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Differences between Post-Bariatric Patients and Controls in a Substance Abuse Rehabilitation Program: Implications for Treatment

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DIFFERENCES BETWEEN POST-BARIATRIC PATIENTS AND CONTROLS IN A SUBSTANCE ABUSE REHABILITATION PROGRAM: IMPLICATIONS FOR TREATMENT

by

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Thesis

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Abstract

A comprehensive substance abuse treatment facility began observing increased admissions who reported histories of bariatric surgeries. The present study examined what unique variables may pose risk for substance abuse among bariatric surgery candidates and what issues may affect prognosis or treatment outcome for those currently in substance abuse treatment. Participants completed a questionnaire and participated in a semi-structured interview. Results indicate that post-bariatric patients developed problematic substance use significantly later in life, during a time that is not normative of new development of substances; were significantly more likely to be diagnosed with alcohol use disorders; and reported a significantly poorer psychological quality of life; yet they did not report a greater total number of drinks per drinking day or total substances used, and did not endorse greater behavioral excess. Post-bariatric patients may be overrepresented in substance abuse treatment programs, and they may need tailored treatment to address their unique characteristics.

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Obesity

Obesity is a chronic condition characterized by an excessively high proportion of body fat stores (Formiguera & Canton, 2004). Excess body fat is operationalized as greater than or equal to 25% of body fat in women and 18% in men (Bray, 1998). Although it is possible to measure body fat, it is a difficult, impractical, and cost prohibitive task; currently, there are no established parameters of body fat. To examine population-based estimates of obesity, the World Health Organization (WHO) created the Body Mass Index (BMI), which defines weight classifications based on weight and height (see Table 1). BMI is calculated by dividing individuals' weight in kilograms by the square of their height in meters. A BMI greater than or equal to 25 kg/m^2 is classified as overweight, while a BMI greater than or equal to 30 kg/m^2 is considered obese. A BMI ranging from 18.5 to 24.9 kg/m^2 constitutes normal weight. There are several alternatives to measuring obesity; however, BMI is the WHO's recommended form of measurement for adults. It is widely used because of its empirical support with respect to identifying medical complications associated with obesity and is an inexpensive and practical system for classification for obesity research (Manson, Skerrett, & Willet, 2002).

Obesity is the number one cause of preventable death in the United States and considered an epidemic (Sturm, 2002). Using BMI, the US Department of Health and Human Services reports that 66% of Americans are overweight, including the 34% of Americans who are obese (United States Department of Health and Human Services, 2008). These statistics convert to roughly 129.6 million people in the United States who are overweight or obese. The WHO estimates that over a billion people worldwide are overweight and 300 million are considered obese. These statistics are expected to double in the next 20 years (Formiguera & Canton, 2004).

Notably, the prevalence of overweight individuals has stayed relatively stable in the last 20 years, while the rate of obesity has risen dramatically (Flegal, Carroll, Ogden, & Curtin, 2010; Flegal, Carroll, Ogden, & Johnson, 2002).

Morbid Obesity

Additionally, the rate of severe or morbid obesity is increasing faster than moderate obesity (Sturm, 2003; Sturm, 2007). The prevalence of morbid obesity, otherwise known as Obesity Class III (see Table 1), quadrupled in the United States from 1986 to 2000 (Sturm, 2003), and from 2000 to 2005, the rates increased from 24% to 50%, respectively (Sturm, 2007).

Table 1

Classification of Adult Obesity

Classification	BMI (kg/m^2)	Risk of comorbidities
Normal range	18.5-24.9	Average
Overweight	≥25.0	Increased
Preobesity	25.0-29.9	Increased
Obesity class I	30.00-34.99	Moderate
Obesity class II	35.00-39.9	Severe
Obesity class III	≥40.00	Very Severe

As BMI increases, morbidity and mortality rates increase (see Table 1). Obesity is associated with many adverse health complications including type two diabetes, certain cancers, gallstones, osteoarthritis, hypertension, stroke, dyslipidemia, respiratory disease, gout, increased rates of cardiovascular disease, obstructive sleep apnea, kidney disease, glucose intolerance, progressive liver disease, and obesity-related cancers (e.g., colon, breast, esophageal, uterine, ovarian, kidney and pancreatic; Eckel, 2008; Must et al., 1999; Pi-Sunyer, 2002). Obesity affects nearly every organ and system in the body. The health concerns associated with obesity clearly warrant further research addressing this epidemic.

Obesity and Psychological Functioning

Morbid obesity is not only associated with myriad health-related consequences but is also associated with a poorer quality of life (Kolotkin, Meter, & Williams, 2001). Kolotkin and colleagues state: "Both physical functioning and psychosocial functioning are negatively impacted by excess weight, with greater impairments associated with greater degrees of obesity" (p. 225). Furthermore, there appears to be an inverse relationship between BMI and health-related quality of life (Chang, Hung, Chang, Tai, Lin, & Wang, 2008; van Nunen, Wouters, Vingerhoets, Hox, & Geenen, 2007). Specifically, those seeking surgical treatment for obesity tend to report a poorer quality of life than the general population (van Nunen, Wouters, Vingerhoets, Hox, & Geenen, 2007). A recent study conducted in Taiwan compared morbidly obese patients seeking surgical weight loss treatment to matched healthy controls and found significant differences in overall quality of life as well as health-related and physical, psychological, and social quality of life, suggesting this relationship appears to hold even across cultures (Chang, Hung, Chang, Tai, Lin, & Wang, 2008).

