ROLE OF PRE-OPERATIVE WEIGHT, DEPRESSION, SELF-ESTEEM AND HISTORY OF SEXUAL ABUSE IN PREDICTING WEIGHT LOSS AFTER GASTRIC BYPASS

ROLE OF PRE-OPERATIVE WEIGHT, DEPRESSION, SELF-ESTEEM AND HISTORY OF SEXUAL ABUSE IN PREDICTING WEIGHT LOSS AFTER GASTRIC BYPASS

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TITLE: Role Of Pre-Operative Weight, Depression, Self-Esteem And History Of Sexual Abuse In Predicting Weight Loss After Gastric Bypass
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ABSTRACT

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Background: The objective of this thesis is to examine the role of psychosocial factors in weight loss success after bariatric surgery. Specifically, the study investigated whether pre-operative body mass index (BMI), weight, depressive symptoms, self-esteem and a childhood history of sexual abuse (CSA) reliably predicted weight loss one year after Roux-en-y Gastric Bypass surgery (RYGBP). Based on previous research, it was proposed that a higher pre-operative BMI and weight, depression, low self-esteem, and a history of CSA would predict poor outcomes one year after RYGBP as evidenced by a BMI > 35 kg/m^2 and a lower percent total weight loss (%TWL). Methods: We administered a comprehensive battery of psychological screening tools, including the Beck Depression Inventory-II, the Rosenberg Self-Esteem Scale and a self-report measure assessing CSA, to 262 patients seeking bariatric surgery at St. Joseph's Healthcare Hamilton. Patients completed the questionnaires prior to surgery and again one year post-surgery. Results: A total of 79 patients were seen at one-year follow up and on average, achieved a good weight loss outcome (BMI = 32.8 kg/m^2). Through hierarchical multiple regression analysis we found that pre-operative BMI accounted for a significant proportion of variance in postoperative BMI [R^2 = .60, $F(1, 77) = 114.4$, $p <$ .001]. Weight before surgery, however, did not significantly predict %TWL after surgery. None of the psychosocial variables significantly predicted post-operative BMI or weight loss. These results are preliminary and are limited by the fact that participants did not present with clinically significant symptomatology and those with active

psychopathology were excluded as suitable surgical candidates. Limitations also include the use of absolute versus relative measures as markers of weight loss outcome. Conclusion: These findings indicate that pre-operative BMI is a significant predictor of BMI one year after bariatric surgery, suggesting that more attention should be directed toward managing pre-operative BMI for heavier patients. In the current Ontario system, depression, CSA or self-esteem do not predict weight loss one year post-operatively.

DEDICATION

In the name of Allah, the Most Gracious, the Most Merciful. I would like to thank Allah SWT for giving me the opportunity to pursue a Masters degree and with this research, benefit others; for knowledge without application is simply information.

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LIST OF ABBREVIATIONS AND SYMBOLS

BMI – body mass index

RYGBP – roux-en-y gastric bypass

CSA – childhood sexual abuse

BDI-II – Beck Depression Inventory-II

RSES – Rosenberg Self-Esteem Scale

BED – binge eating disorder

% EWL – percentage of excess weight loss

% BMIL – percentage of body mass index loss

% TWL – percentage of total weight loss

DECLARATION OF ACADEMIC ACHIEVEMENT

I hereby certify that the material presented in this thesis towards completion of a Masters (M.Sc.) degree in the McMaster Integrative Neuroscience Discovery and Study program, at McMaster University, Hamilton, Ontario is exclusively my own work and has not been submitted for any academic assessment other than partial-fulfillment of the degree named above.

Signature of candidate:…….

Date: ……

Introduction

Obesity is a multifaceted and debilitating global health concern (Turconi & Cena, 2007; Vallis et al., 2001). For lay perceptions, obesity may be visually conceptualized as an individual that is excessively overweight (Kuczmarski, 2007). More formally, obesity is defined as an increased accumulation of adipose tissue or body fat that is often correlated with a myriad of medical and cardiovascular diseases, such as coronary artery disease, type II diabetes and obstructive sleep apnea (Sugerman, 2008). Obesity is also associated with negative impacts on psychosocial health, impaired quality of life and a higher incidence of premature mortality (Kuczmarski, 2007; Turconi & Cena, 2007; World Health Organization, 2012). The prevalence rates of virtually all classes of obesity in Canada have drastically increased between 1985 and 2003, with 26% of Canadian adults meeting the criteria for obesity between 2009 and 2011 (Katzmarzyk & Mason, 2006; Statistics Canada, 2011). Additionally, approximately 1.5 million obese Canadian adults met the selection criteria for bariatric surgery between 2007 and 2009 (Padwal et al., 2012).

With regard to obesity-related research, as well as the screening and classification of obesity in clinical settings, the most commonly used measure is the body mass index (BMI) (Östman, Britton, & Jonsson et al., 2004). BMI is calculated as weight in kilograms divided by the square of height in meters (kg/m2) (Kuczmarski, 2007; Östman, Britton, & Jonsson et al., 2004). A BMI of 30 kg/m^2 up to 40 kg/m^2 is defined as the cut-off for obesity, whereas a BMI > 40 kg/m^2 constitutes morbid obesity (World Health

Organization, 2007). Table 1 illustrates the different classes of obesity with their respective BMIs (Östman et al., 2004).

Additionally, evidence regarding the causal mechanisms of obesity suggests that obesity manifests from a combination of variables, including genetic predispositions, lifestyle, co-morbid mental health conditions and the socio-cultural environment (Östman et al., 2004). The primary goal in treating obesity is to modify dietary intake by reducing energy-rich and fatty foods and to increase energy expenditure through regular exercise (Östman et al., 2004). The challenge, however, with such conventional measures as well as medically supervised weight-control programs, is continued weight loss maintenance (Alvarez & Baltasar, 2004).

In terms of etiology, it is proposed that physiologically our bodies have evolved to create an adaptive regulatory system against malnutrition during times of scarcity (Manco, 2007). From an evolutionary perspective, it is hypothesized that genes that allowed for long-term energy storage would be invaluable to survival. However, in our present society, this genetic makeup and convenient access to food can instead lead to the development of obesity (Ostman et al., 2004). Therefore, it has been argued that such adaptive mechanisms may be responding overwhelmingly to weight loss rather than weight gain (Manco, 2007). Therefore, individuals who present with a hereditary vulnerability to obesity often experience compensatory alterations in appetite control and energy expenditure in response to weight loss efforts (Manco, 2007). In addition, the significant weight loss after surgery is associated with increased mobility and body agility, which contributes to non-exercise activity thermogenesis (NEAT). NEAT is the

energy required to carry out activities of daily living, as well as to change positions and maintain posture (Manco, 2007). Thus, present evidence suggests that bariatric surgery may be the only feasible option for maintenance of long-term weight loss, with a majority of patients achieving greater than 50% excess weight loss within the first 18 months, in addition to improvements in psychosocial functioning and quality of life (Masheb et al., 2007; Pataky et al., 2011).

Often perceived as an extreme method of weight reduction, bariatric or weight loss surgery has reliably demonstrated sustained weight loss in obese individuals. Surgery physically and physiologically limits energy intake. Thus, energy requirements decrease as individuals lose weight (Manco, 2007). In dieting obese individuals, the resting energy expenditure in comparison to metabolically active tissue declines and diet-induced thermogenesis (DIT), which is the energy utilized for digestive processes such as absorption and storage of nutrients is halted (Manco, 2007). Such metabolic deregulations have been linked to regaining weight after dieting (Manco, 2007). However, post-surgery, there is marked weight loss due to a combination of reduced energy intake, increased energy expenditure and improved metabolic efficiency (Manco, 2007). Current evidence suggests that bariatric surgery may be the only viable option for maintenance of long-term weight loss (up to 14 years after Roux-en y Gastric Bypass), especially in comparison to traditional methods, such as very-low-calorie diets, exercise and pharmacotherapy (Brethauer, Chand, & Schauer, 2006; & Colquitt et al., 2009).

Although bariatric surgery seems to be a promising treatment option for individuals with obesity, a smaller proportion, about 15-20%, fail to reach this outcome

(Pataky et al., 2011). Suboptimal outcomes post-surgery are often attributed to behavioural and psychological reasons, rather than surgical ones. A critical aspect of bariatric surgery is that it works as a forced behaviour modification technique, in that several non-surgical and psychological factors have been shown to play a role in the durability of the resulting weight loss (De Panfilis et al., 2006; van Hout et al., 2005). These include factors such as the patient's motivation to follow a stringent long-term dietary regimen, as well as the ability to cope with personal and social outcomes of massive weight loss (van Hout et al., 2009).

Additionally, a significant minority of severely obese individuals presents with a co-morbid psychiatric condition or generally, a complicated psychosocial history and this may also impact surgical outcomes (Averbukh et al., 2003). Pre-bariatric surgery patients present with rates of up to 70% for current and lifetime Axis I disorders (de Zwaan et al., 2011). Patients with psychiatric disorders are presumed to have poor weight loss outcomes as well as physiological and psychological complications post-surgery. In many of the reported studies depressive disorders seem to be a predictor of poor weight loss (Livhits et al., 2012). However, these studies provide conflicting results and no well-defined predictors of weight loss can be determined.

Personality has also been shown to have an important effect on health-related behaviours (Glinski et al., 2001). Many studies have focused on the influence of personality on bariatric surgery outcomes. Of these studies, many have examined self-esteem as a predictive factor. It is important to understand the impact of self-esteem on weight loss due to weight-related stigma that most obese individuals face, as well as

societal and media depictions of thinness and beauty. However, results are conflicting and it is not clear whether low self-esteem is related to unsuccessful weight loss.

Lifetime history of sexual abuse is estimated to range between 15% and 25% in the general female population (Leserman, 2005). It is important to look at history of abuse because childhood sexual abuse (CSA) has been related to obesity in adulthood (Larsen et al., 2005). It is hypothesized that obesity amongst sexually abused women serves as a defense mechanism against sexual encounters, and weight-loss surgery may trigger memories and uneasiness at the thought of being thin or attractive (Larsen et al., 2005). Thus, many authors have examined the association between CSA and weight loss, however, no clear association has been found between sexual abuse and post-surgery outcomes.

