of the causes of excessive weight gain in obese individuals (O’Donnell & Warren, 2004; Robinson et al., 2014). However, results are mixed regarding preoperative predictors of weight loss following bariatric surgery (White et al., 2010). Some studies have shown that individuals who had overeating behaviors such as binge eating episodes before getting bariatric surgery had less weight loss within the first 6 months than individuals who did not have any overeating behaviors (Crowley et al., 2011). Research indicates that individuals with preoperative binge eating behavior had significantly lower overall weight loss in both one and two years follow-ups after surgery compared to individuals with no overeating behaviors (Chao et al., 2016).

However, other studies indicate that preoperative overeating behaviors are unrelated to postoperative weight loss (Ramona et al., 2005; White et al., 2010). Patients who overate preoperatively had similar weight loss to patients who did not have any overeating episodes or behaviors (Ramona et al., 2005; White et al., 2010). The cause of obesity in many of the bariatric population is due to overeating behaviors and that those patients often change their eating habits after getting the surgery (White et al., 2010). Surgery helps reduce the overeating behavior in patients by decreasing the stomach size and causing a restriction of food intake (White et al., 2010).

Though there is conflicting research on overeating behaviors being a beneficial preoperative factor; studies do show that postoperative weight gain is often associated with overeating behaviors after surgery (Colles et al., 2008). Individuals who had overeating behaviors before surgery were most at risk for redeveloping those behaviors postoperative (Colles et al., 2008). Long-term postoperative weight loss maintenance is often dependent on the patients eating behaviors and research has shown that individuals who had higher severity of preoperative overeating behaviors were at risk at relapsing on their diets (Colles et al., 2008).

Craving

Research has shown that one of the most important factors that contribute to postoperative weight regain is the result of having strong urges of food cravings (Odom et al., 2010). Craving is defined as an intense desire to eat a certain types or specific foods (Budak & Thomas, 2009; O’Donnell & Warren, 2004; Rogers & Smit, 2000).

Individuals who had higher levels of craving also had higher preoperative BMI (Sudan et al., 2017). Postoperative weight loss maintenance is often depended on an individual's control over food craving (Odom et al., 2010). Bariatric surgery has shown to reduce cravings and consumption of food within the first couple of months after surgery but it does not decrease food cravings to normative levels (Leahey et al., 2012). In some cases, the craving levels and consumption of foods significantly increases, often returning to preoperative levels (Leahey et al., 2012). Individuals who had sweet cravings preoperatively, saw an increase in their craving after 3 months postoperatively (Leahey et al., 2012). Also, bariatric surgery did not reduce any level of cravings when it came to high fat food (Leahey et al., 2012). Individuals who had higher levels of craving along with guilt actually lost less weight 6 months postoperatively than individuals with lower levels of cravings (Crowley et al., 2012). Individuals who had greater reduction of sweets and craving for sweets actually had greater %EWL within the first 3 months of surgery (Leahey et al., 2012). Food craving have been associated with negative weight loss factors such as non-compliance with dietary restrictions and weight loss programs and increase in snacking (Crowley et al. 2012; Sudan et al., 2017).

Social Isolation

Social isolation negatively impacts the amount of weight an individual can lose (Elfhag & Rössner, 2005). Social isolation is defined as lack of social interaction with other people (O'Donnell & Warren, 2004). In a weight loss study, individuals who attended weight loss programs alone lost significantly less weight compared to individuals who had social support (Wing & Jeffery, 1999). These individuals also had higher dropout rates and significantly lower weight loss maintenance compared to individual who had three or more social support members such as friends and family (Wing & Jeffery, 1999). Bariatric patients who lacked social support tended to have higher postoperative psychological complication (Herpertz et al., 2004). Lack of social support also increased the risk of weight relapse in patients (Elfhag & Rössner, 2005). Inadequate social support negatively impacts the amount of weight an individual can lose and it can negatively impact the experience of losing weight (Sharman et al., 2017).

On the contrary, meta-analyses have shown that social supports such as family members or support groups are a beneficial factor when it comes to aiding and maintaining weight loss (Livhits et al., 2011; Wedin et al., 2014). A patient being married increases the odds for achieving successful weight loss by as much as 7 times (Wedin et al., 2014). Patients who attended support groups after bariatric surgery were associated with great postoperative weight loss (Livhits et al., 2011). Sharman et al. (2017) study found that the need for social support was much higher within the first year bariatric surgery especially for psychological support. Social support also helps individuals cope with the lifestyle changes and stressors they might face after surgery (Livhits et al., 2011). Overall, social support is an important factor in the success of bariatric surgery (Livhits et al., 2011; Wedin et al., 2014; Wing & Jeffery, 1999).