Although the obese report a poorer quality of life in several domains of quality of life, less evidence supports any relationship between obesity and psychopathology (Stunkdard & Wadden, 1999). It is well known that the obese are more likely to report a negative body image, are more prone to distort their body image (Jones, Grilo, Masheb, & White, 2009), and report less satisfaction and greater preoccupation with their physical appearance. However, most studies that compare obese and non-obese groups find comparable rates of psychiatric problems (Stunkdard & Wadden, 1999; Friedman & Brownell, 2002). An exception to this is evidence from several population-based studies that found a positive association between major depression and obesity (Petry, Barry, Pietrzak, & Wagner, 2008), particularly among women

(Pickering, Grant, Chou, & Compton, 2007; Scott, McGee, Wells, & Oakley Browne, 2008; Simon et al., 2006). A notable and consistent finding, however, is the elevated rates of psychopathology among obese patients seeking weight loss surgery (Abiles et al., 2008; Fitzgibbon, Stolley, & Kirschenbaum, 1993; Kalarchian et al., 2007; Kolotkin et al., 2003; Roberts, Kaplan, Shema, & Strawbridge, 2000); these findings will be extensively reviewed later. Negative body image dissatisfaction, concerns about physical appearance, and self-reported depression related to weight status are central reasons why people seek treatment (Rosen, 2002). However, the combination of psychological distress *and* health-related conditions may influence many overweight or obese to seek weight loss treatment, rather than psychiatric care.

Treatment for Obesity: Weight Loss Programs

Several literature reviews conclude that weight loss is associated with improvements in many dimensions of life, including the physical, psychological, and social domains (Fontaine & Barofsky, 2001; Foster & Wadden, 2002; Kolotkin, Meter, & Williams, 2001; Kushner & Foster, 2000). Even modest or short-term weight losses are associated with improvements in mood, self-esteem, energy, and quality of life (Brownell & Wadden, 1992; Fontaine et al., 1999). Consequently, many obese persons enroll in various weight loss programs for both health-related and psychological reasons. These programs (e.g., behavioral weight loss, commercial, pharmacological, and surgical treatment) and data regarding their typical outcomes are reviewed below.

Behavioral Weight Loss (BWL)

Behavioral weight loss programs teach patients skills to achieve weight loss, and the goals of treatment are to modify eating habits and increase physical activity (Foster, Makris, & Bailer, 2005). Specifically, BWL programs tend to focus on restricting caloric consumption and

increasing exercise by achieving small changes rather than large or drastic changes in behavior. These programs typically include strategies such as goal-setting, self-monitoring, stimulus control, cognitive restructuring, and relapse prevention (i.e., prevention of weight re-gain) (Foster, Makris, & Bailer, 2005). Several studies, however, conclude that very few in BWL programs reach their ideal or goal weight (Wadden, Sternberg, Letizia, Stunkdard, & Foster, 1989; Wadden, Stunkard, & Liebschutz, 1988). The average weight loss ranges from 15-20 kg during the first 12 weeks of treatment (an average weight loss of 7-10% of body weight within the 16- to 24-week treatment phase (Brownell & Wadden, 1992; Wilson & Brownell, 2002). Treatment outcome studies, however, tend to find dramatic fluctuations and significant weight-regain, with approximately one-third of treatment-maintained weight loss regained at one-year follow-up (Wilson & Brownell, 2002). Studies that examine a longer treatment duration tend to find that the majority of patients are unable to lose more than 10-15% of total body weight for the duration, and the majority of studies find weight maintenance with only modest weight loss results (Wilson & Brownell, 2002; Brownell & Wadden, 1992). In general, studies that examine a longer follow-up tend to find a return to baseline weight (Wadden, Stunkard, & Liebschutz, 1988; Wadden et al., 1989). For instance, Wadden and colleagues (1988) examined BWL subjects who had received either a very low calorie diet, behavior therapy, or a combined treatment, and found that three years after treatment the average subject in all BWL conditions regained a range of 74% and 85% of their final treatment weight loss, and there were no significant differences between the groups. BWL programs have been extensively researched, with the consensus being that BWL outcomes are generally unsuccessful in providing long-term weight loss.

Commercial Weight Loss Programs

While BWL programs have been extensively researched, very few patients use them outside of university settings (Brownell & Wadden, 1992; Wadden, Brownell, & Foster, 2002). More frequently, overweight and obese individuals tend to use commercial or self-help weight loss programs (e.g., Jenny Craig, Weight Watchers), which tend to provide social support rather than medical care as treatment (Womble & Wadden, 2002). These programs are rarely evaluated empirically. One exception by Lowe and colleagues (2001) examined long-term weight loss outcome of participants of a Weight Watchers program who had previously achieved their goal weight upon completion. At one year post-treatment, the reported weight regain was consistent with results found from clinical studies (i.e., one-third of weight regained at one year). Surprisingly, the subjects on average reported a percentage of weight re-gain that was less than what is typically reported in research from clinical populations (the sample re-gained 76.5% of their initial weight loss at the end of a 5-year investigation). However, several limitations were present. The researchers relied entirely on self-report of all the Weight Watchers subjects, in addition to selectively sampling patients who endorsed reaching their treatment goal weight. Brownell and Wadden (1992) conclude that the safety and effectiveness of commercial programs remains unknown.

Pharmacological Weight Loss Treatment

The National Institute of Health (NIH, 2000) guidelines support the use of medication for patients with a BMI $\geq$ 30 (or a BMI $\geq$ 27 with comorbid health conditions), who understand the risks and likelihood for success. The NIH suggests changes in lifestyle should be targeted first; however, if gains are not made after 6 months, pharmacotherapy may be considered. Additionally, the guidelines suggest that medications should only be used within a

comprehensive treatment program, which includes diet, physical activity changes, and behavior therapy. The guidelines add that short-term medication use is not an effective form of weight loss treatment. Pharmacological treatment for obesity is associated with several side effects, abuse, and relapse, and the outcomes for currently available medications provide only modest results (Aronne, 2002).

Weight Loss Surgery

Weight loss, or bariatric, surgery is currently the most effective weight loss treatment for clinically severe or morbid obesity, according to the NIH (2000) guidelines. To undergo bariatric surgery, an individual must have a BMI greater than 40, or within the range of 35-39.9 (moderately obese) with serious medical comorbidities (e.g., diabetes, hypertension).