Given the lack of reliable findings between psychosocial variables and bariatric surgery outcomes, the purpose of the following Masters thesis is to investigate the association between specific psychosocial variables and weight loss one-year post-surgery in morbidly obese patients undergoing roux-en-y gastric bypass (RYGBP). Self-report measures were utilized in order to gather information about different facets of psychosocial functioning. The studies that have been reviewed in this thesis have been drawn from a comprehensive systematic literature review, utilizing key word searching of six different databases. Articles were searched from 1966 to present. Both the primary literature, as well as review papers were utilized in formulating the rationale for this research study, and were also referenced for designing the protocol and selecting suitable weight loss parameters.

CHAPTER 1

Defining Morbid Obesity and Weight Loss Methods

Morbid obesity defined as having a BMI of greater than 40kg/m^2 affects approximately 3-9% of individuals in Canada (Katzmarzyk & Mason, 2006; Padwal et al., 2011). Individuals with morbid obesity are also vulnerable to obesity-related comorbidities such as hypertension, sleep apnea, type II diabetes and hyperlipidemia (Livhits et al., 2012). Psychological conditions, such as depression, anxiety and low self-esteem are also common in persons with morbid obesity (van Hout, Verschure, & van Heck, 2005).

Morbid obesity is found to be resistant to the widely available forms of intervention such as behavioural weight loss programs, drug therapies and even rigorous exercise, all of which result in less than significant weight loss (Wallace et al., 2010). Additionally, dietary modifications alone are not a viable option, since fewer than 5% of morbidly obese individuals are able to sustain significant weight loss by dieting (Vallis et al., 2001). It is further proposed that only about 5 to 10% of weight loss occurs through dieting, exercise and prescribed weight loss medications (Manco, 2007). Furthermore, dietary weight reduction is habitually followed by high rates of recidivism (Manco, 2007). Thus, bariatric surgery is, at present, considered the most effective treatment available for massive weight loss. The indications for surgery as recommended by the National Institutes of Health Consensus Conference include a BMI of > 40 kg/m^2, demonstration of ability to comply with post-surgery guidelines or a BMI of > 35 kg/m^2, in addition to obesity-related comorbidities such as hypertension and sleep apnea

(Manco, 2007).

CHAPTER 2

Types of Bariatric Surgeries and Explanation of Roux-en-y-Gastric Bypass

The emergence of the first bariatric surgery operation dates back to the 1950s (Östman et al., 2004). The jejunoileal bypass was the initial technique utilized by surgeons in the treatment of morbid obesity (Buchwald & Buchwald, 2008). However, in addition to weight loss, it also produced a malabsorption syndrome, consisting of severe diarrhea as well as other medical complications linked to the liver and kidneys (Buchwald & Buchwald, 2008). Therefore, in the 1970's two new procedures, the gastric bypass and gastroplasty, began gaining popularity due to their lower incidence of complications (Buchwald & Buchwald, 2008).

Based on observations, it was noted that patients with gastrointestinal disorders presenting for surgery lost weight when the small intestine was shortened (Östman et al., 2004). This early technique has developed over time and is now the most effective treatment available for obesity (Pories & Beshay, 2002). Post-operative outcomes are not only limited to weight loss but are also correlated with improvements in quality of life, decreased new diagnoses of diabetes and stabilization of blood-glucose levels (Östman et al., 2004). At present, various surgical procedures are available, including RYGBP, vertical banded gastroplasty (VBG), gastric banding (GB), bileopancreatic bypass (BPB) and duodenal switch (DS) (Pories & Beshay, 2002).

Empirical evidence from randomized controlled trials has documented that RYGBP yields significantly greater weight loss (60% to 70% of excess body weight) relative to other bariatric surgeries, as well as fewer side effects (Östman et al., 2004;

Pories & Beshay, 2002). In this technique, the surgeon creates a 15mL pouch-shaped stomach, with a capacity of two ounces, reducing gastric capacity by 90-95% (Goncalves et al., 2008; Östman et al., 2004). A bowel loop limb, shaped like a "Y" from the small intestine is brought up to the pouch and is stapled (Östman et al., 2004). This is referred to as the "roux limb" and this limb drains the gastric pouch. Upon digestion, food passes directly from the pouch via the roux limb to the small intestine (Clements et al., 2006). By bypassing the lower part of the stomach, mainly the duodenum, and a small portion of the proximal jejunum, fewer calories and nutrients are absorbed, thus leading to faster satiation and ultimately weight loss (Clements et al., 2006; Pories & Beshay, 2002). Through this unique and powerful combination of both malabsorptive and restrictive properties, the RYGBP procedure results in significant weight loss (Clements et al., 2006). The RYGBP technique is illustrated in Figure 1.

Due to such anatomical changes of the stomach and upper portion of the small intestine (both of which play a primary role in the uptake of nutrients from the gastrointestinal tract) patients are often diagnosed with vitamin B12 and iron deficiencies (Clements et al., 2006; Östman et al., 2004). In fact, it is estimated that iron deficiency occurs in 20% to 50% of patients, and vitamin B12 deficiency occurs in 25% to 35% of post-surgery patients (Choban et al., 2002). Additionally, the absorption of calcium and vitamin B1 is typically reduced because these nutrients are not permitted to enter the duodenum (Goncalves et al., 2008; Ponsky et al., 2005). Bariatric dieticians, therefore, require patients to observe a strict dietary regimen, including a daily dose of supplementary vitamins, as well as an initial liquid diet immediately after surgery

followed by monitoring of solid foods (Clements et al., 2006). Patients are also required to attend pre-assessment and follow-up appointments with the bariatric team, as well as comply with prescribed eating patterns. Noncompliant behaviours include consuming alcohol, binge eating, or not following a multivitamin supplements regimen. A patient's psychological state and overall cognitive functioning may impact observance of dietary and medical guidelines post-surgery, thus influencing weight loss (De Panfilis et al., 2006; van Hout et al., 2005). For this reason, an analysis of the psychosocial status of bariatric surgery candidates is of importance (Averbukh et al., 2003).

CHAPTER 3

Psychosocial Aspects of Obesity

As previously mentioned, it is critical to assess the psychosocial status of bariatric surgery candidates, as it has been reported to play a role in weight loss outcomes. Although bariatric surgery seems to be a promising treatment option for individuals with obesity, 15-20% of individuals who receive surgery fail to reach optimal weight loss outcomes (Pataky et al., 2011). A critical aspect of bariatric surgery is the motivation and ability to follow a stringent long-term dietary regimen, as well as the ability to cope with personal and social outcomes of massive weight loss (van Hout et al., 2009). The literature reports that bariatric surgery candidates have an increased prevalence of psychopathology relative to other surgery populations, including obese individuals who do not opt for surgery (Greenberg et al., 2009; Wadden et al., 2007). A significant minority of severely obese individuals, for example, presents with a co-morbid psychiatric condition such as major depressive disorder (MDD), binge eating disorder (BED) or a personality disorder, lower levels of self-esteem or a complicated psychosocial history, all of which might impact surgical outcomes (Averbukh et al., 2003; Pull et al., 2010). Comorbidity has been well documented with rates of current and lifetime Axis I disorders shown to be as high as 70% (de Zwaan et al., 2001). Kalarchian et al. (2007) reported that 66% of bariatric surgery candidates presented with a lifetime history of Axis I disorders, as well as a 38% prevalence of current Axis I disorders, of which anxiety was the most frequently reported while another study showed about 20%-30% of patients report clinically significant depressive symptoms before undergoing

bariatric surgery (Wadden et al. 2007). These findings are important because it has been suggested that obese individuals with two or more mental disorders lose significantly less weight than those individuals with one or no mental health condition (Kinzl et al., 2006).

Therefore, it is proposed that cognitive and interpersonal impairments may modulate weight loss outcomes after surgery (Hsu et al., 1998). The exact mechanisms of how psychopathology influences surgery outcome is unclear. From a historical perspective, the belief that psychopathology may influence obesity-related intervention emerged from two primary assumptions. First, it was believed that obesity had a positive psychological impact in that a larger body size may be representative of strength or power. Secondly, from a psychodynamic approach, an increased appetite, or hyperphagia was considered pleasurable and emotionally satisfying. However, current evidence is lacking to support these assumptions and studies now report descriptive data on psychopathology, eating patterns and weight loss. One theory, based on evidence of increased levels of depression and suicidal behaviour after surgery may either imply a lack of adaptation to heightened social inclusivity or an undiagnosed personality or mental health illness surfacing in the face of weight loss, and without the option of resorting to food and eating (Hsu et al., 1998). Additionally, studies have reported greater interpersonal conflict in familial and marital relations, perhaps due to improvements in self-esteem and an increase in assertiveness after weight loss (Hsu et al., 1998).

As a consequence, surgical candidates must undergo a psychological evaluation in order to ensure that they are able to comprehend the risks of surgery, have sensible

weight loss goals, and ultimately the motivation to pursue the strict diet regime post-surgery (Kendrick et al., 2007; Pull, 2010).

CHAPTER 4

Rationale for the Selection of Non-Surgical Factors in Weight Loss Outcomes after Surgery

In terms of the pre-operative psychological evaluation, there is mixed evidence with regards to specific psychopathology related to obesity or even an "obese" personality (Larsen et al., 2004). However, diminished self-esteem, mild forms of social anxiety, and depression have been implicated in bariatric surgery candidates (Larsen et al., 2004). Additionally, bariatric surgery has been associated with improvements of psychological comorbidities, such as reduction in depressive and anxiety symptoms (Pull, 2010; van Hout et al., 2006). Additionally, investigators have reported that CSA in bariatric surgery candidates is highly correlated with depression and low self-esteem (Grilo et al., 2005). Therefore, it is plausible that a history of CSA, coupled with depression and impaired self-esteem may give rise to obesity (i.e. through emotional eating as a coping mechanism), or may even be a consequence of obesity (i.e. suffering from distress and discrimination due to excessive weight gain). Given the fact that there is no clear consensus in the literature with regard to psychosocial predictors on bariatric surgery outcomes, and Canadian data on this topic is not available, we chose to examine the interplay of pre-operative BMI, depression, self-esteem and history of sexual abuse as predictors of weight loss in a Canadian surgery population.