Affective Disturbance

Research shows that affective disturbances have an impact on weight loss (Elfhag & Rössner, 2005; Gariepy et al., 2010; Lasikiewicz et al., 2013; Pratt & Brody, 2014). Affective disturbances are defined as mood issues, such as depression, anxiety, and stress (O’Donnell & Warren, 2004). Affective disturbances are common among individuals who are obese (Elfhag & Rössner, 2005; Gariepy et al., 2010; Lasikiewicz et al., 2013;

Pratt & Brody, 2014). Affective disturbances are negatively associated with long-term weight loss maintenances (Elfhag & Rössner, 2005). Studies indicate that bariatric surgery patients who had either depression and/or anxiety lost significantly less weight compared to individuals who had no affective disturbances (Legenbauer et al., 2009; de Zwaanet al., 2011). Stress is viewed as a risk factor for weight regain especially in individuals who had a history maladaptive overeating behaviors (Elfhag & Rössner, 2005). The higher severity of stress an individual has, the higher the risk of them relapsing on their diet (Elfhag & Rössner, 2005).

However, other studies report that affective disturbances as a positive predictor of weight loss in bariatric surgery patients (Herpertz et al., 2004; Gerbrand et al., 2005).

Higher levels of preoperative affective disturbances have been viewed as a positive factor in long-term weight loss maintenance (Herpertz et al., 2004; Odom et al., 2010). Odom et al. (2010) study found that patients with higher scores on the Beck Depression Inventory were associated with lesser risk of significant postoperative weight regain. Herpertz et al. (2004) study on the other hand found that higher levels of preoperative stress actually positively predicted weight loss at postoperative follow-ups (Herpertz et al., 2004). However, postoperative affective disturbances have shown to negatively affect the rate of weight loss in patients (Legenbauer et al., 2009). Individuals who had preoperative affective disturbances were at a higher risk of redeveloping postoperative affective disturbances and elevated risk of not achieving successful weight loss (Legenbaue et al., 2009; de Zwaanet al., 2011).

Preoperative weight loss

Research is relatively inconclusive regarding the benefits of preoperative weight loss as being a predictor of postoperative weight loss success (Livhit et al., 2012). Prior to getting surgery, patients are often recommended to lose an average of 5-10% of their weight as part of the requirement to getting surgery, though often times patient do not lose much weight or any weight at all (Ali et al., 2007). The main purpose of losing that percentage of weight is to help reduce any complications during surgery (Ali et al., 2007). Patients who lost more than 5% of their preoperative weight had significantly shorter surgery time compared to patients who did not lose any preoperative weight (Alvarado et al., 2005). Patient with preoperative weight loss had greater weight loss 1 year postsurgery (Alvarado et al., 2005). Some meta-analyses have shown that individuals who lost at least 10% of their excessive body weight before their bariatric surgery were two times more likely losing 70% of their excessive body weight postsurgery (Wimmelmann et al.,, 2014).

However, some research studies indicate that preoperative weight loss does not affect the amount of weight a patient can lose postoperatively (Lavhits et al., 2012). Those studies found no correction between preoperative weight loss and postoperative weight loss (Lavhits et al., 2012). Kadeli et al. (2012) research found that preoperative weight loss did not have any influence in the rate of weight loss and that individuals lost the same percentage of initial body weight no matter what weight they started with.

Other studies found preoperative weight loss as a negative association with postoperative weight loss (Limbach et al., 2014; Pekkarinen et al., 2016). In those studies, patients who lost a large percentage of preoperative weight lost less weight than predicted in the first two years after surgery (Limbach et al. 2014; Pekkarinen et al., 2016). Though research literature has been mixed about the benefits of preoperative weight loss as a predictor of postoperative weight loss success, current literature agrees the safety benefit of losing weight before surgery (Ali et al., 2007; Alvarado et al., 2005; Livhit et al., 2012).

Chapter 3: Method

This secondary analysis examined the relationship between preoperative factors and postoperative weight loss in 144 patients who underwent bariatric surgery from January 2012 – June 2019. The primary outcome criterion was excessive weight loss 6 months postsurgery. Preoperative factors evaluated were overeating, craving, social isolation, affect disturbance, and preoperative weight loss. This study controlled for age, gender/sex, surgical BMI, and type of surgery.

Participants

Subjects were patients who underwent Bariatric Surgery at a medical center in New York City. The medical center provided the archival data of 144 bariatric surgery patients. Demographic information extracted consisted of age, gender/sex, employment status, education level, and clinical parameters, such as medical and psychiatric history.

Inclusion Criteria

The subjects were individuals who, at the time of surgery, were at least 18 years of age and had at least a fourth-grade reading level. All subjects also needed to have passed the presurgical evaluation and have a valid Overeating Questionnaire in order to receive bariatric surgery. The subjects had to have followed up with their medical appointments for least 6 months plus or minus 1 month postsurgery in order to be included in the data set.