Consequently, corresponding to increasing rates of morbid obesity, the number of bariatric surgeries performed has increased significantly in recent years. The exact number of post-surgical patients in the U.S. is unknown; however, many estimates are documented. From 1990 to 1997 the estimated number of surgeries performed annually increased from 4,925 to 12,541, respectively (Pope, Birkmeyer, & Finlayson, 2002). In 2002, Poulose et al. reported an estimated 69,490 bariatric operations performed to date, while a year later 103,000 surgeries were estimated (Steinbrook, 2004). Smoot and colleagues (2006) examined National Hospital discharge data from 1998 through 2002 and concluded that the rate of surgeries performed increased significantly over time. The American Society for Metabolic and Bariatric Surgery estimates that 0.4% of those medically eligible in the United States have undergone bariatric surgery (ASMBS); however, the dramatic increase in the number of surgeries performed in the 10 years is clearly evidenced. They estimate that in 2008, roughly 220,000 people received weight loss surgery, while in the early 1990s only 16,000 had (ASMBS).

Gastric Bypass Surgery

Although there are various types of surgical weight loss procedures (e.g., horizontal gastroplasty, nonadjustable gastric banding, biliopancreatic diversion), there are currently two types of procedures which dominate: gastric bypass and gastric-banding. Gastric bypass, which was later modified to the Roux-en-Y procedure, is currently the gold standard procedure for weight loss surgery. A gastric bypass divides the stomach into a small pouch (about 1-2 tbsp) and a larger pouch, and re-arranges the small intestine to connect to both pouches. This procedure provides significant weight loss through a combination of gastric restriction and malabsorption, through the reconstruction of the stomach to the small intestine (Mitchell & Courcoulas, 2005). In other words, the procedure restricts how much food can be eaten and creates a rapid sense of satiety shortly after eating. When gastric bypass was later modified to the Roux-en Y procedure, the size of the pouch was reduced, which limited many of the adverse complications (e.g., nausea, vomiting, and abdominal pain after eating); the Roux-en-Y also promoted greater weight loss than previous surgeries (Colquitt, Picot, Loveman, & Clegg, 2009).

Gastric bypass surgery is the preferred surgical weight loss treatment in the United States, while the gastric-banded procedure is more frequently performed in Europe and Australia (O'Brien et al., 2002). Gastric-banding is similar to gastric bypass. A small pouch (20 ml) is banded, designed to limit the intake; however, in gastric-banding the gastrointestional tract is unaltered, so it is designed as a purely restrictive procedure. Although gastric-banding is a highly successful weight loss procedure, it appears to be less successful than gastric bypass surgery. Three randomized controlled trials have found a statistically significant difference with gastric bypass yielding greater weight loss (Howard et al., 1995; Olbers, Fagevik-Olsen, Maleckas, & Lonroth, 2005; Sugerman, Starkey, & Birkenhauer, 1987). Some hypothesize that greater weight

loss may occur in Roux-en-Y due to greater malabsorption (Sugerman, Londrey, Kellum, Wolf, Liszka, & Engle et al., 1989). Additionally, gastric bypass surgery induces "dumping syndrome," or rapid gastric emptying, in many patients. Dumping syndrome causes significant nausea, bloating, cramping, diarrhea, dizziness, and fatigue, after the consumption of sweet foods and milk products (Hsu et al., 1998). This discourages patients from future consumption of sweets which contributes to greater weight loss (Wadden, Brownell, & Foster, 2002).

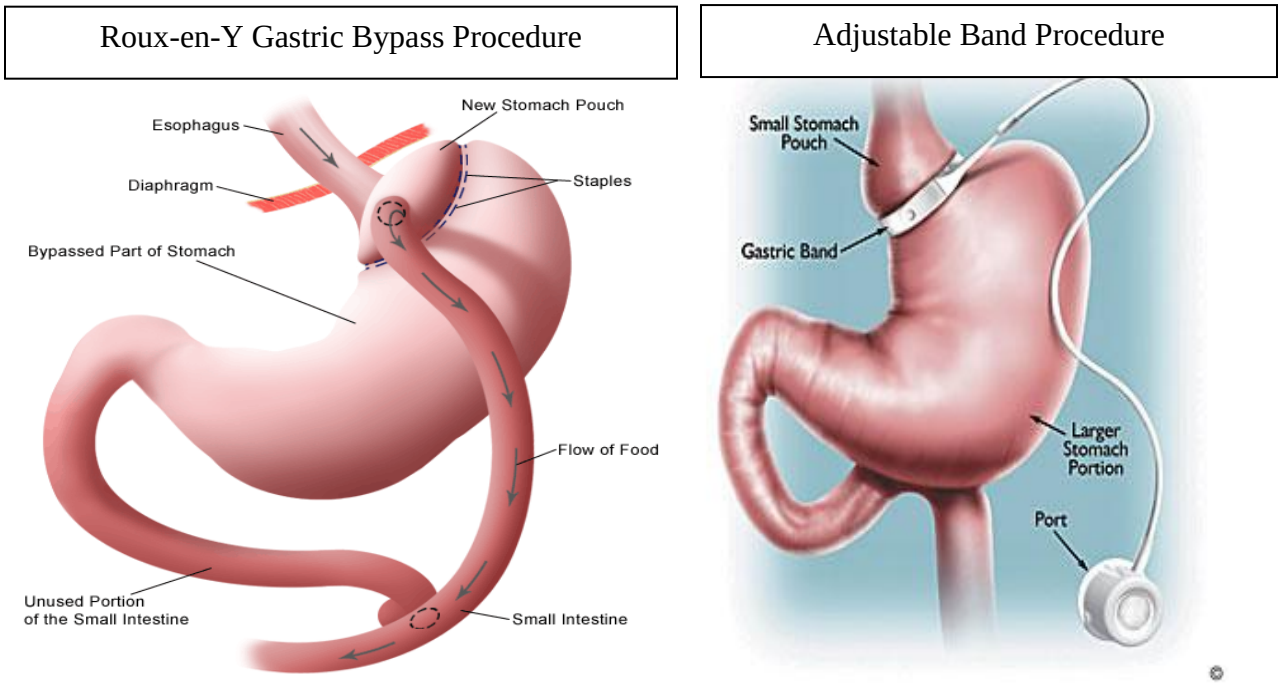


Figure 1. Gastric Bypass and Gastric Banding Procedures

Weight Loss Outcome after Bariatric Surgery

Those who undergo bariatric surgery lose a significant amount of excess body weight, compared to those who use non-surgical weight loss methods (Buchwald, 2004; Colquitt et al., 2009; Maggard et al., 2005). Studies have found that obese individuals (e.g., those who are 200% overweight) lose at least 50% of excess weight (Stunkard, Stinnett, & Smoller, 1986), and a recent meta-analysis examining various surgical treatments for obesity found that bariatric