The Role of Pre-operative BMI in Bariatric Surgery Outcomes

Typically, medical institutions that provide bariatric care have long wait times for their patients, ranging from months to years. In order to ensure optimal results, the

bariatric staff conducts rigorous patient assessments, ensuring that those individuals who are intrinsically motivated and physically fit have access to surgery (Alami et al., 2007). For example, evidence suggests that a low pre-operative BMI is a predictor for success (Alami et al., 2007; Livhits et al., 2012). Additionally, the literature suggests that an individual's ability to lose weight prior to surgery is correlated with losing weight after surgery, as well as the motivation to adopt healthy eating patterns and engage in physical activity (Alami et al., 2007; Alvarado et al., 2005). Benotti et al. (2009) further suggests that weight loss before surgery may be related to a decreased risk of medical and surgical complications post-surgery. Finally, in a comprehensive systematic review, Livhits et al. (2012) found a positive association with pre-operative BMI, compulsory pre-operative weight loss and post-operative weight loss. Given these findings, pre-operative weight loss seems to be a reliable predictor of successful weight loss outcomes after bariatric surgery.

The Role of Depression in Bariatric Surgery Outcomes

Increased levels of depression as well as emotional eating are found amongst morbidly obese individuals electing for surgery. The association between depression and obesity may be bi-directional (Colles et al., 2008). For example, Luppino et al. (2010) found that obese persons had a 55% increased risk of developing depression over time, whereas depressed persons had a 58% increased risk of becoming obese. Individuals with obesity may be a target of weight-related discrimination and may, therefore, be more susceptible to depression. Conversely, individuals who are already experiencing depression before their weight gain may turn to increased food intake, and reduced

activity levels as a coping mechanism thus, leading to weight gain. Additionally, it is hypothesized that feelings of anxiety and depression may be experienced as an individual who has undergone massive weight loss adjusts to a new body image (Delin et al., 1995). This individual may also experience distress related to food and eating (Delin et al., 1995).

Several investigators have examined the role of depression as a predictor for weight loss. For example, Averbukh and colleagues (2003) reported that individuals with higher levels of depression before surgery tended to lose more weight post-surgery. Other groups, however, have reported that depressive disorders were correlated with poorer outcomes after surgery (Colles et al., 2008; Kalarchian et al., 2008; Kinzl et al., 2006; Legenbauer et al., 2011; Ryden et al., 2003), or no association at all (Dixon et al., 2003; Dymek et al., 2001; Ma et al., 2006; Tsushima et al., 2004; Wolfe & Terry, 2006).

Overall, it is suggested that depression might be a negative predictor for weight loss outcomes but not necessarily a contraindication that can predict how successful surgery will be (van Hout et al., 2005). There may be several reasons for such differences, including a lack of power and the use of self-report measures such as the BDI to assess incidence of depressive symptoms versus a full range of DSM-IV psychiatric diagnoses. Additionally, it has been reported that severe or morbid obesity is associated with a greater risk of major depression, and it may be that some studies comprised of individuals with morbid obesity, whereas others comprised of individuals with super-obesity. Last, the use of different weight loss measures such as absolute verses relative weight loss may have resulted in a different weight loss profile. Also, depression in

addition to other forms of psychopathology such as BED, or anxiety may have confounded the weight loss outcomes.

The Role of a History of Sexual Abuse in Bariatric Surgery Outcomes

Approximately 15-25% of women experience some form of sexual abuse in their lifetime (Leserman, 2005). It is important to look at history of abuse because CSA has been related to obesity in adulthood (Larsen et al., 2005) and several studies have examined the association between history of sexual abuse and weight loss after surgery. CSA can be loosely defined as an act in which "a child, directly or indirectly, is obliged to participate in sexual acts…imposed by an adult or an adolescent on a child or a younger adolescent, against the latter's will, or by obtaining his participation by ruse, lies, force or fear" (Dorais, 2009, p. 7). There are two guiding hypotheses regarding the association between CSA and weight in the obesity literature. The first hypothesis evolved from studies that have examined a suggestive association between binge eating and obesity (Boan et al., 2004; Fujioka et al., 2008; Larsen et al., 2004). Atypical eating patterns may play a dysregulatory role in the serotonin 5-hydroxytryptamine (5-HT) pathway that is known to be involved in mood, sleep and eating behaviour (Gustafson & Sarwer, 2004). It has been reported with bulimic women that a childhood history of sexual abuse is correlated with reduced levels of serotonin and cortisol in the hypothalamic-pituitary-adrenal (HPA) Axis, thus contributing to irregularities in eating patterns and weight gain (Steiger et al., 2001). Investigators have proposed a similar rationale for obese individuals. An alternate theory follows from an adaptive approach. It has been proposed that excessive body weight may serve as a defense mechanism in

some women with a history of sexual abuse (Gustafson & Sarwer, 2004). Victims of sexual abuse may experience both vulnerability and anxiety as they lose weight and approach the initial weight at which they were first abused (Buser et al., 2004). This concept is coined by some investigators as "barrier weight" which is defined as a minimum weight that serves as a protective mechanism for post-traumatic symptoms. This prevents the patient from reaching a lower weight that maybe associated with a traumatic event in their life (Gustafson & Sarwer, 2004). Therefore, weight gain is seen as a protective barrier for further sexual advances, as well as a justification for obesity, thereby reducing the likelihood of significant weight loss.

In terms of its predictive value in determining weight loss after surgery, the majority of investigators have not found a significant relationship between a history of CSA and weight loss (Clark et al., 2007; Grilo et al., 2005; Larsen et al., 2005). Clark et al. (2007) did, however, report that approximately 25% of the victims of sexual abuse required psychiatric hospitalization post-surgery. Similarly, Grilo et al. (2005) and Larsen et al. (2005) proposed that individuals who report a history of sexual abuse might need further psychological care as sexual abuse was significantly correlated with higher levels of depression.

The Role of Self-Esteem in Bariatric Surgery Outcomes

A small number of studies have investigated pre-operative levels of self-esteem as a predictive factor for surgical weight loss. It has been proposed that higher self-esteem can determine an individual's level of efficacy in controlling their weight before and after surgery, regardless of weight loss (Delin et al. 1995). Additionally, self-esteem may

determine an individual's self-worth regardless of their weight, and it may help, especially in an obese population, to gauge the level of importance placed on his/her actual weight. With this in mind, Delin and colleagues (1995) found that increased self-esteem correlated significantly with successful weight loss after surgery. In contrast, van Gemert and colleagues (1998) reported that patients with a poor sense of self-esteem are perhaps the ones who endure the most distress due to their weight, hence presenting as intrinsically motivated and self-directed in following the dietary regimen pre and post-surgery.

There are several plausible explanations for such differences in findings. First, the samples within these studies are very heterogeneous, thus making it difficult to compare them. For example, Tsushima et al. (2004) divided their sample into individuals who lost less than 50% of their excess weight versus those who lost more than 50% of their excess weight, and they found no difference between these groups in terms of self-esteem. However, van Gemert et al. (1998) found that their sample had higher levels of psychopathology, including poor interpersonal skills, depression, denial of psychological distress and low self-esteem. Additionally, the differential use of statistical design impedes comparisons. For example, Delin et al. (1995) carried out correlations between self-esteem and weight loss (due to an insufficient sample size) while other authors conducted regression analyses. Thus, the differences may be due to a lack of power in some studies, and consequently choice of statistical analysis. Finally, there is no standard measure used to assess self-esteem, and authors have utilized both self-report measures such as the Coopersmith Self-Esteem Inventory, as well as diagnostic measures such as

the Minnesota Multiphasic Personality-2 (MMPI-II), which may have yielded different results in terms of self-esteem. Overall, the role of self-esteem in predicting weight loss after RYGBP remains unsettled.

CHAPTER 5

The Need for Psychological Assessment of Bariatric Surgery Candidates

It can be delineated from the aforementioned literature review on the role of psychosocial factors in bariatric surgery outcomes, that a psychological assessment is required for optimal patient selection. Mental health professionals assist with both pre-operative patient selection and post-operative support. As part of an interdisciplinary team, psychologists provide risk assessments as well as conduct clinical interviews to monitor mental and emotional stability to assess patient comprehension and readiness (Moorehead, 2008). Moreover, psychologists play a vital role post-operatively. The widespread view that the main cause of obesity is excessive eating and possessing an attitude of laziness is a concern for stigmatization of the disease and its treatment (Bray, 2002). Through therapy and referral to support groups, psychologists may be able to ward off such beliefs, both in individuals who have elected for surgery as well as their families, and to help reinforce the notion that this form of weight loss is not the "easy way out" (Moorehead, 2008).

There have been several reports on the prevalence of psychopathology in bariatric surgery candidates, as well as evidence to support the idea that individuals who present with an atypical psychological profile are at risk for suboptimal weight loss outcomes as well as greater risk of complications. The literature consistently reports a higher prevalence of a formal psychiatric diagnosis in bariatric populations, as well as higher levels of depression and lower levels of self-esteem (Sarwer et al., 2010). However, at present, there is little agreement as to which psychosocial factors can reliably predict

absolute and relative weight loss outcomes after surgery (Pull, 2010).

It is crucial, therefore, to identify which factors are associated with successful versus poor outcomes, as well as determine which individuals would require further psychotherapeutic support post-surgery (Pull, 2010; & Ray et al., 2003). All patients are therefore required to undergo a careful psychiatric consultation and assessment, based on the assumption that an active psychopathology may limit comprehension and motivation to comply with the behavioural and dietary requirements post-surgery (Kendrick et al., 2007).

The following are considered absolute contraindications in most psychological assessments: psychotic disorders, untreated personality or borderline disorders, untreated MDD, untreated bipolar disorder, schizoaffective disorder, active bulimia nervosa and active substance abuse (Kendrick et al., 2007). Patients with active BED should be evaluated on a case-by-case basis, and this should not be considered an absolute contraindication to surgery (Santry et al., 2007).

CHAPTER 6

Masters Research Study: Examining the Role of Pre-Operative BMI, Weight, Depression, Self-Esteem and History of CSA on BMI 1-Year after RYGBP

Given the need for conducting a psychological assessment prior to surgery for accurate patient selection, it is essential to identify which psychosocial factors would predict successful weight loss outcomes after surgery. Identifying such characteristics pre-operatively may assist clinicians and surgeons with better patient selection ready for surgery as well as focused follow-up plans for those at risk for losing less weight.

Hypotheses

Hypothesis I - It was proposed that individuals with a higher pre-operative BMI, higher levels of depression, low self-esteem, and/or a history of CSA will be more likely to have poor weight loss outcomes (BMI of greater than 35 kg/m^2 one-year post-surgery), as defined by a Reinhold criterion modified by Christou (1982). According to this definition, a post-operative one-year BMI of $\leq$ 30 kg/m^2 is considered an "excellent" outcome, and a BMI of $\leq$ 35 kg/m^2 is considered a "good" outcome.