Exclusion Criteria

Those individuals below 18 years of age, who had less than a fourth-grade reading level, were not deemed appropriate for surgery per the presurgical screening evaluation, or who did not follow up for their medical appointments for at least 6 months plus or minus 1 month postsurgery were excluded from the study.

Measures

The de-identified data were extracted from medical charts, evaluation reports, and self-report questionnaires.

Demographics

The following data were collected: patient age, weight and BMI at the time of the surgery, 6-month postoperative weight (plus or minus one month), total weight loss (TWL), type of bariatric surgery, gender/sex, and psychiatric and medical comorbidities.

Percentage of Excessive Weight Loss (%EWL) is a metric for measuring weight loss in patients. It's calculated by dividing the patient's weight loss by their ideal body weight. The ideal body weight is obtained from the Metropolitan Life Insurance Table (1983), which calculates the patient's ideal weight by their gender, height, and frame (Montero et al., 2011). The %EWL was calculated by the physician and collected from the medical charts.

Overeating Questionnaire

The Overeating Questionnaire (OQ) is an 80-item self-report questionnaire that measures key habits, thoughts, and attitudes related to obesity (O'Donnell & Warren, 2004; Lent & Swencionis, 2012). It takes 20 minutes to complete and is written at a fourth-grade reading level. It was normed on a nationally represented sample of 1,788 individuals ages 9 to 98. The internal consistency median of the OQ is estimated to be .82 and its test-retest reliability to be a median of .88.

Overeating is measured by eight questions that assess an individual's continued eating even after the need of hunger is satisfied. The internal consistency is .80, with a test-retest reliability of .64. A low T score (≤ 40) indicates an individual's behavioral resources will help them maintain a healthy body weight. It can also indicate that an individual is not fully aware of their overeating habits. A high T score (≥ 60) indicates that an individual has overeating behaviors and is aware of it. A very high score (≥70) indicates that an individual has severe overeating behaviors.

Craving is measured by six questions that assess an individual's desire to consume certain types of foods. The internal consistency is .82, with a test-retest reliability of .93. A low T score (≤ 40) indicates an individual may be relatively invulnerable to having any desire for food. A high T score (≥ 60) indicates a high desire for specific types of food. A very high score (≥70) indicates a strong desire for specific types of food.

Affective disturbance is measured by eight questions that assess the presence of depression, anxiety, and stress. The internal consistency is .87, with a test-retest reliability of .89. A low T score (≤ 40) indicates relatively no emotional turmoil.. A high T score (≥ 60) indicates emotional disturbances and that the individual's coping resources are occupied with problems other than diet and weight. A very high score (≥70) indicates severe emotional disturbances.

Social isolation is measured by eight questions that assess lack of social resources and interactions with other people. The internal consistency is .87 with a test-retest reliability of .88. A low T score (≤ 40) indicates an individual likely has social resources and a network of people they could enlist in weight loss maintenance efforts. A high T score (≥ 60) indicates a lack of social resources and interactions with others. A very high score (≥70) indicates a severe lack of social resources and interactions with others.

Procedures

Existing data were analyzed from participants in a larger study. The present study received an Institutional Review Board exempt determination prior to data collection and analysis. Presurgical and postsurgical data were extracted from the larger study’s data set. All of the data collected was already de-identified and was in Excel format. No protected health information was included in the data set. The data were screened for inclusion and exclusion criteria, then were entered into this study's database. All de-identified data were entered into both an Excel spreadsheet and SPSS.

Chapter 4: Results

Statistical Analysis

Statistical analyses were conducted to examine whether overeating behaviors, craving, social isolation, affective disturbance, and preoperative weight loss are predictive of postsurgery excessive weight loss at 6 months postsurgery. The variables of interest were analyzed using SPSS 24.0. The power analysis was for a multiple regression with five predictors. In this analysis, the effect size was set at 0.15, which is considered a medium effect size for a multiple regression (Cohen, 1988, 1992), the significance level was set at 0.05, and the power level was set at 0.80, which is for the conventional standards (Cohen 1988, 1992). This determined that 114 subjects were needed to perform the multiple regression analysis for this study.

Demographics and Clinical Characteristics of Study Participants

The 144 subjects consisted of 106 females and 38 males, with a mean age of 42 and an age range of 19 to 66. The mean height of the sample was 65 inches, with a range from 57 to 77 inches. The weight of the sample ranged from 192 pounds to 478 pounds, with a mean BMI of 46 and an BMI range of 35.2 to 72.6. Participants self-identified as 2.8% Asian or Pacific Islander, 20.1% Black or African American, 20.1% Hispanic, and 57% White or Caucasian. Demographic and physical characteristics and are shown in Tables 1, 2, 3, and 4.