patients lost an average of 61.6% excess weight (Buchwald, 2004). Additionally, the majority of patients had a reduction in obesity-related co-morbid conditions such as diabetes, hyperlipidemia, hypertension, and sleep apnea, with several conditions eliminated post-surgery (Buchwald, 2004). Furthermore, bariatric surgery is associated with a reduction in the usage of medications associated with comorbid conditions such as diabetes, hyperlipidemia, hypertension, and depression (Sears, Fillmore, Bui, & Rodriguez, 2008). Several comprehensive reviews conclude that bariatric surgery is highly effective in promoting weight loss and reducing comorbid weight-related health conditions (Buchwald, 2004; Colquitt et al., 2009; Maggard et al., 2005).

Quality of Life following Bariatric Surgery

Bariatric surgery is associated with improvements in health-related quality of life, a construct which taps physical health, emotional well-being, and psychosocial functioning (Kolotkin, Crosby, Williams, Hartley, & Nicol, 2001; de Zwaan et al., 2002). Prior to receiving surgical treatment, bariatric candidates report a poorer health-related quality of life than those not seeking treatment, even after controlling for BMI, age, and gender (Kolotkin, Crosby, & Williams, 2002; Kolotkin, Crosby, Pendleton, Strong, Gress, & Adams, 2003). For instance, a recent study conducted a follow-up of 75 gastric bypass patients a year after surgery, finding significant improvements in health-related quality of life, independent of the amount of weight lost (Sears et al., 2008). However, of the 58 patients whose weight loss data were available, an average of 52.9 kg was lost. In addition to the small sample size as a limitation, given that the majority of patients lost a significant amount of weight, patients who receive successful results from surgery may be more motivated to participate in the follow-up procedures, including research studies. However, these patients may not be representative of all post-bariatric patients,

specifically those who experience weight re-gain, or those who encounter post-surgical complications. For instance, although the majority of weight loss patients experience significant weight loss, a minority (reported as high as 20%) fail to lose a significant amount (Sarwer, Wadden, & Fabricatore, 2005). These patients may not be accurately represented in the current literature. A recent report found that 79% of their participants followed after surgery reported weight regain (Odom et al., 2010), and among these participants, a "decreased postoperative well-being" was an independent predictor of weight regain. Those who do not have favorable outcomes (as defined as significant weight loss) from weight loss surgery may report a poorer health-related quality of life, a finding that is not reported in the current literature.

Some hypothesize the improvement in quality of life may dissipate over time (Kodama et al., 1998; Sarwer, Wadden, & Fabricatore, 2005). Most follow-up studies tend to be conducted a year after surgery, when substantial weight loss typically occurs. A "honeymoon" period may occur during that year, and longitudinal findings are rarely examined in the current literature. Additionally, suicide has been reported as a major cause of death in post-bariatric patients (Hsu et al., 1998). Current data are unavailable; however, a recent report examined self-injurious behavior among bariatric candidates and reported that many, nearly 10%, had a history of attempted suicide and that 22 out of the 121 candidates reported self-harm and other maladaptive behaviors, such as sexual promiscuity and alcohol abuse (Sansone, Wiederman, Schumacher, & Routsong-Weichers, 2008). In contract, in a study with a longer follow-up (13-15 years post-surgery) of 86 gastric bypass patients, there was only one reported case of suicide and one death due to chronic alcoholism (Mitchell et al., 2001). Longitudinal studies with larger samples are needed to understand quality of life and suicidality in post-bariatric patients.

Psychopathology and Bariatric Surgery

Few studies have examined the role of psychosocial and psychiatric factors in long-term outcomes in the bariatric population. Certain factors, however, are recommended as contraindications for surgery approval. The American Association of Clinical Endocrinologists (AACE), The Obesity Society (TOS), and the American Society for Metabolic and Bariatric Surgery (ASMBS) provide guidelines and clinical recommendations for metabolic and bariatric surgery, stating: "a psychosocial-behavioral evaluation, which assesses environmental, familial, and behavioral factors, should be considered for all patients before bariatric surgery" (p. 324). Additionally, the report recommends severe uncontrolled psychiatric illness and current drug or alcohol abuse as exclusionary criteria for bariatric surgery (Mechanick, Kushner, & Sugerman et al., 2008). However, during the pre-surgical screening each surgical treatment team decides its own psychiatric exclusion criteria, as there is not a clear consensus, with only a handful of studies examining possible psychiatric contraindications (Marcus, Kalarchian, & Courcoulas, 2009; Segal, Libanori, & Azevedo, 2001).

Few empirical reports have examined the bariatric surgery psychiatric approval process itself. Fabricatore and colleagues (2006) contacted 194 bariatric surgery mental health professionals and assessed which psychosocial domains were evaluated in their approval procedure and what they considered a contraindication for surgery approval. The survey had open and close-ended questions, and the most commonly reported assessed symptoms were depression, eating disorders, and anxiety disorders. When asked what they believed was a "clean contraindication to surgery," mental health professionals reported psychiatric issues, non-specific mental health issues, eating disorders, mood disorders and substance use disorders. Walfish (2007) sampled 103 psychologists through a brief mail survey and found significant variability in