Hypothesis II - It was proposed that individuals with higher levels of depression, low self-esteem, and/or a history of CSA will be more likely to have poor weight loss outcomes post-surgery as measured by percentage of total weight loss (%TWL).

Methods

We recruited patients presenting for RYGBP surgery at St. Joseph's Healthcare Hamilton, a large teaching hospital in Ontario, Canada. All patients referred to the bariatric surgery program were provided information about the ongoing studies at the

clinic and asked if they were interested in participating. If they were interested, a written informed consent was obtained. Ethics approval was obtained from St. Joseph's Research Ethics Board (R.P.# 11-3531) and participants were assured that their medical and surgical care would not be affected by the decision to partake in the research. Participants were also informed that there would be no compensation provided for their participation. Interested participants were provided a battery of self-report psychological measures, as described below. This psychological battery was compiled after a thorough literature review that identified all possible mental health conditions hypothesized to impact surgical outcomes and consultation with experts worldwide regarding strategies to best screen for psychological factors in this population. Participants completed this battery before surgery and at one-year post-surgery. There were no exclusion criteria and all candidates referred for bariatric surgery were accepted into the study (regardless of whether or not they were actually approved for surgery). Gastric bypass, specifically the RYGBP, was the primary operation performed.

Data entry was checked for accuracy and non-biased coding by an undergraduate research assistant who was blinded to the study hypothesis. Approximately 25% of the questionnaires were re-checked for reliability of data entry. For the overall battery, there was an inter-rater agreement of 97% between data entry coders, and 100% agreement for the specific measures used in this study.

Materials

The following measures were included[1]:

1. *BMI.* Patients' charts from the clinic were retrieved in order to obtain baseline and one-year follow-up BMI information.
2. *The Beck Depression Inventory – II.* The BDI-II is a standardized 21- item self-report measure, assessing depression symptomatology (Beck, Steer, & Brown, 1996). Each item is rated on a 4-point scale ranging from 0 to 3. Total scores range from 0 to 63 (Beck et al., 1996). The BDI-II has been shown to have excellent internal consistency, (α =.92) in an outpatient sample (Beck et al., 1996). Additionally, the BDI-II has demonstrated good convergent and divergent validity (Beck et al., 1996).
3. *Rosenberg Self-Esteem Scale.* The RSES evaluates state self-esteem by asking respondents to reflect on their current feelings about self-worth (Rosenberg, 1965). The RSES has acceptable to good internal consistency (α =.77 to.88), as well as good criterion validity and construct validity with anxiety (α = -.64) and depression (α = -.54) (Rosenberg, 1965).
4. *Childhood History of Sexual Abuse.* This assessment consisted of a yes/no question: "Have you experienced any form of sexual abuse in your childhood?" This questionnaire was generated by the researcher.

[1] Note: The questionnaire package consisted of approximately 30 psychosocial measures, however, for the purposes of this study, we used only a subset of these measures.

Anthropometric Data

The bariatric clinic nurses measured weight and height during initial visits. Pre-operative and one-year post-operative BMI was obtained from charts. The following measures were also calculated at one-year follow-up: %TWL = (initial weight – follow-up weight)/ initial weight x 100; Percentage BMI Loss (%BMIL) = [(initial BMI – follow-up BMI) / (initial BMI – 25) x 100]. Obesity and super-obesity status were established from the World Health Organization classification.

With regards to selecting the weight loss measures, there is little consistency in the literature about an appropriate measure (van de Laar et al., 2011). Additionally, existing measures, such as %EWL have been under scrutiny for accuracy and reliability. For example, it is reported from several studies that %EWL is highly dependent and variable of initial BMI (van de Laar et al., 2011). Therefore, investigators caution against the use of %EWL especially when comparing individuals with different BMIs at baseline (Karmali, Birch & Sharma, 2009; van de Laar et al., 2011). Additionally, %EWL is based on a calculation requiring "ideal weights" which some authors propose is an invalid concept (Karmali et al., 2009).

Therefore, BMI, an absolute measure, and %TWL, a relative measure, were selected as the primary outcome measures for the present study. The literature indicates that BMI before surgery is a significant predictor of BMI after surgery, however, these studies are conducted overwhelmingly in areas where private healthcare systems are prevalent, and therefore insurance companies mandate pre-operative weight loss. Of concern is the fact that these studies used non-Canadian samples (Alami et al., 2007;

Chen et al., 2009; Latner et al., 2004; Livhits et al., 2012). Additionally, authors suggest that for the purposes of a non-surgical report as well as to assess individual weight loss outcomes, it is common practice to use absolute terms such as BMI (van de Laar et al., 2011). Finally, the major journals within the field of obesity research also recommend using BMI to report results (Deitel, Gawdat & Melissas, 2007).

For %TWL, it has been reported that this measure demonstrates the least variation coefficient as a result of baseline BMI (Hatoum & Kaplan, 2012; van de Laar et al., 2011). Several authors have concluded that %TWL is a superior relative weight loss measure and can be utilized for comparison amongst different studies as well as patients undergoing RYGBP (Hatoum & Kaplan, 2012; van de Laar et al., 2011). Finally, in terms of its practicality, %TWL is simpler to calculate and convert into actual weight, as well as describe to the patient in comparison to %EWL (van de Laar et al., 2011).

Results

Statistical Analyses

For all computations, the statistical package SPSS Student version 16.0 was used. Results were deemed significant when the P value was <.05. Pearson's correlations' were used to determine the correlation between demographic variables and weight loss, as well as the correlations between pre-operative BMI and psychosocial measures. Chi-Square was used to determine the correlation between history of CSA (using dummy coding) and post-operative weight loss outcome (i.e. Excellent, good, or poor). Hierarchical multiple regression analysis was performed to determine the predictive value of the psychosocial variables with weight loss at one year.

In the first model of hierarchical regression, predictors were selected based on existing literature and factors known to reliably predict outcome (i.e. pre-operative BMI) were entered into step 1 of the model. In step 2, the three psychosocial variables (i.e. depression, self-esteem and CSA) were entered.

In the second regression model, %TWL was entered as the dependent variable. Last in the third model, demographic variables (including age, gender, ethnicity, marital status and job status) were added in addition to psychosocial variables to see their influence on %TWL one year after surgery.

Power Analysis

Green's (1991) equation was used to determine sample size and test the overall model: $50 + 8k$, where k is the number of predictors (Field, 2009). According to this, a sample size of 82 would be required. However, this equation oversimplifies the issue, because sample size ultimately depends on effect size (Field, 2009). Therefore, graphs provided by Miles & Shelvin (2001), that plot effect size in relation to number of predictors, were also used to determine sample size (Figure 2) (Field, 2009). According to this graph, a sample size of between 40 and 90 would be required for an expected medium to large effect size. Similarly, the G*Power computer program was utilized to analyze the sample size required to achieve a large effect size for linear multiple regression, for four predictors with 95% power, at the 0.05 alpha level (Faul, Erdfelder, Buchner & Lang, 2009). Effect sizes were determined from the literature, and for the purposes of multiple regression, r^2 values were converted to f^2 values. From the Thonney et al. (2010) paper, a large effect size of $f^2 = 0.39$ was indicated and using G* Power, it

was determined that a sample size of 52 would be required to achieve a large effect size. The final sample size for this study was 79.

Participant Characteristics

A total of 271 participants consented to the study at baseline. The mean age of the participants at baseline was 46.5 years (*SD* = 10.12) and approximately 85% of the sample was composed of females. Mean BMI at baseline was 49.3 kg/m^2 (*SD* = 7.53). Most of the patients were Caucasian, married, had received some college education, and were employed (see Table 2). All participants underwent RYGBP.

Complete follow-up data was available for 79 participants (Table 3). The majority of the sample was female, Caucasian, employed and married, with a mean age of 47.1 years (*SD* = 8.57). Mean BMI at baseline and one-year post-surgery was 49 kg/m^2 (*SD* = 6.30) and 32.8 kg/m^2 (*SD* = 6.57), respectively. The mean weight before surgery was 132 kg (*SD* = 22.63), and the mean percentage TWL post-surgery was 33.2% (*SD* = 8.34). With regard to emotional functioning, the sample was within normal range, with a mean BDI score of 11.8 (*SD* = 9.85), corresponding to minimal depression and a mean RSES score of 18.5 (*SD* = 4.31), corresponding to normal levels of self-esteem. With regards to rate of sexual abuse, only about 5% of the total baseline sample reported a history of CSA, which is a much lower rate than the general population.

The correlations between baseline psychosocial variables and one-year BMI are presented in Table 4. Overall, a higher BMI before surgery was correlated with a higher BMI one year after surgery, $r(79) = .77$, $p < .01$. None of the psychosocial variables reached significance. To assess the relation between history of CSA on BMI at one year

after surgery, we ran a Chi-Square test. However, a primary assumption of this test is that the expected frequencies in the contingency table should be greater than one (Field, 2009). Due to sample size limitations, we used Fisher's exact test to counteract this problem. Overall, there was a significant association between weight loss outcome and whether or not patients experienced a history of sexual abuse, $\chi^2(1, N = 79) = 8.97, p = .003, \phi_{Cramer} = .46$.

Testing Assumptions of Multiple Regression Analysis

There are several assumptions that must be tested when interpreting the results of a multiple regression analysis. This includes normality of data, residuals, collinearity (i.e. when the independent variables are not independent from each other) and homoscedasticity (i.e. when the variance or error terms are all the same along the regression line) (Field, 2009). The Durbin-Watson test was used to determine autocorrelation in the residuals, and the variation inflation factor (VIF) was used to measure multi-collinearity (Field, 2009). We also plotted the ZPRED (standardized forms of the values predicted by the model) against the ZRESID (standardized differences between the observed data and the values that the model predicts) to see whether the assumptions of normality, random errors and homoscedasticity have been met (Figures 3-5) (Field, 2009). In summary, all assumptions were met, and we concluded there is no collinearity within our data and that our model is generalizable.

Analysis I – Predicting BMI One Year after Surgery

Pre-operative BMI accounted for a significant proportion of variance in post-operative weight loss, $R^2 = .60, F = 114.45\ (1, 77), p < .01$, whereas BDI, RSES and CSA

combined accounted for 2% in predicting weight loss (this was not significant; see Table 5). Pre-operative BMI also significantly predicted one-year BMI, $\beta = .84$, $p < .001$. The effect size was $f^2 = 1.44$, which is considered to be a large effect size according to Cohen's criteria (Field, 2009). Although none of the psychosocial variables significantly predicted post-operative BMI, the individual contribution of a history of CSA seemed to have more of an impact on predicting BMI, even though this did not reach significance ($b = 3.66$, $p > .05$).