Table 1

Gender of Subjects

Gender	*n*	%
Female	106	73.6
Male	38	26.4
Total	144	100.0

Table 2

Race/Ethnicity of Subjects

Race/Ethnicity	*n*	%
Asian/ Pacific Islander	4	2.8
Black/ African American	29	20.1
Hispanic	29	20.1
White/Caucasian	82	57.0
Total	144	100.0

Table 3

Baseline Characteristics of Subjects

Baseline characteristic	Minimum	Maximum	Mean
Age	19	66	42.62
Height in inches	57.0	77.0	65.4
Weight in pounds	192.0	478.0	283.37
Body mass index	35.2	72.6	46.46

Table 4

Comorbidities of Subjects at Baseline

Comorbidity	*n*	%
Sleep apnea	87	60.4
Type 1 diabetes	6	4.2
Type 2 diabetes	19	13.2
Gastric reflux	45	27.8
Hypertension	55	38.2
Heart disease	7	4.9
Hypercholesterolemia	41	28.5
Gall bladder disease	7	4.9
Joint pain	37	25.7
Leg, back, foot pain	58	40.3
Difficulty walking	13	9.0
Difficulty bending	24	16.7

Three different types of bariatric surgeries were performed: 62.5% laparoscopic sleeve gastrectomy, 32.6% laparoscopic Roux-en-Y gastric bypass, and 4.9% laparoscopic adjustable gastric banding. The types of surgery for the sample are shown in table 5.

Table 5

Bariatric Surgical Procedures

Type of Procedure	*n*	%
Laparoscopic Roux-en-Y gastric bypass	47	32.6
Laparoscopic sleeve gastrectomy	90	62.5
Laparoscopic adjustable gastric banding	7	4.9
Total	144	100.0

The findings indicated that 33% of the sample gained weight since the time of their preoperative psychological evaluation to the date of surgery, 21% remained weight stable, and 46% lost weight before their bariatric surgery, with a mean of 0.43% weight loss. The total weight loss 6 months postsurgery was widely distributed, from 13 pounds to 120 pounds loss, with individual weights ranging from 146.1 to 360.6 pounds 6 months postsurgery. The excess weight loss percentage 6 months postsurgery mean was 49%, with the range from 13% to 88%. The analysis indicated a valid sample of 140. The descriptive statistics are in table 6.

Table 6

Weight Loss and Overeating Scale Scores

	n	Minimum	Maximum	Mean	*SD*
Percentage of weight loss before surgery	144	-8.50	12.50	0.43	3.09
Overeating score	144	31	77	51.96	9.98
Craving score	144	32	76	49.54	9.53
Social isolation score	144	34	80	49.30	10.19
Affective disturbance score	144	34	79	47.34	9.03
Weight 6 months postsurgery in pounds	144	146.10	360.60	210.93	41.51
Body mass index 6 months postsurgery	144	24.8	53.1	34.56	5.49
Total weight loss in pounds	144	13.00	120.00	70.75	20.46
Percentage of excess weight loss 6 months postsurgery	140	15.0	88.0	49.45	13.91
Valid *n* (listwise)	140				

The T scores for overeating, craving, social isolation, and affect disturbance were elevated, as shown in Tables 7, 8, 9 and 10.

Table 7

Overeating T Score Increase

Overeating T score increase		*n*	Valid %	Cumulative %
Valid	.00	114	79.2	79.2
	1.00	30	20.8	100.0
	Total	144	100.0	

Table 8

Craving T Score Increase

Craving T score increase		*n*	Valid %	Cumulative %
Valid	.00	121	84.0	84.0
	1.00	23	16.0	100.0
	Total	144	100.0	

Table 9

Social Isolation T Score Increase

Social Isolation T score increase		*n*	Valid %	Cumulative %
Valid	.00	123	85.4	85.4
	1.00	21	14.6	100.0
	Total	144	100.0	

Table 10

Affective Disturbance T Score Increase

Affective Disturbance T score increase		*n*	Valid %	Cumulative %
Valid	.00	132	91.7	91.7
	1.00	12	8.3	100.0
	Total	144	100.0	

Hypothesis 1

To examine the relationship between eating scores (measured by overeating score and craving score) before surgery and 6-month postsurgical excessive weight loss, a hierarchical linear regression was conducted. The data were reviewed to ensure they met all assumptions (Field 2009; Osborne & Waters, 2002). The assumptions were analyzed through a visual examination of the data plots, as well as for skewness and kurtosis of the variables (Field 2009; Osborne & Waters, 2002). The test for assumptions and multiple linear regression were met to conduct the analysis. An examination of the tolerance statistic and the variable inflation factors indicated that there was no problem with multicollinearity. The Durbin-Watson statistic test was conducted to assess for correlation between residuals and it varies between 0 and 4, with a value of 2 indicating no correlation (Field, 2009). The Durbin-Watson statistic was equal to 2.088 indicating that there is no correlation between the residuals (Field, 2009). Hierarchical linear regression at the first level, model 1 included age, race, surgical BMI, and type of surgery. Hierarchical regression at the second level, in model 2 added overeating score and craving score after having controlled for others. The results of the hierarchical linear regression analysis, demonstrated a multiple correlation of $R = 0.156$ with a coefficient of determination of .024 ($R^2 = 0.24$), which is not significant, as shown in Table 11. Results indicated no significant ANOVA as shown in Table 13. The analysis of the coefficients, as shown in Table 14, showed that the overeating score and craving score did not make a significant contribution to the 6-month postsurgical excessive weight loss.