the measures used during evaluations as well as reasons for delay or denial of surgery. Fifteen percent of the total sample was delayed or denied surgery; the most commonly reported reasons were active psychopathology, such as psychosis or bipolar disorder (mentioned 53 times), untreated or undertreated depression (mentioned 41 times), or a lack of understanding the risks and postoperative requirements of surgery (mentioned 31 times), followed by active substance abuse and eating disorders (both mentioned 26 times). Interestingly, although current substance abuse was reported 26 times (cited by at least 25% of the total sample), there were no specific measures reported by psychologists to assess abuse or dependence criteria. The most commonly used measures were the MMPI-2 (Butcher, Dahlstrom, Graham, Tellegen, & Kreammer, 1989), followed by the Beck Depression Inventory (Beck, Steer, & Brown, 1996) and the Millon Behavioral Medicine Diagnostic (Millon, Green, Meagher, & Millon, 1982). These findings may suggest that the majority of candidates receive approval for surgery and that substance use is rarely systematically assessed by many psychologists and mental health providers conducting pre-surgical evaluations. Mental health professionals seemingly agree that psychiatric issues are important to evaluate for surgical approval. However, given that there are currently no definitive data as to what psychiatric issues might be a predictor of poor outcome, many clinicians are relying on their own judgment when conducting bariatric assessments.

Psychopathology in Bariatric Surgery Candidates

Several population-based studies have assessed the rate of psychopathology in bariatric candidates using structured clinical interviews assessing DSM-IV-TR diagnoses (Kalarchian et al., 2007; Mauri et al., 2008; Mühlhans, Horbach, & de Zwaan, 2009; Rosenberger, Henderson, & Grilo, 2006). High rates of psychopathology are found among surgery candidates. These include mood, anxiety (Ali, Rasmussen, Monash, & Fuller, 2009; Kalarchian et al., 2007; Lier,

Biringer, Stubhaug, Eriksen, & Tangen, 2010; Mauri et al., 2008; Mühlhans, Horbach, & de Zwaan, 2009; Rosenberger, Henderson, & Grilo., 2006; Sarwer et al., 2004), somatization (Rosik, 2005), and eating disorders, such as binge eating disorder (Black, Goldstein, & Mason, 1992; de Zwaan et al., 2003; Kalarchian, Wilson, Brolin, & Bradley, 1998). Not surprisingly, studies conducted independent of the pre-surgical psychiatric approval process tend to find higher rates of psychopathology (Kalarchian et al., 2007; Mühlhans, Horbach, & de Zwaan, 2009) than those associated with the approval process (Mauri et al., 2008; Rosenberger, Henderson, & Grilo., 2006). These data suggest that bariatric candidates may be underreporting symptoms in fear their surgery may not be granted approval.

Psychopathology in Post-Surgery Patients

Herpetz and colleagues (2003) reviewed 40 studies examining psychopathology, psychosocial functioning, and quality of life among post-bariatric surgery patients and concluded that psychological status improves after weight loss surgery. Eight studies examined psychiatric comorbidity which typically was assessed by standardized or structured questionnaires as well as clinical interviews. Axis I disorders (predominantly affective, anxiety, and eating disorders) were considerably less common at follow-up, ranging from no diagnosis to one-half or one-third of pre-surgical ratings; however, the rate of personality disorders did not change after surgery. Additionally, weight loss was correlated with improvements in psychological variables such as psychological stability and self-esteem.

A high prevalence of binge eating disorder is found among bariatric surgery candidates, with prevalence rates ranging from 39-46% (Herpertz et al., 2003). Some researchers suggest that binge eating behavior may re-emerge in some patients after surgery (Niego, Kofman, Weiss, & Geliebter, 2007). Herpetz et al. (2003) found that the change in Binge Eating Disorder (BED)

symptoms after surgery was related to the type of surgery received, yet they concluded that overall the surgery is associated with improvements in eating disordered behavior, such as binge eating and night eating. Niego and colleagues (2007) reviewed the current literature on binge eating in the bariatric population and found that binge eating ceases in many patients after surgery, yet it is unclear if or when it may re-emerge after the initial weight loss "honeymoon" stage. Additionally, there is considerable debate regarding the DSM-IV-TR binge size, or portion criteria for "a large amount of food" among post-bariatric patients. Powers, Perez, Boyd, and Rosemurgy (1999) argue that gastric restriction makes binge eating physiologically impossible for post-surgery patients due to quick satiety as a consequence of the surgical anatomical changes. The authors suspect, however, that binge eating might occur in this population if it were *physically* possible. Some post-bariatric patients who binge eat vomit after satiety (de Zwaan et al., 2010), yet post-bariatric patient binge-purge behavior may be uncharacteristic of what constitutes a "normal" binge-purge episode, e.g., in bulimia nervosa. It is unclear whether a vomit response occurs involuntarily as a weight management mechanism or rather represents a compensatory behavior characteristic of bulimia nervosa. Given the physiological constraints of bariatric surgery, Niego and colleagues highlight studies that do not include the "large amount of food" criteria tend to find binge eating behavior persists in post-bariatric patients, typically reemerging 18-35 months post-surgery.

Given the evidence regarding psychiatric status in post-bariatric patients, it is evident that very few studies have long-term follow-up findings. For instance, the majority of studies examined in the Herpetz et al. review were conducted two years following surgery. Nonetheless, the current data seem to suggest that presurgical psychiatric illness and psychological distress do not affect weight loss outcomes. The data also suggest that significant improvements occur in

other areas, including psychological outcomes of the majority of weight loss patients (Burgmer, Petersen, Burgmer, de Zwaan, Wolf, & Herpertz, 2007; van Hout, Boekestein, Fortuin, Pelle, & Heck, 2006). Longitudinal studies may elucidate whether or not a "honeymoon" period may occur following surgery, with a later return to previous functioning.