Univariate Analysis of Variance

Patients were divided into groups according to post-operative BMI (Table 6). A one-way between subjects Analysis of Variance (ANOVA) was conducted to compare the effect of BMI before surgery on BMI outcome one year after surgery, in excellent, good and poor conditions. There was a significant effect of pre-operative BMI on having excellent, good or poor outcomes after surgery, $F(2, 69) = 6.18$, $p = 0.003$, $p < .01$. Post-hoc comparisons using the Tukey HSD (honestly significant difference) test showed that the mean score for the excellent (M = 3.75, *SD* = 1.08) and good conditions (M =.65, *SD* =.68) was significantly different than the poor condition (M = -3.75, *SD* = 1.07). On average, individuals with an excellent post-operative result had a lower pre-operative BMI (about 3.5 points lower) than those individuals with poor post-operative results. However, the "excellent" condition did not significantly differ from the good condition. The good and poor groups differed significantly based on BMI before surgery. Results of the post-hoc test are presented in Table 7. The post-hoc tests included the Bonferroni correction to adjust for Type I errors.

Analysis II – Predicting %TWL One Year after Surgery

Neither the pre-operative weight nor the psychosocial variables were related to %TWL one-year post-surgery. When combined with demographic variables (i.e. gender, age, ethnicity, marital status and job status), weight before surgery was not a predictor of % TWL after surgery. However, approximately 14% of the variance was due to demographic variables, $F = (5, 72) = 2.43$, $p < 0.05$. Specifically, younger age significantly predicted % TWL after surgery, $b = -.33$, $t(72) = -2.88$, $p < .01$.The effect size was $f^2 = 0.19$, which is considered a medium to large effect size according to Cohen's criteria (Field, 2009).

Additional Analyses

In a third and final analysis, correlations were calculated between percentage of BMI loss (%BMIL) and psychosocial variables. We found no association for either BMI before surgery or psychosocial variables in predicting %BMIL after surgery (Appendix, Table 1).

Discussion

Bariatric surgery is currently the most effective treatment for achieving sustained weight loss, resolving co morbidities and improving quality of life (Goncalves et al., 2008; Steinmann et al., 2011). The present study investigated the role of pre-operative BMI, weight, depression, self-esteem and history of CSA in predicting BMI one year after bypass surgery. On average, the patients who underwent surgery demonstrated good weight loss outcomes as assessed by their one-year follow-up BMI. Overall, the findings indicate that both weight before surgery and psychosocial variables did not reliably

predict weight loss after surgery. Additionally, pre-operative BMI was found to be the most significant predictor of BMI one year after bariatric surgery, in that a lower BMI before surgery was predictive of a lower BMI after surgery.

Main Findings of Psychosocial Factors as Predictors of Post-Operative BMI

The lack of significant findings using psychosocial variables for predicting BMI or weight loss after surgery is contrary to our hypotheses, however, they are in agreement with other studies (Black et al., 2003; Busetto, et al., 2002; Dixon et al., 2003; Dymek et al., 2001; Ma et al., 2006 & Tsushima et al., 2004). There are several plausible explanations for such findings. First, it is quite likely that patients with an existing psychopathology were actively excluded from surgery by clinical staff thus, creating a skewed image of the actual psychopathology present in the sample. This indicates the effectiveness of a multidisciplinary team approach. The individuals in our sample were referred for surgery by their family physician and underwent a round of psychosocial and dietary assessments before being accepted for surgery (Herpetz et al., 2004). Therefore, we may have selected only those individuals who demonstrated the ability to succeed after the operation and achieve a healthy weight loss. Second, the BDI scale that was used to measure depression assessed only symptoms of depression, rather than diagnoses of clinical depression. Perhaps utilizing a diagnostic measure of depression would yield different results. Related to this is the non-clinically symptomatic nature of our sample. In the general population, the lifetime prevalence of depression, as assessed by the DSM-III was found to be 20-25% (Ryden et al., 1996). For the present sample, only about 11% of individuals met the criteria for moderate to severe levels of depressive

symptomatology. Additionally, the sample in our study might not be representative of the prevailing morbidly obese community. For example, individuals who are electing for surgery may be intrinsically motivated to lose weight, or may have more family support, offsetting some forms of psychosocial distress.

In contrast to the findings from our sample, some studies have observed that surgical candidates present with more psychological concerns than those obese individuals who do not opt for surgery (van Hout et al., 2005). Several investigators have also reported that psychosocial factors are predictive of weight loss (Colles et al., 2008; Delin et al., 1995; Rowston et al., 1992; & Ryden et al., 1996). With regards to a negative association, Delin et al. (1995) reported that higher levels of depression (as measured by scale scores) predicted lower %EWL. However, this correlation was not enough to predict successful versus inadequate weight loss outcomes (Delin et al., 1995). Additionally, small sample sizes make it difficult for findings to generalize, even with the use of similar measures, such as the BDI. For example, Rowston et al. (1992) and Ryden et al. (1996) reported that pre-operative depression is predictive of less weight loss after surgery; however, their sample sizes were 16 and 20, respectively. Taking into consideration post-operative satisfaction, Ryden et al. (1996) concluded that bariatric surgery did have positive psychosocial impacts on the patients, even those who lost less than 50% of their excess weight.

Several explanations are possible in relation to such divergent findings. First, clinicians and researchers might be using multiple yet stringent measures for the same variable, such as depression, to gain insight into its different levels. For example, Ryden

et al. (1996) used the BDI as well as the Hopkins Symptoms Check List on the subscale of depression. Delin et al. (1995) and Rowston et al. (1992) utilized semi-structured interviews, which may have garnered more detail about the depression. These interviews consisted of open-ended questions, which may have acquired more details than simply a self-report measure. Lastly, self-report measures of depression provide only an indication of psychosocial functioning, not necessarily a formal diagnosis (Vallis & Ross, 1993).

Interestingly, investigators have also found a positive association between pre-operative psychosocial variables and post-operative weight loss. For example, Averbukh et al. (2003) reported that higher levels of depression, through scale scores, prior to surgery, correlated with more weight loss after surgery. These findings can be attributed to heterogeneity of populations due to a combination of factors including varying sample sizes, different surgical procedures and varying follow-up times resulting in differences in post-operative weight loss. The authors explain that a majority of their sample reported BED and individuals with BED develop a larger gastric pouch than those without BED. Due to the surgically reduced gastric pouch and lower gastric capacity, patients are able to reduce their nutritional intake significantly, resulting in increased weight loss (Averbukh et al., 2003). In the present study, we did not assess the history and frequency of BED in our sample, therefore, making it difficult to determine the influence of eating disorders on depression.

In addition to depression, we also looked at self-esteem as an independent factor in predicting weight loss. However, we did not find any association between levels of self-esteem and weight loss after surgery. This finding is in line with that of Tsushima et

al. (2004) in that they reported no difference in the incidence of low self-esteem between patients with greater or less than 50% EWL one year after surgery. Our findings may be attributed to the fact that most individuals within our sample had normal to high levels of self-esteem. This may be partly due to impression management, in that the RSE is a self-report questionnaire, and individuals may be wary that their scores are being analyzed for surgery selection purposes. Additionally, the few individuals in our sample that did present with low levels of self-esteem also achieved good to excellent weight loss after surgery (i.e. a BMI $\leq$ 35). In contrast, other studies have found that self-esteem is related to weight loss after surgery. For example, Delin et al. (1995) found that individuals with higher levels of self-esteem lost more weight two years after surgery. However, due to a lack of power (about 20 patients), the authors conducted a correlational analysis, not a regression model. Therefore, although self-esteem may have been correlated with weight loss, it may not necessarily be predictive of weight loss. Finally, van Gemert et al. (1998) reported that individuals with lower levels of self-esteem lost more weight at 86 months after surgery. This may be due to the fact that their sample overall reported higher levels of psychosocial distress, including feelings of despair and social insecurity (van Gemert et al., 1998). Increased levels of distress may have motivated these patients to strictly comply with post-surgery guidelines and gain maximum benefit from the surgical procedure in order to alleviate their distress about weight, self-concept and interpersonal relations (van Gemert et al., 1998).

Lastly, we found that a history of CSA was not predictive of weight loss one year after surgery. This finding is in line with several studies that have not found an

association with CSA and weight loss (Clark et al., 2007; Grilo et al., 2005; & Larsen & Geenen, 2005). However, only about 5% of our sample reported a history of CSA through a self-report measure asking simply for a Yes/No response, therefore, we may not have had any variability on the factor to detect any significant findings. Interestingly, Larsen & Greenen (2005) found a higher prevalence of sexual abuse in their sample yet found no significant associations between history of CSA and post-operative weight. In contrast, Fujioka et al. (2008) reported that patients with a history of CSA lost less weight after surgery. A reason for such differences may be due to co-morbid conditions of the sample. For example, Fujioka et al. (2008) observed that their sample consisted of individuals with BED and this may have moderated weight loss outcomes. Additionally, they found that the statistically significant effect of CSA on weight loss did not persist 24 months after surgery (Fujioka et al., 2008). Moreover, Rowston et al. (1992) found the opposite, in that 50% of the women in their sample reported a history of sexual abuse. These individuals also weighed less pre-operatively, and on average lost more weight at 24 months after surgery. However, in our sample, we did not find any statistically significant difference in pre-operative weight for those women who reported a history of CSA versus those who did not. Another reason for such divergent findings may be that we did not take into account the severity of the abuse, or age at which the individual was abused. The participants in the Rowston et al. (1992) study admitted to a severe history of abuse, and at very young ages. As a result, these factors may have played a role in weight loss outcome. It is important to note, however, that these findings were based on a fairly

small sample size of 12 women, thereby reducing the generalizability of results to other samples.

Characteristics of Study Population and Weight Loss Outcomes

With regards to generalizability and in order to understand the present population it is important to compare it to other bariatric samples in the literature. With regards to depression, our sample presented with minimal levels of depressive symptoms, according to an average BDI score of 11.8 (*SD* = 9.8). This is comparable to other studies, such as Alger-Mayer et al. (2009) who reported a BDI score of 12.6 (*SD* = 9.3) and Sallet et al. (2007) who reported a score of 8.1 (*SD* = 5.7). Additionally, Averbukh et al. (2003) reported a mean BDI score of 14.5 (*SD* = 10.1), again indicating minimal levels of depression. Dixon et al., (2003) reported a score of 17.7 (*SD* = 9.5) for their sample, however, even this score is considered to be borderline or moderate levels of depressive symptoms, and is not high enough to warrant clinical attention.