Table 11

Model 1 and 2 Summary for Weight Loss and Overeating and Craving Scores

Model	R	R^2	Adjusted R^2	*SE* of Estimate	R^2 Change	*F* Change	*df*1	*df*2	Significance *F* Change
1	.137[a]	.019	-.012	.03118	.019	.621	4	129	.648
2	.156[b]	.024	-.022	.03134	.005	.353	2	127	.703

[a]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery)

[b]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery), overeating score, craving score

[c]Dependent variable: % excess weight loss 6 months postsurgery

Table 12

Analyses of Variance for Weight Loss and Overeating and Craving Scores

Model		*SS*	*MS*	*Mean Square*	*F*	*p*
1	Regression	.002	4	.001	.621	.648[b]
	Residual	.125	129	.001		
	Total	.128	133			
2	Regression	.003	6	.001	.528	.786[c]
	Residual	.125	127	.001		
	Total	.128	133			

[a]Dependent variable: % excess weight loss 6 months postsurgery

[b]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery)

[c]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery), overeating score, craving score

Table 13

Predictor Variable Coefficients for Weight Loss and Overeating and Craving Scores

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	*SE*	β	*t*	*p*	Tolerance	VIF
1	(Constant)	.070	.027		2.587	.011		
	Race	.003	.006	.052	.591	.556	.987	1.013
	Age	.000	.000	.112	1.271	.206	.971	1.030
	Body mass index (at surgery)	9.801E-5	.000	.020	.228	.820	.958	1.044
	Type of surgery	-.004	.006	-.059	-.669	.505	.970	1.031
2	(Constant)	.080	.032		2.470	.015		
	Race	.003	.006	.053	.597	.552	.981	1.019
	Age	.000	.000	.102	1.130	.261	.948	1.055
	Body mass index (at surgery)	8.638E-5	.000	.018	.199	.843	.949	1.054
	Type of surgery	-.005	.006	-.070	-.773	.441	.926	1.080
	Overeating score	.000	.000	.045	.406	.685	.635	1.574
	Craving score	.000	.000	-.092	-.836	.405	.630	1.588

Note. VIF = Variation Inflation Factor

Hypothesis 2

To examine the relationship between the psychosocial scores (measured by the affective disturbance and social isolation scores) before surgery and 6-month postsurgery excessive weight loss, a hierarchical linear regression analysis was conducted. The test for assumptions and a hierarchical linear regression were met to conduct the analysis. The Durbin-Watson statistic for the present analysis was equal to 2.079 indicated that there is no correlation between the residuals (Field, 2009). Hierarchical linear regression at the first level, model 1 included for factors of age, race, surgical BMI, and type of surgery. Hierarchical linear regression at the second level, model 2 added the affective disturbance score and social isolation score, after controlling for the previous predictors. The results of the hierarchical linear regression analysis demonstrated a multiple correlation of R = 0.150 with a coefficient of determination of .023 (R^2 = 0.23), which is not significant, as shown in Table 14. An examination of the tolerance statistic and the variable inflation factors indicated that there was no problem with multicollinearity. ANOVA results indicated no significance, as shown in Table 15. The analysis of coefficients, as shown in table 16, revealed that the affective disturbance and social isolation scores did not make a significant contribution to the 6-month postsurgery excessive weight loss.

Table 14

Model 1 and 2 Summary for Weight Loss and Affective Disturbance and Social Isolation Scores

Model	R	R^2	Adjusted R^2	*SE of* Estimate	R^2 Change	F Change	*df*1	*df*2	Significance F Change
1	.137[a]	.019	-.012	.03118	.019	.621	4	129	.648
2	.150[b]	.023	-.024	.03137	.004	.231	2	127	.794

[a]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery)

[b]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery), affective disturbance score, social isolation score

[c]Dependent variable: % excess weight loss 6 months postsurgery

Table 15

Analyses of Variance for Weight Loss and Affective Disturbance and Social Isolation Scores

Model		*SS*	*MS*	*Mean Square*	*F*	*p*
1	Regression	.002	4	.001	.621	.648[b]
	Residual	.125	129	.001		
	Total	.128	133			
2	Regression	.003	6	.001	.486	.818[c]
	Residual	.125	127	.001		
	Total	.128	133			