Substance Use and Obesity

As previously discussed, the evidence from population-based studies typically finds that obesity is not associated with a greater likelihood of psychological problems. The relationship between obesity and substance use, however, yields several inconsistent findings. Petry and colleagues (2008) examined data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) and found that being moderately overweight was associated with lifetime alcohol abuse. They did not find a relationship, however, for other substances. In contrast, Simon et al. (2006) examined data from the National Comorbidity Survey Replication (NCS-R) and did not find a relationship between substance use and weight status. Pickering et al. (2007) also used NESARC data and found comparable rates of substance abuse and dependence among the obese and non-obese. Using the same data set, Barry and Petry (2009) found an increased risk of lifetime alcohol abuse and dependence among overweight and obese men, as well as a decreased risk for past-year alcohol abuse in women. Additionally, they found that overweight status in women conferred increased risk of lifetime nicotine dependence, while obese women were at a decreased risk for past-year nicotine dependence. The methodology used in these examinations varies significantly. For instance, Simon and colleagues categorized participants into two categories, those with a BMI less than 30 and those with a BMI greater than 30, while Petry et al. used more specific weight categories (i.e., underweight, normal weight, overweight, obese, extremely obese). Pickering et al. examined only past year substance use and

controlled for several comorbid medical conditions and stressful life events, while Barry and Petry did not. Particularly given sometimes dramatic differences in how individuals are classified into groups with respect to weight status, it is often difficult to draw broad inferences from this body of literature as a whole.

Nonetheless, substance use affects mechanisms such as appetite, hunger, and food intake. Therefore, examining the effect of substance use on eating behavior may allow researchers to make inferences that population-based studies do not. For instance, nicotine is an appetite suppressant, and cigarette smokers on average tend to weigh 3 to 4kg less than non-smokers (Perkins, 1993). Nicotine use is associated with weight loss, while smoking cessation is associated with hunger and weight gain (Perkins, 1993). Studies have shown that sucrose tablets reduce tobacco-related cravings after smoking cessation, and sugar and carbohydrate intake has been associated with a decreased alcohol relapse episode after treatment (Perkins, Levine, Marcus, & Shiffman, 1997). Studies like these could point towards common underlying mechanisms for substance use and eating behavior.

Additionally, neurobiological research has identified parallels between food intake and substance use by examining brain sites involved in pleasure and reward, specifically with respect to cravings (Pelchat, 2002). This evidence will be reviewed later; findings suggest, however, that food and drugs of abuse share common reward substrates (Pelchat, 2009). Furthermore, Kleiner and colleagues (2003) suggest that drugs of abuse may compete with food for brain reward sites. Consequently, excessive eating might function as a substitute for alcohol and other drugs, mediating the mechanisms that underlie reward or reinforcement in addiction.

Eating and Addiction

Given the possibly shared mechanisms of food and drug abuse, parallels have also been drawn between eating and addictive behaviors—specifically, comparisons of their clinical features and of the biological mechanisms involved in both drugs of abuse and the excessive consumption of food. For instance, several researchers have emphasized ways in which DSM-IV-TR criteria and symptoms of BED are similar to substance dependence (Cassin & von Ranson, 2007; Davis & Carter, 2008; Ifland et al., 2009). This conceptualization of BED suggests that highly palatable foods may have addictive properties, similar to drugs of abuse. In particular, the concept of "food addiction" has gained attention in recent media reports, whereby substances such as sugar, refined carbohydrates, fat, salt, and caffeine are hypothesized to have addictive properties (Corwin & Grigson, 2009; Ifland et al., 2009). Given that behaviors associated with obesity (e.g., compulsive overeating) parallel the mechanisms and clinical features of substance dependence, several researchers have suggested perhaps *binge eating* specifically should be conceptualized as an addiction rather than an eating disorder (Avena, 2007; Cassin & von Ranson, 2007; Davis & Carter, 2008). This argument is buttressed by the many commonalities in behavioral symptomatology, shared clinical factors, animal models of research, and similarities in neurobiology.

Behavioral Symptomatology

Binge eating disorder shares many clinical features of substance dependence (see Table 2). The defining components of addictive behavior are debatable; however, salient features such as loss of control, withdrawal, and tolerance are criteria of the DSM-IV-TR diagnosis for substance dependence (American Psychiatric Association [APA], 2000). Additionally, craving

and relapse are common experiences associated with addiction, although not a feature of the formal "dependence" diagnosis (Davis & Carter, 2008).

Table 2

Binge Eating Disorder and Substance Dependence Commonalities

	BED	Substance Dependence
Loss of Control	"A sense of lack of control over eating during the episode"	"The substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance"
Withdrawal	Reported by clinicians observing behaviors in patients with BED	Examples: irritability, restlessness
Tolerance	"Eating until feeling uncomfortably full, eating large amounts of food when not feeling physically hungry"	"A need for markedly increased amounts of the substance to achieve intoxication or desired effect, markedly diminished effect with continued use of the same amount of substance"

Adapted from Davis & Carter, 2009 and Cassin & von Ranson, 2007

"Food addiction" remains a controversial theory; consequently there is reluctance by many to classify BED as an addiction rather than an eating disorder. Cassin and von Ranson (2007) examined whether binge eating may be experienced as an addiction among women with BED. There are no standard criteria by which an "addiction" is assessed; therefore, the authors used Goodman's proposed diagnosis of an "addictive disorder" and the DSM-IV substance dependence criteria. DSM criteria were modified to directly pertain to binge eating. For example, in the criterion "persistent desire or unsuccessful efforts to control substance use," substance use was changed to "binge eating" to directly compare criteria. The authors found that most binge eaters met criteria for dependence (92.4%) but not for "addictive disorder" (40.5%). Participants

were most likely to endorse eating larger amounts than intended, continuing to engage in the behavior despite knowledge of persistent adverse effects, and having a persistent desire or making unsuccessful efforts to stop the behavior, and were less likely to report tolerance and withdrawal symptoms. There was also substantial variability in the type of withdrawal symptoms reported, including irritability, moodiness, anxiety, restlessness, migraines, insomnia, poor concentration, and lethargy.