In terms of self-esteem, on average our sample reported normal levels of self-esteem, as indicated by a RSES score of 18.5. This is comparable to the results of Tsushima et al. (2004) who reported normal levels of self-esteem in their sample, using the Minnesota Multiphasic Personality Inventory (MMPI). In contrast, van Gemert et al. (1998) found that their sample reported lower levels of self-esteem (using the Dutch Personality Inventory) as compared to the reference group. Therefore, due to varying measures of reporting self-esteem, it is difficult to make useful comparisons between the present sample and other bariatric populations.

To further describe weight loss outcomes between the excellent, good and poor weight loss outcomes, it was noted that the mean BDI score for those individuals who achieved a good to excellent outcome after surgery was in the mild range, whereas those individuals who achieved poor outcomes presented on average, with moderate levels of depressive symptoms. Additionally, it was noted that individuals with poor outcomes, on average reported higher levels of self-esteem than those with excellent or good weight loss outcomes. It can be speculated that perhaps these individuals judge self-worth independent of weight or weight loss, and therefore, another variable may have hampered their weight loss outcomes. However, after conducting a univariate analysis of variance between group outcome and each of the psychosocial variables, no significant effect was found between pre-operative psychosocial functioning and post-operative weight loss outcome. Therefore, it is probable that individuals who achieved good outcomes versus those who presented with poor outcomes differed on some other variable not analyzed in this study.

Finally, the rate of history of CSA did not differ significantly between the three weight loss outcomes. Although 38% of individuals who had poor outcomes after surgery reported history of CSA, it is important to note that only 10 individuals comprised this group, perhaps skewing the results. Overall, these findings warrant further investigation, with validated questionnaires in order to detect history, as well as severity of CSA (Fujioka et al., 2008).

Main Findings of Pre-Operative BMI in association with Post-Operative BMI

The finding from our study that pre-operative BMI is a significant predictor of BMI at one year after surgery is generally convergent with the literature. Several studies (through the use of regression models) have found that lower pre-operative BMI reliably predicted a lower post-operative BMI (Livhits et al., 2012). Furthermore, investigators have reported that a lower pre-operative BMI or body weight is associated with a lower post-operative BMI or increased weight loss (Alvarado et al., 2005; Chen et al., 2009; Latner et al., 2004; Ma et al., 2006; & Thalheimer et al. (2007). In addition, Bueter et al. (2007) reported that individuals with successful outcomes after laparoscopic adjustable gastric banding (LAGB) had an initial lower excess body weight than those who had poor outcomes. Lufti et al. (2006) found that patients with a pre-operative BMI of less than 50 kg/m^2 had increased odds of %EWL after LAGB. Similarly, Chau et al. (2005) concluded that a higher baseline BMI was correlated with suboptimal weigh loss outcomes.

These findings may be attributed to several reasons. First, and most intuitively, heavier individuals lose more weight after surgery since they start with a higher BMI. However, when compared to individuals who initially had a lower BMI, their weight loss may not be significant with regards to successful weight loss, and ultimately these individuals will have a higher BMI than their less obese peers (Livhits et al., 2012). This speaks to the fact that although heavier patients lose greater absolute amounts of weight than less obese patients, they tend to remain obese because they lose a smaller percentage of their excess body weight (Vallis & Ross, 1993). Additionally, it has been reported that heavier or super-obese patients demonstrate successful weight loss outcomes in terms of

total weight; however, they continue to have a lower %EWL (Vallis & Ross, 1993). Overall, the findings of this study are consistent with the observation that patients, who are less obese pre-operatively, are typically more successful in losing weight post-operatively (Livhits et al., 2012).

In contrast to the findings of this study, several reports have indicated a positive association between BMI before surgery and BMI or weight loss, in that a higher BMI before surgery is associated with more weight loss after surgery. For example, Averbukh et al. (2003) found that a higher pre-operative BMI was indicative of greater %EWL. However, it must be taken into consideration that %EWL does not fully adjust the correlation between baseline weight and weight loss (van de Laar et al., 2011). Additionally, Colles et al. (2008) found that a higher BMI at baseline was significantly associated with more percentage weight loss at 12 months. Interestingly, however, port and tube disruptions were most common in patients with a BMI of greater than 50 kg/m^2. This may have negative implications, in that patients may need to return for surgery or endure a longer recovery period, even though they have lost significant weight. Larsen et al. (2004) also found that a higher initial BMI was correlated with greater weight loss, however, due to small effect sizes, the investigators cautioned against drawing clinical implications.

Implications of Pre-Operative BMI as a Predictor of Post-Operative BMI

The findings of the present study may imply the possibility of mandatory pre-operative weight loss, which has been correlated with greater weight loss after surgery. At present, several bariatric centers involve mandated weight loss before surgery,

requiring patients to reduce at least 10% of their excess body weight (Tarnoff et al., 2008). Pre-operative weight loss may represent an individual's determination and self-directed ability to lose weight (Alami et al., 2007). These behaviours may in turn lead to successful weight loss outcomes if they transfer to compliance with dietary guidelines (Fujioka et al., 2008). Additionally, a higher BMI may be indicative of greater comorbidities such as hypertension or diabetes, therefore, starting off with a lower BMI might resolve some of these conditions and contribute to successful or more weight loss (Santry et al., 2007; Kadeli et al., 2012). Finally, a lower pre-operative weight may also be beneficial to the surgeon by improving the mechanical and technical aspects of the operation, thereby reducing risk and operation time (Alami et al., 2007; Tarnoff et al., 2008). The idea and methodology of mandatory weight loss is controversial, however, with regards to safety and efficacy (Livhits et al., 2012). For example, no consistent guidelines exist with regards to the method of losing weight pre-operatively, with some centers utilizing formal dietician consultations, whereas others requiring a low calorie diet in combination with exercise (Fujioka et al., 2008; Livhits et al., 2012). Further studies must be conducted in order to elucidate the mediating effects of pre-operative BMI, in addition to other comorbidities, and anthropometric variables.

Predictors of Percentage TWL versus Post-Operative BMI

In addition to pre and post-operative BMI, we also looked at %TWL as the dependent variable. We found that neither pre-operative weight nor psychosocial functioning was a significant predictor. This is in agreement with the findings of Kinzl et al. (2006) who found no association between pre-operative weight and post-operative

weight loss, in terms of BMI. Additionally, many of the studies that found no association between pre-operative BMI and weight had % EWL as their outcome measure not % TWL, therefore, making comparisons difficult (Kim et al., 2007; Perugini et al., 2003). In contrast, Powers et al. (1997) found that pre-operative weight was correlated with overall weight loss. The lack of standardization in reporting weight loss outcomes may be an explanation for such equivocal findings. For example, in a recent systematic review, Livhits et al. (2012) observed that studies that primarily reported a negative or no association of pre-operative weight or BMI with post-operative weight reported weight outcomes using relative parameters such as %EWL. In contrast, studies that found a positive correlation used absolute measures of weight loss such as kilograms lost or BMI change (Livhits et al., 2012). Therefore, it is uncertain as to whether these findings are a true representation of successful versus poor weight loss, or a difference simply of the type of weight loss measure selected.

Last, when combined with demographic variables, there was a significant association with %TWL post-surgery. For age, younger patients demonstrated greater weight loss. This may indicate that younger individuals typically have fewer co morbidities and increased mobility, explaining their greater success at weight loss (Livingston et al., 2002; Santry et al., 2007). This is in agreement with other reports that have found that younger individuals are typically more successful following bariatric surgery than older individuals (Vallis & Ross, 1993). However, age may be confounded with the fact that these individuals are also less obese, thus contributing to greater weight loss (Vallis & Ross, 1993). In contrast, some studies such as Valley & Grace (1987) did

not find an association between age and post-operative weight loss. These findings may imply that age is not necessarily a contraindication for surgery; however, older patients should be assessed on a case-by-case basis for risk factors that may negatively impact surgical outcomes.

The findings of this study are important with regards to the predictive value of pre-operative BMI on post-operative BMI in a public health system, where there is no insurance-mandated weight loss. These findings also suggest that further distinctions be made in terms of absolute and relative weight loss, especially in a primarily super-obese sample. Using different weight loss measures may yield in different results, with some predictors losing their predictability value.

Theoretical Implications

The aforementioned findings speak to larger theoretical and applied implications. Bariatric researchers have concluded from numerous studies that obese versus non-obese individuals do not significantly differ in terms of psychopathology (Vallis & Ross, 1993; van Hout et al., 2009). A theoretical, evidence-based framework is thus required to specify variables and behaviours that are relevant to post-surgical adherence (Vallis & Ross, 1993). This would also allow for easier comparison between studies because researchers and clinicians alike will be assessing the aforementioned variables in the same manner (Vallis & Ross, 1993).

The implications for the discrepancy in studies, in terms of negative and positive associations, warrants further investigation. With regards to research, Vallis & Ross (1993) recommend using questionnaires with a health locus of control, such as those

pertaining to intrinsic motivation to lose weight and determination to follow stringent dietary regulations (Vallis & Ross, 1993). Additionally, instead of looking simply at depression, a distinction should be made between clinical depression versus sadness and worry about obesity, which may in fact, assist in losing weight (Vallis & Ross, 1993).

Placing these findings into a theoretical context, Friedman & Brownell (2002) recommend using a 'Generational Approach'. They propose that the first generation of studies do not consider the whole range of psychosocial functioning in obese individuals, in that obesity may be correlated with severe psychopathology in some individuals, moderate levels of anxiety or no distress at all. Additionally, these studies utilize fairly homogenous samples, thereby limiting generalizability (Friedman & Brownell, 2002). Therefore, the bariatric literature must evolve into a second generation of studies that evaluate the psychosocial consequences of being obese, and whether these consequences vary across individuals (both opting for surgery and those selecting traditional methods of weight loss) as well as different classes of obesity. Moreover, the factors that make certain individuals with obesity more vulnerable to psychopathology should be examined (Friedman & Brownell, 2002). Ultimately, as evidence increases, with reliable effect sizes, the third generation of researchers should ascertain causal relations between psychosocial variables and weight loss after surgery (Friedman & Brownell, 2002).