[a]Dependent variable: % excess weight loss 6 months postsurgery

[b]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery)

[c]Predictors: (Constant), type of surgery, age, race, body mass index (at surgery), affective disturbance score, social isolation score

Table 16

Predictor Variable Coefficients for Weight Loss and Affective Disturbance and Social Isolation Scores

Note. VIF = Variance Inflation Factor

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	*SE*	β	*t*	*p*	Tolerance	VIF
1	(Constant)	.070	.027		2.587	.011		
	Race	.003	.006	.052	.591	.556	.987	1.013
	Age	.000	.000	.112	1.271	.206	.971	1.030
	Body mass index (at surgery)	9.801E-5	.000	.020	.228	.820	.958	1.044
	Type of surgery	-.004	.006	-.059	-.669	.505	.970	1.031
2	(Constant)	.059	.032		1.866	.064		
	Race	.003	.006	.051	.579	.564	.979	1.022
	Age	.000	.000	.115	1.294	.198	.969	1.032
	Body mass index (at surgery)	7.645E-5	.000	.016	.176	.860	.952	1.051
	Type of surgery	-.003	.006	-.047	-.516	.606	.932	1.073
	Affective disturbance score	.000	.000	.057	.544	.587	.689	1.452
	Social isolation score	.000	.000	.007	.065	.949	.708	1.412

Hypothesis 3

To examine the relationship between percentage of weight loss before surgery and 6-month postsurgery excessive weight loss, a hierarchical linear regression analysis was conducted. The test for assumptions and hierarchical linear regression were met to conduct the analysis. The Durbin-Watson statistic was equal to 2.08, indicating that there is no correlation between the residuals (Field, 2009). Hierarchical linear regression at the first level model 1, controlling for BMI before surgery, age, affective disturbance score, social isolation score, overeating score, craving score, and percentage of weight loss. The results of the hierarchical linear regression analysis demonstrated a multiple correlation of R = 0.402 with a coefficient of determination of .162 (R^2 = 0.162), as shown in Table 17. An examination of the tolerance statistic and the variable inflation factors indicated that there was no difficulty with multicollinearity. The overall ANOVA for the regression was significant for model 1, F(7,139) = 3.645, p = .001), as shown Table 18. The analysis of the beta coefficients, as shown in Table 19, revealed that the age and BMI before surgery were negatively correlated with the percentage of excessive weight loss 6 months after bariatric surgery. In model 2, percentage of weight loss before surgery was added. The results of the hierarchical linear regression analysis, demonstrated a multiple correlation of R = 0.404 with a coefficient of determination of .163 (R^2 = 0.163). An examination of the tolerance statistic and the variable inflation factors indicated that there was no difficulty with multicollinearity. The overall ANOVA for the regression was significant for model 2, F(8,139) = 3.193, p = .002). The analysis of the beta coefficients revealed that once again the age and BMI before surgery were negatively correlated to the percentage of excessive weight loss 6 months after bariatric surgery. The percentage of weight loss before was not associated with excessive weight loss 6 months after bariatric surgery.

Table 17

Model Summary 1 and 2 for Weight Loss Before Surgery and 6-Month Postsurgery Excessive Weight Loss

Model	*R*	R^2	Adjusted R^2	*SE* of Estimate
1	.402[a]	.162	.118	13.03107
2	.404[b]	.163	.112	13.10902

[a]Predictors: (Constant), social isolation score, body mass index (before surgery), gender, age, overeating score, craving score, affective disturbance score

[b]Predictors: (Constant), social isolation score, body mass index (before surgery), gender, age, overeating score, craving score, affective disturbance score, percentage of weight loss before surgery

[c]Dependent variable: % excess weight loss 6 months postsurgery

Table 18

Analyses of Variance for Weight Loss Before Surgery and 6-Month Postsurgery Excessive Weight Loss

Model		*SS*	*MS*	*Mean Square*	*F*	*p*
1	Regression	4357.831	7	622.547	3.645	.001[b]
	Residual	22542.118	132	170.774		
	Total	26899.949	139			
2	Regression	4388.076	8	548.510	3.192	.002[c]
	Residual	22511.872	131	171.846		
	Total	26899.949	139			

[a]Dependent Variable: % excess weight loss 6 months postsurgery

[b]Predictors: (Constant), social isolation, body mass index (before surgery), % excess weight loss 6 months postsurgery, gender, age, overeating score, craving score, affective disturbance score

[c]Predictors: (Constant), social isolation, body mass index (before surgery), % excess weight loss 6 months postsurgery, gender, age, overeating score, craving score, affective disturbance score, percentage of weight loss before surgery

Table 19

Predictor Variable Coefficients for Age, Body Mass Index, Weight Loss Before Surgery, and 6-Month Postsurgery Excessive Weight Loss