Nonetheless, depending on the type of drug of abuse, withdrawal symptoms vary significantly. For instance, withdrawal symptoms are relatively uncommon for alcohol addiction, while very common for opiate dependence. This variability could also be the case for "food" addiction, perhaps depending on the type of food (e.g., sugar versus high-fat foods). Withdrawal itself refers to maladaptive physiological changes that occur in an individual who ceases heavy use of a substance. Often the physical consequences of withdrawal are the opposite effects of the drug's positive effects. Clinicians working with binge eaters describe withdrawal symptoms among that population (McAleavey & Fiumara, 2001). An empirical investigation of this phenomenon is warranted; however, many are reluctant to conceptualize food as a drug, especially given the variability in the type of food and its psychoactive effects. For example, there is a widely held belief that chocolate significantly improves mood, yet this alone does not make a strong argument that chocolate is inherently addictive (Rogers & Smit, 2000) or that removal of chocolate from a chocolate eater's diet will create withdrawal-like symptoms.

The evidence for tolerance among binge eaters remains controversial. Tolerance refers to a physiological response by which the desired effect of a drug is decreased after repeated exposures. Therefore, an individual increases the dosage to maintain the desired effect. Marlatt and Donovan (2005) further characterize tolerance as maintained by environmental cues that

elicit a preparatory physiological response and allow individuals to consume more of the drug even after the positive effects are diminished. Given the relationship between increased BMI and greater severity of binge eating (e.g., frequency of binging, average size of binge episode, and binge severity; Picot & Lilenfeld, 2002), this may suggest that "food tolerance" occurs among the obese.

Although not a formal criterion for substance dependence, craving is a commonly described phenomenon reported by many substance-using individuals; similarly, food cravings have been reported among those with BED (Davis & Carter, 2008), with the assumption that cravings influence binge eating and snacking behavior (Pelchat, 2002). Craving is defined behaviorally as "increased efforts to obtain a substance of abuse or its associated cues as a result of dependence and abstinence" (Avena, Rada, & Hobel, 2008). Furthermore, weight cycling, (which is associated with BED; Petroni et al., 2007) has been compared to the experience of relapse in substance users. Relapse occurs when a substance user who has experienced a period of abstinence encounters a lapse and then re-engages in excessive drug use. Cycles of cessation and relapse are common, mirroring a pattern of weight cycling experienced by many dieters and binge eaters (Davis & Carter, 2008).

Loss of control refers to the compulsive use of a substance despite significant adverse consequences. These consequences may include psychosocial distress, medical or health complications, legal troubles, occupational and financial problems, and poor interpersonal relations. Loss of control is also characterized by repeated unsuccessful attempts to cut down use or stop entirely. In other words, the individuals continue compulsive use of a substance in the midst of significant adverse consequences, and they are unable to cease or control their behavior. Colles, Dixon, and O'Brien (2008) suggest that loss of control among binge eaters may cause

them to seek out bariatric surgery in an attempt to gain control over their weight and psychological disturbances. Bariatric patients were examined pre- and post-surgery, and the individuals with pre-surgery BED were more likely to engage in grazing behavior post-surgery. There was high overlap between uncontrolled eating and grazing behavior (Colles, Dixon, & O'Brien, 2008). Given the comorbidity between binge eating and obesity, there is reason to believe that binge eating behavior persists despite adverse consequences (e.g., poor health, weight-related stigma and discrimination).

In summary, the current evidence suggests that there are common features associated with obesity (e.g., compulsive overeating) that operate similar to addictive behaviors. Behavioral symptoms such as tolerance, withdrawal, craving, and loss of control are often characteristic of compulsive overeating or compulsive substance use. Interestingly, Volkow and O'Brien (2007) suggest obesity should be classified and treated as not only a metabolic disorder, but a mental disorder, also drawing comparisons to substance dependence. However, there is considerable debate over its inclusion within the DSM-V. Marcus and Wildes (2009) conclude there is insufficient evidence to support the inclusion of obesity as a mental disorder for classification within the DSM-V. Future research is necessary to examine whether obesity represents a unique condition best understood as an "addiction."

Animal Models of Binge Eating

In animal models, the study of binge eating is limited by a number of subjective factors that are not easily assessed. For instance, feelings identified as risk factors in humans, such as loss of control, cannot be ascertained in rat behavior. To mimic the phenomenon of binge eating, food deprivation is often used to mimic dietary restraint in animal models of research. For instance, one study examined rats that were given limited access to palatable, or highly preferred,

foods compared to rats given a standard chow diet (Cottone, Sabino, Steardo, & Zorrilla, 2008). Following this event, rats were presented with a mere morsel of palatable food and then chow (i.e., less preferred food). The rats in the state of deprivation overate or exhibited behaviors similar to binge eating in humans including increased consumption (of nearly half of their daily caloric intake, a 7-fold increase designed to originally satiate) and displayed anxiety-like behavior in response to less preferred foods. The binge size was also correlated with the degree of anxiety-like behavior. Furthermore, this binge-like behavior occurs even after a rat has eaten a satiating quantity of chow. The authors suggest that this animal model may mirror similar patterns observed in humans, such as theories of restrained eating among individuals with anorexia nervosa, bulimia nervosa, or dieters restricting their caloric intake. However, binge eating in humans is not necessarily driven by metabolic need, as binge eating is associated with obesity and overweight status.

Environmental stressors such as negative affect are associated with binge eating in humans (Stice, 2001; Engel et al., 2007). Smyth et al. (2007) examined the temporal sequencing of binge eating and vomit behavior in women with bulimia and concluded that negative affect and stress are more likely to occur prior to a binge or vomit episode. Animal research has examined the role of environmental stressors in rats by using stressors such as tail pinching and food shock (Corwin & Buda-Levin, 2004). Animal models find that physical and environmental stress plays a key role in the maintenance of binge eating behavior. For instance, rats on a restricted diet and then exposed to a foot shock and given free access to “preferred” foods eat significantly more than rats not on a restricted diet (Hagan, Wauford, Chandler, Jarrett, Rybak, & Blackburn, 2002). Implications for human behavior will be discussed below.