Clinical Implications

In addition to theoretical implications, these findings may also have important clinical implications. For example, Black et al. (2003) propose that it may be unnecessary, and even unfair practice to deny surgery to individuals with an active

psychiatric illness, especially if they are otherwise motivated and understand the lifestyle changes associated with surgically-induced weight loss. Additionally, with further research and larger sample sizes, Canadian bariatric centers may propose mandatory weight loss before surgery to ensure a higher rate of success after surgery. With regards to weight loss parameters, perhaps surgeons can report weight loss in both absolute terms as well as relative terms to garner a more accurate picture of weight loss. However, these numbers should be taken into context with qualitative outcomes, such as improvement in quality of life, and satisfaction with the surgery.

Limitations

Despite the theoretical and clinical implications of this study, these findings must be taken with caution. The limitations of this study can be summarized as institutional barriers in patient selection, methodological drawbacks, homogeneity of sample and choice of weight loss parameters. First, with regard to patient selection, our sample was heavily biased by selection criteria about who would succeed after surgery. Therefore, these results might not apply to other surgical candidates. Additionally, this sample was from a public health care system. Perhaps patients' insured in a privatized system would show different results in terms of psychopathology and access to mental health services depending on socioeconomic status (Rowe et al., 2000).

A second limitation of the present study includes the use of self-report measures, which may undermine the accuracy of responses received as well as the honesty of the respondents. For example, the self-report measure assessing sexual abuse did not provide information on the severity or frequency of abuse, nor the relationship between the

perpetrator and the victim. This additional information might have provided insight into the relationship, if any, between abuse, psychopathology and weight gain (Larsen & Greenen, 2005). Furthermore, the findings are limited by a small sample size (N=79), thereby limiting generalizability to other bariatric populations. Missing data was also reported on some of the psychosocial measures, and it may be interesting to see whether the patients who responded were at all different from those who did not complete the questionnaires. The use of self-report measures, however, does not invalidate our study because we used only standardized measures (i.e. BDI, RSES) and those that are commonly used in the literature (Averbukh et al., 2003; Colles et al., 2008; Delin et al., 1995; Dixon et al., 2003; & Ryden et al., 1996).

Another limitation, and speculation for the lack of significant findings may be due to our highly homogeneous sample, consisting primarily of Caucasian married women. This pattern is seen across bariatric practice and literature, specifically that women are overrepresented in the bariatric surgery population, even when controlled for sex-specific prevalence of morbid obesity (Santry, 2007; Zizza et al., 2003). This observation may be attributed to several reasons. First, this finding suggests that obese women are more motivated than obese men to lose weight, perhaps due to socio-cultural ideals placed on women regarding beauty and thinness (Zizza et al., 2003). These findings imply that perhaps more focus needs to be placed on creating awareness of bariatric surgery, not as simply a weight loss or aesthetic procedure, but one that has several life-long benefits, such as increased quality of life, mobility, as well as resolution of comorbidities. Furthermore, some studies suggest that male sex is correlated with higher rates of early

morbidity after surgery and more health services utilization (Brethauer et al., 2006). However, evidence regarding patient selection suggests that sex does not influence surgeon evaluation on who to operate (Santry et al., 2007). A more plausible argument in understanding the overrepresentation of women as surgery candidates may be due to marked differences between men and women in terms of diet and exercise (Harris & Baer, 2007). In terms of metabolism, men tend to burn more calories at rest than women, and even through increased physical activity, weight loss may be more resistant for women. Additionally, women maintain greater fat stores than men and utilize it to a lesser degree as a source of energy (Harris & Baer, 2007). To further explain the greater percentage of women undergoing bariatric surgery, it has been proposed that a common side effect of many antipsychotic drugs is weight gain and it has been reported that a higher proportion of women tend to be consumers of these for depressive and anxiety disorders (Kolotkin et al., 2008). Higher lifetime rates of MDD have also been reported for women (Kessler et al., 2003). Finally, the onset of obesity has been frequently reported with pregnancy and menopause, and this observation might explain the greater proportion of middle-aged married women opting for weight-loss surgery (Kolotkin et al., 2008; Zizza et al., 2003).

With regards to study design, we looked simply at pre and post BMI, and pre-operative weight and post-operative %TWL. Perhaps assessing outcomes 3, 6, and 9 months after surgery would have provided detailed insights into weight loss, and what factors within each time frame are predictive of weight loss outcomes. It has also been reported that waist circumference might be a more accurate measure of weight loss, than

BMI or %TWL, especially when assessed from a biological hypothesis of central obesity (van Jaarsveld, 2009). However, the present study did utilize three measures to assess the reliability in weight loss, including BMI, %TWL, as well as %BMIL all of which have been widely reported in the literature to be accurate measures of weight loss (van de Laar et al., 2011). Finally, it is important to note that we assessed surgery outcome through short-term weight loss; however, successful outcomes can be also be evaluated through patient satisfaction surveys, long-term weight loss, or improvements in psychosocial functioning, all of which may have yielded different results. Therefore, it is possible that there were individuals in our sample who did not necessarily have a significant change in BMI, or even %TWL after surgery, yet still experienced a better quality of life due to reduction in comorbidities and an overall healthier lifestyle required for success after bariatric surgery.

Future Directions

Reliable psychosocial predictors of weight loss are still lacking, and future studies are needed to establish the predictive value of specific factors, as well as their cumulative effect (Pull, 2010). There are an infinite number of predictors that we could not feasibly include in this study. For example, other demographic variables such as age of onset, has been reported as being inversely related to weight loss (Rowe et al., 2000). Additionally, there are a myriad of physical and medical comorbidities (i.e. diabetes, hypertension) that in conjunction with a higher BMI and weight could have contributed to less weight loss. However, we did not account for these medical conditions and were not able to include them as predictors in our model. Finally, the effects of psycho-pharmaceuticals, such as

anti-depressants, were not teased apart in individuals with a history of depression. With regard to subsequent steps, it may be interesting to examine the influence of psychoactive drugs on weight gain and weight loss.

Conclusion

In summary, this study proposed several psychosocial predictors of post-operative BMI and %TWL after RYGBP in a morbidly obese population. The conclusions from this study are generally in agreement with the existing literature. First, the results from this study indicate that pre-operative BMI is significantly associated with one-year post-operative BMI in morbidly obese individuals undergoing RYGBP. Second, our data shows that none of the psychosocial factors were predictive of post-operative BMI or percentage TWL. These findings are novel in that the participants were drawn from a Canadian, public health hospital and may assist bariatric clinicians in patient selection and psychological evaluation.

Table 1
World Health Organization – Different classes of obesity and their corresponding body bass indices (BMI).

Weight Category	BMI (kg/m^2)
Normal BMI	19-24
Overweight	25-29
Obese	30-39
Morbid Obesity	40-49
Super Obesity	50+

Table 2
Baseline (preoperative) demographic characteristics of participants.

Characteristic	Total Sample (N = 271)
Age (yrs.)	46.5 (*SD* = 10.12) [Range: 20 - 74]
Gender (% female)	85.2%
BMI (kg/m^2)	49.3 (*SD* = 7.53) [Range: 36.6 - 76.4]
Ethnicity (%)	
Caucasian	77.9%
African American	1.8%
Asian	1.1%
Aboriginal	1.1%
Other	2.2%
Missing	15.9%

Level of Education (Highest level)	
Less than High School	1.1%
Some High School	16.6%
High School Diploma	19.6%
Some College	31.4%
College Diploma	9.6%
Some University	5.5%
University Degree	11.4%
Postgraduate	2.2%
Trade School	0.7%
Missing	1.8%
Job Status (% in each category)	
Employed	56.8%
Unemployed	17.1%
Disability	8.9%
Retired	3.3%
Missing	14%
Marital Status (% in each category)	
Married	57.9%
Single	16.2%
Divorced/Separated	11.4%
Widow	1.8%
Partner/Relationship	10.3%
Missing	2.2%

Table 3
Follow-up (one year post-operative) demographic characteristics of participants.

Characteristic	Total Sample (N = 79)
Age (yrs.)	47.08 (*SD* =8.57) [Range: 26 - 66]
Gender (% female)	92%
BMI Pre-surgery (kg/m^2)	49.02 (*SD* = 6.30) [Range: 39 - 74.4]
BMI 12-months Post-surgery (kg/m^2)	32.84 (*SD* = 6.57) [Range: 22.9 - 57.80]
Mean Baseline Weight (kg)	132.04 (*SD* = 22.63)
Mean Percent Total Weight Loss	32.23% (*SD* = 8.34)
Ethnicity (% in each category)	
Caucasian	92.4%
African American	2.5%
Asian	2.5%
Aboriginal	1.3%
Other	1.3%
Job Status (% in each category)	
Employed	68.4%
Unemployed	21.5%
Disability	6.3%
Retired	3.8%
Marital Status (% in each category)	
Married	64.6%
Single	10.1%
Divorced	12.7%
Partner/Relationship	8.9%
Widow	3.8%

BDI Total Score [a]	11.75 (*SD* = 9.85) [Range: 0 - 44]
RSES Total Score [b]	18.48 (*SD* =4.31) [Range: 9 - 29]
Childhood History of Sexual Abuse	
No	94.9%
Yes	5.1%

Note. [a] BDI – Beck Depression Inventory-II; the maximum score is 63
[b] RSES – Rosenberg Self-Esteem Scale; the maximum score is 30

Table 4
Correlations between pre-operative BMI, one year BMI, depression and self-esteem (N =79).

	BMI Pre-Surgery	BMI 12 Months Post-surgery	Depression	Self-Esteem
BMI Pre-surgery	---	.77**	-.12	.06
BMI 12 Months Post-surgery	.77**	---	-.09	.09
Depression	-.12	-.09	---	-.61**
Self-Esteem	.06	.09	-.61**	---

**Correlations are significant at the $p < .01$ level (2-Tailed)

Table 5
Multiple regression analysis of psychosocial predictors on one-year BMI.

	B	SE B	β
Step 1			
Constant	-6.24	3.68	
BMI_Presurgery	.79	.08	.77**
Step 2			
Constant	-7.49	4.89	
BMI_Presurgery	.79	.08	.78**
BDI	-.02	2.13	-.03
RSES	.06	.06	.04
Sexual Abuse	3.66	.14	.12

Note: $R^2 = .60$ for Step 1, $\Delta R^2 = .02$ for Step 2 ($p < .001$).