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	*SE*	β	*t*	*p*	Tolerance	VIF
1	(Constant)	86.814	9.539		9.101	.000		
	Gender	3.177	2.544	.102	1.249	.214	.953	1.049
	Age	-.220	.109	-.166	-2.025	.045	.948	1.055
	Body mass index (before surgery)	-.637	.167	-.309	.3.803	.000	.965	1.037
	Craving score	.364	3.677	.010	.099	.921	.657	1.521
2	Overeating score	2.934	3.240	.087	.905	.367	.690	1.449
	Affective disturbance score	-8.591	4.475	-.167	-1.920	.057	.841	1.188
	Social isolation score	5.021	3.437	.129	1.461	.146	.810	1.235
	(Constant)	.86.577	9.586		9.031	.000		
	Gender	3.183	2.552	.102	1.247	.215	.953	1.049
	Age	-.228	.111	-.172	-2.061	.041	.919	1.088
	Body mass index (before surgery)	-.652	.172	-.316	-3.791	.000	.919	1.089
	Craving score	.180	3.714	.005	.048	.961	.648	1.543
	Overeating score	.2.943	3.250	.087	.905	.367	.690	1.449
	Affective disturbance score	-8.241	4.565	-.160	-1.805	.073	.813	1.229
	Social isolation score	4.882	3.646	.126	1.409	.161	.802	1.246
	Percentage weight loss before surgery	15.907	37.916	.036	.420	.676	.884	1.132

Note. VIF = Variance Inflation Factor

Chapter 5: Discussion

Interpretation and Implications

As annual rates of obesity continue to increase in most demographic groups, the need for bariatric surgery has also risen in the United States (Colquitt et al., 2014; Young, 2016). Though bariatric surgery is one of the most effective weight loss treatment methods, up to 30% of patients do not achieve successful postoperative weight loss (Robinson et al., 2014). It is important to be aware of factors that are both positively and negatively associated with weight loss so that it can help physicians set up appropriate plans for patients before undergoing their bariatric surgery (Sarwer et al., 2008). For example, one factor associated with postoperative success is support (Robinson et al., 2014). Research has shown that setting up support groups postsurgery for individuals who had difficulties losing preoperative weight were twice as more likely of having successful weight loss (Robinson et al., 2014). The importance of being aware of what factors will hinder successful weight loss will help physicians development a better overall treatment plan for those patients who might be highly vulnerable to not losing any postoperative weight.

The current study examined five potential variables for successful weight loss based on the prior literature in an effort to increase overall successful rate in postoperative weight loss in individuals receiving the bariatric surgery. The five variables were: (a) overeating behaviors, (b) craving, (c) social isolation, (d) affective disturbance, and (e) preoperative weight loss. Each variable was examined with percentage of excessive weight loss at 6 months after bariatric surgery.

The present study found no significant relationship between any of the variables such as overeating behaviors, cravings, social isolation, affective disturbance, and preoperative weight loss to 6 months after bariatric surgery weight loss. However, the results corroborate with previous studies that demonstrated that an individual’s age and BMI were negatively correlated to a successful postoperative weight loss (Contreras et al., 2013; Courcoulas et al., 2013; Robinson et al., 2014; Still et al., 2014; Wood et al., 2016). These finding demonstrated that the older the age of the individuals going through bariatric surgery, the less weight loss they achieved. Similarly, the higher the BMI an individual had before the bariatric surgery, the less weight loss they achieved. There are multiple factors as to why this might be. Previous literature demonstrates that having faster recovery time, greater presence of sarcopenia (age related loss of skeletal muscle mass and strength) and more mobility all increase an individual’s likelihood to participate in physical exercise (Contreras et al., 2013). Though previous literature highlighted both age and BMI being main preoperative factors, it is still important data to help clinicians to emphasize that the importance of not prolonging the bariatric surgery for individuals who are fit candidates for it (Contreras et al., 2013; Courcoulas et al., 2013; Robinson et al., 2014; Still et al., 2014; Wood et al., 2016).

Although most research studies have indicated that preoperative eating behaviors are one of factors that relates to postoperative weight loss success, the present study did not account for the behavioral/physiological changes postsurgery (Robinson et al., 2014; Still et al., 2014; Wood et al., 2016). An example could be an individual might have overeating behaviors or cravings prior to bariatric surgery but at postsurgery, their eating patterns are likely to change due to reduction of the actual stomach size, causing a restriction of food intake. The actual recovery period after the bariatric surgery also accounts for the behavioral changes. The recovery period can take up to several weeks, during which time individuals are placed on liquid diets to promote stomach healing after the surgery. This can prevents that individual from consuming foods that they might be craving such as high caloric foods, fatty foods or sugary foods. (White et al., 2010). These factors can prevent individuals from engaging in these overeating behaviors, which might explain the insignificance finding of the overeating and craving variable in the study.