Table 6
Means categorized by one-year weight loss outcome in morbidly obese participants (N = 79)

	Excellent (SD) BMI < 30 n = 37	Good (SD) BMI ≤ 35 n = 32	Failure (SD) BMI > 35 n = 10
Mean % BMI Loss	40.73 (4.75) Range: 31.7 - 51	27.92 (5.61) Range: 18 - 38	21.91 (2.83) Range: 18.6 - 26
Mean Pre-operative BMI	44.14 (3.01) Range: 36.7- 49.9	44.63 (2.63) Range: 40.1- 49.6	47.74 (1.34) Range: 44.6-48.9
Mean Post-operative BMI (12-months)	26.10 (2.33) Range: 19.4 - 29.9	32.13 (1.42) Range: 30-35.40	37.25 (1.23) Range: 35.7-38.6
Mean BDI Score	15.86 (11.54) Range: 1-44	10.45 (9.53) Range: 10-30	19.24 (4.86) Range: 13-28
Mean RSES Score	17.75 (4.57) Range: 9-29	19.64 (4.92) Range: 10-30	19.18 (5.13) Range: 13-29
% History of Childhood Sexual Abuse	Yes: 3% No: 97%	Yes: 10.3% No: 89.7%	Yes: 37.5% No: 62.5%

Table 7
Tukey HSD comparison of weight loss outcomes based on pre-operative BMI

(I) Group Outcome	(J) Group Outcome	Mean Diff (I-J)	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Excellent	Poor	-3.75*	1.07	-6.29	-1.19
	Good	-.65	.68	-2.28	.97
Poor	Excellent	3.75*	1.07	1.19	6.29
	Good	3.09*	1.08	.51	5.68
Good	Excellent	.65	.68	-.97	2.28
	Poor	-3.09*	1.08	-5.68	-.51

* Bonferronni-adjusted *p* value was 0.008

Figure 1. Diagram of the Gastric Pouch in Roux-en-y Gastric Bypass; Adapted from: intuitivesurgical.com© (2013)

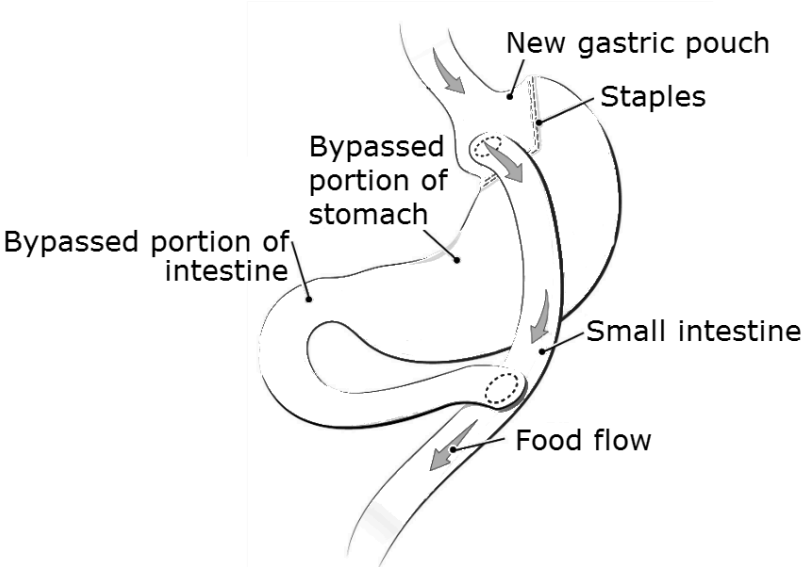


Figure 2. Determining sample size using number of predictors and effect size. Reproduced from: © Andy Field (2009).

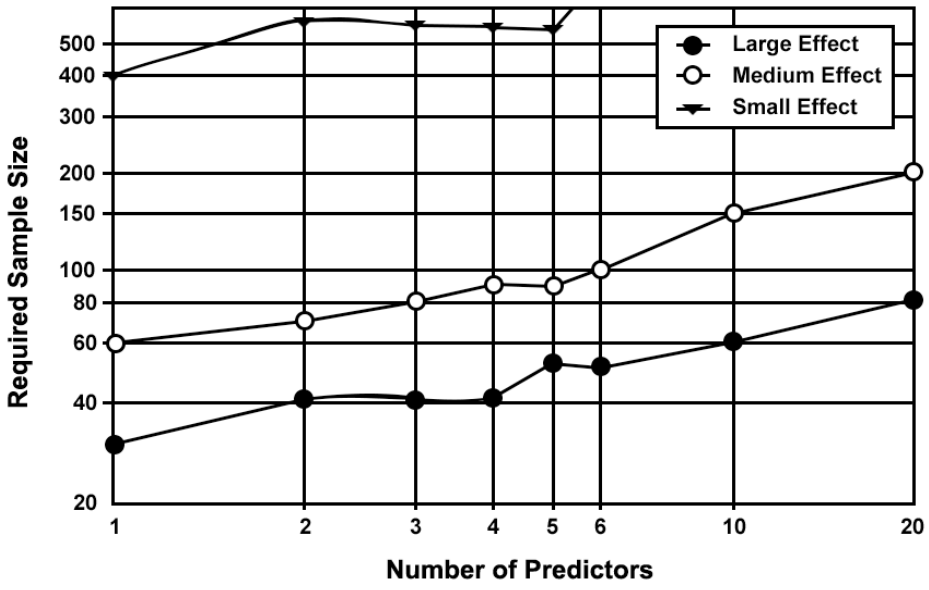


Figure 3. Histogram of normality of data

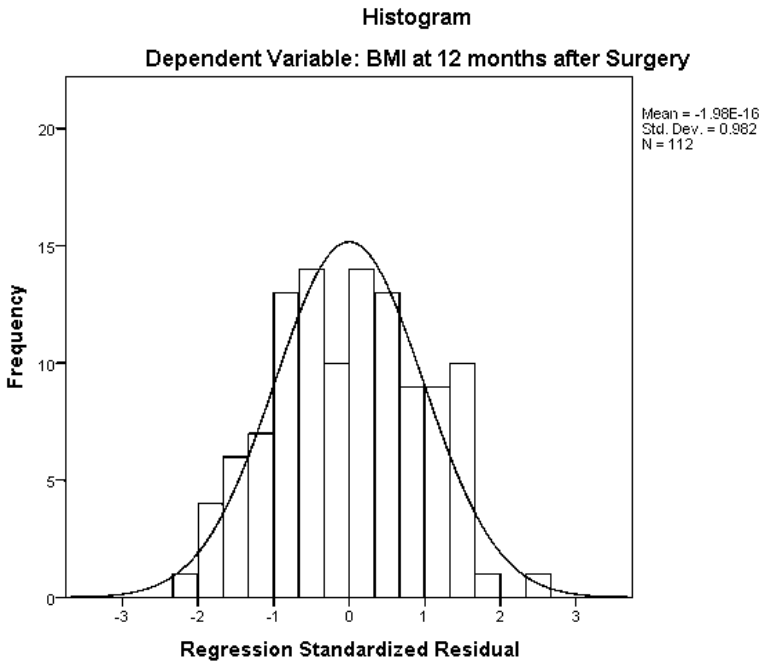


Figure 4. Probability plot of normally distributed residuals

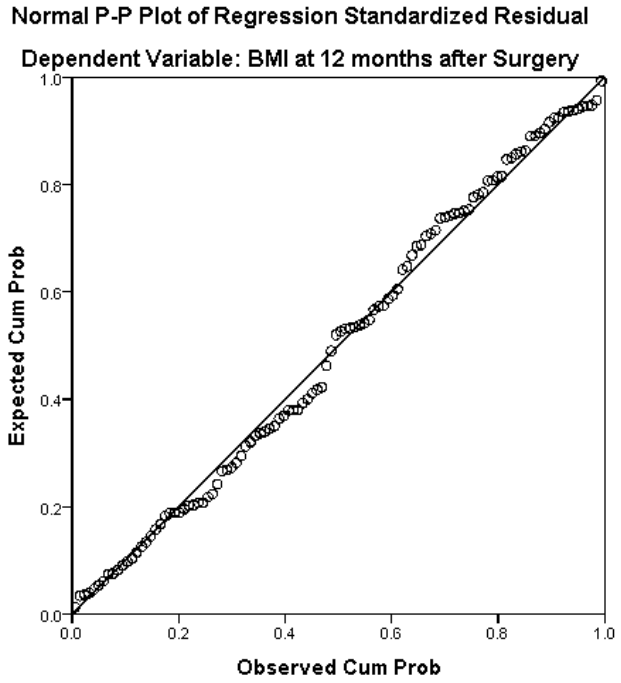
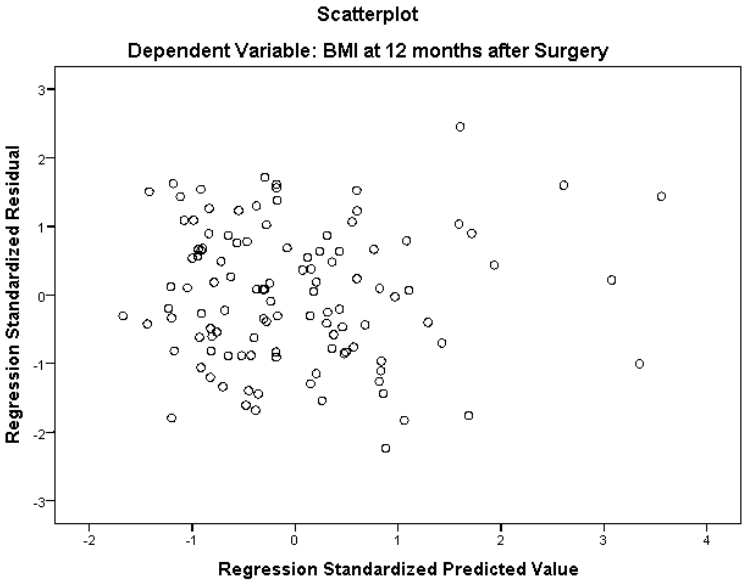


Figure 5. Plot of *ZRESID (regression standardized residual) against *ZPRED (regression standardized predicted value).



Appendix

Table 1
Correlations between BMI pre-surgery, psychosocial variables and percentage BMI loss (%BMIL) one year after RYGBP

	BMI Pre-Surgery	One Year %BMIL	Depression	Self-Esteem
BMI Pre-surgery	---	.033	.013	-.14
One Year %BMIL	.033	---	.01	.07
Depression	.013	.01	---	-.02
Self-Esteem	-.14	.07	-.02	---

**Correlations are significant at the $p < .01$ level (2-Tailed)

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