Previous studies have demonstrated that psychological issues, such as affective disturbances and social isolation, to be preoperative factors that may have influences on postoperative weight loss (Elfhag & Rössner, 2005; Gariepy et al., 2010; Livhits et al., 2011; Lasikiewicz et al., 2013; Pratt & Brody, 2014). However, the current study did not find them to be significant predictor to excessive weight loss 6 months after bariatric surgery. Those previous studies that found affective disturbances and social isolation to be significant factors indicated continued high levels of psychological issues after bariatric surgery (Elfhag & Rössner, 2005; Gariepy et al., 2010; Livhits et al., 2011; Lasikiewicz et al., 2013; Pratt & Brody, 2014). Research has shown that affective disturbances and social isolation are common among individuals who are obese and it is often attributed to their excessive weight (Elfhag & Rössner, 2005; Gariepy et al., 2010; Livhits et al., 2011; Lasikiewicz et al., 2013; Pratt & Brody, 2014). As weight starts to decrease, affect disturbances and social isolation behaviors related to excessive weight are likely to decrease, which may explain the nonsignificant findings for the social isolation and affective disturbances variables in this study (Elfhag & Rössner, 2005; Gariepy et al., 2010; Livhits et al., 2011; Lasikiewicz et al., 2013; Pratt & Brody, 2014).

In terms of preoperative weight loss, the current study's findings were similar to a few studies that found that preoperative weight loss does not have any influence or effect on the amount of weight an individual can lose postoperatively (Lavhits et al. 2012: Kadeli et al. 2012). Research studies have provided potential explanation as to why that might be the case, indicating that preoperative weight loss might not reflect individuals true potential to lose weight as they might become more motivated to lose weight after the surgery (Lavhits et al. 2012: Kadeli et al. 2012). Research studies that found preoperative weight loss to have significant effects postsurgery occurred only when individuals achieved over 10% of excessive weight loss (Lavhits et al. 2012; Wimmelmann et al., 2014). The current study's found only 46% of the sample lost weight preoperatively, with a mean of 0.43% of excessive weight loss, far from the recommended 5-10% for surgery. The current study found the preoperative weight loss was not a significant preoperative factor in excessive weight loss 6 months after bariatric surgery.

Limitation and Strengths

This study had some limitations that should be noted. The first limitation is the amount of time weight loss was tracked in the patients. This study examines 6 months postoperative weight loss. Research demonstrates that bariatric surgery patients tended to lose most of the weight by their second postoperative year (Sarwer et al., 2008). Another limitation of this study is imbalance of gender in the current subject pool. The men only made up a fraction of the sample compared to the amount of women in the study.

However, research does state that women make up the majority of bariatric surgery population (Young et al, 2016). It is estimated that around 80 % of bariatric surgeries performed in the past 10 years have been on women (Young et al., 2016). Another limitation of this study is that it did not track postoperative behavioral changes. This limits the amount of inferences that could be made from the data collected. Tracking the postoperative behavior may have provided great details of information on the contributing factors, also such tracking might have provide crucial information as to which patients actually followed the postsurgical recommendations. The last limitation of this study is that it does not account for patients who might become pregnant during the duration of the study. Though it is recommended to wait at least 18 months after receiving bariatric surgery to conceive a child due to health concerns, some individuals might have disregard this recommendation and this could be a potential confounding variable for those patient's overall results (Carreau et al., 2017).

Though there are some limitations, the study does have some strengths. One of the major strengths of this study is that medical physicians measured the postoperative weight changes. This allows for a more accurate assessment of weight loss compared to other research designs where weight loss information was gathered only by self-reporting (Sarwer et al., 2008). Another strength of this study is that the physicians closely monitored medical conditions and provided an accurate measurement of an individual's improvement in their medical and psychological comorbidities.

Future Directions

For future studies, researchers track weight loss for a longer period to get a better estimate on the impact of preoperative factors. Research supports that individuals lost the most optimal weight after two years of having bariatric surgery (Sarwer et al., 2008). Tracking the weight loss for a longer period would provide information on weight regain and show when an individual’s weight loss plateaus. Another recommendation is carefully tracking postoperative behavior changes. Although most weight after surgery most often result from postoperative factors, tracking postoperative changes can provide crucial details on whether individuals developed negative behaviors such as overeating or if the individuals actually followed the recommended diet and exercise regimen in the first place (Colles et al., 2008).

Lastly, future research should examine the potential impact of race, ethnicity and culture on bariatric surgery. Research has shown that the prevalence and severity of obesity is varies among races, ethnicities and cultures (Dwyer et al., 2000). There are also differences in the prevalence in both medical and psychological comorbidities (Residori et al., 2003). Analyzing how race, ethnicity and culture might potentially impact the success of bariatric surgery might provide crucial information that could help physicians tailor the treatments plans for individuals, so that they are able to get the most amount of support needed to lose the most optimal weight for their body type.

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