Addictive-like Animal Models of Binge Eating

Animal models have also been utilized to experimentally examine the relationship between binge eating and addictive behaviors in rats. Avena and colleagues have used sugar as a palatable food to examine behavioral and neurochemical responses in rats. For instance, rats given an intermittent schedule of sugar and chow (through exposure and deprivation) are used to mimic a binge-restraint pattern that is common in people with bulimia (Drewnowski, Krahn, Demitrack, Nairn, & Gosnell, 1992). Rats put on an intermittent schedule of a sugar and chow diet show a decrease in chow consumption and an increase in the frequency of sugar consumption over time, compared to rats given free access to the same amount of food (Avena, Rada, & Hobel, 2008). This pattern mimics a "binge" episode that is often characteristic of compulsive substance use (Avena, Rada, & Hobel, 2008; Avena, 2007). Furthermore, rats that are food deprived and then exposed to a free access diet of glucose that is later removed show aggressive withdrawal-like symptoms. These rats exhibit increased withdrawal-like symptoms such as teeth chattering, forepaw tremor, and head shaking (Avena, Rada, & Hobel, 2008). This research may have implications or translate to some understanding of the human experience for eating behaviors and obesity. For instance, Avena and colleagues (2008) suggest that the theory of "food addiction" for humans may have some credibility, given the parallels between drugs of abuse and palatable foods found in rats. Although animal research may be useful in exploring the similar effects of eating behavior in humans, there are obvious limitations in drawing such parallels. Humans are not artificially put on intermittent schedules of sugar and chow; however, there is evidence that using this paradigm in rats may produce binge behavior, opiate-like withdrawal symptoms, which therefore may cause neurochemical changes that are similar among humans (Avena, 2007).

Neurobiology

The endogenous opioid systems are involved in many kinds of drug use, and it is now generally accepted that endogenous opiates mediate the rewarding effects for food as well (Pelchat, 2002; Mercer & Holder, 1997). The reward pathways of endogenous opioids, as well as dopaminergic brain reward circuits, are associated with overeating and drug use (Mathes, Brownley, Mo, & Bulik, 2009; Petroni et al., 2007). This evidence also indicates that highly palatable foods eaten in excessive amounts cause neuroadaptations, thus increasing compulsive use and cravings, and contributing to symptoms of withdrawal. Therefore, increased exposure to rewards (by food) can contribute to similar responses to those observed with drug addiction (Davis & Carter, 2008). This has also been observed among those with BED and bulimia nervosa (Drewnowski, Krahn, Demitrack, Nairn, & Gosnell, 1995). For instance, an opiate antagonist, Naloxone, suppressed the consumption of sweet high-fat food among those who engaged in binge eating, and this effect was independent of BMI. Additionally, evidence conducted from brain imaging studies suggests that dysregulation of particular neural circuits has been observed among obese individuals compared to lean individuals, which may be associated with compulsive behaviors such as overeating (Volkow et al., 2001). Humans all have the same reward pathways, but clearly not all become overweight or obese. Neuroadaptations in conjunction with individual differences in physiological responsiveness to food and the environment may contribute to a greater likelihood of obesity. For instance, Rodin (1985) suggests that those who are more reactive to food may become obese due to an increase in insulin production, which may consequently shift one's metabolism towards fat storage. Thus, obesity is likely due to complex biological and physiological factors, which may also play a role in other forms of excessive behavior.

Bariatric Surgery and Substance Use

The overlap between eating and addictive behavior suggests that post-bariatric patients may be at increased risk for addiction-related complications following surgery. However, few studies have thoroughly examined rates of substance use disorders in those seeking bariatric surgery. Black and colleagues (1992) examined 88 patients seeking vertical banded gastroplasty and found that 22.7% had a lifetime prevalence of an alcohol use disorder. The participants did not significantly differ from controls matched on age and gender, yet they were not matched on BMI. Rates of drug use were even lower (2.3%) and were also not significantly different from controls. In contrast, those seeking treatment were significantly more likely to have a lifetime prevalence of tobacco dependence (40.9% compared to 21.1%). Kalarchian and colleagues (2007) examined bariatric surgery candidates and found lifetime rates of 17.7% and 13.2% for alcohol abuse and dependence, respectively. However, 32.6% met criteria for lifetime rates of any substance disorder, although current rates of substance use were much lower: 1.7% with only .7% meeting criteria for alcohol dependence, and none for alcohol abuse. Interestingly, a more recent study (Mühlhans, Horbach, & Zwaan, 2009) identified even lower lifetime rates of substance use in bariatric candidates. A total of 15.1% of all participants had a lifetime rate of substance use disorders, while 11% met criteria for an alcohol use disorder. Current rates were much lower, with only one participant (N=146) meeting criteria for an alcohol use disorder (0.7%) and only one meeting drug use disorder criteria. Research from the National Comorbidity Survey finds that substance use disorders occur in roughly 14.6% of the general population; therefore it appears in general bariatric candidates present with a higher lifetime prevalence of substance use disorders compared to the general population (Kessler et al., 2009). Of note is the discrepancy between studies conducted as part of the pre-surgical screening process and those

conducted independent of the process. Mühlhans, Horbac, and Zwaan (2009) highlight that higher rates of lifetime and current substance use are found in studies conducted independent of the surgical approval process, suggesting that underreporting of symptoms may occur in those afraid of not receiving surgery.

Addiction Transfer

Interestingly, a recent report (Ertelt, Mitchell, Lancaster, Crosby, Steffen, & Marion, 2008), along with media attention and anecdotal evidence from substance abuse treatment providers, suggests elevated rates of alcohol use among post-bariatric patients. Media reports in particular have identified "addiction transfer" as a phenomenon that occurs among post-bariatric patients. While not a clinical or scientific term, "addiction transfer" refers to patients with addictive disorders who successfully overcome an addiction and subsequently develop another, thus transferring their addictive tendencies onto another form of addictive behavior. This theory implies that an underlying addictive pathology exists and causes the addictive behavior to manifest in a different form after successful treatment. Addiction transfer is similar to the concept of symptom substitution, which was a common debate during behavior therapy's early emergence. The idea of symptom substitution was that mere treatment of overt symptoms, without addressing an underlying pathology, would lead to the emergence of a new symptom. This theory, however, was not supported by empirical evidence (Kazdin, 1982). Similar to symptom substitution, addiction transfer has not received any empirical support.

While substance abuse is recognized as a chronically relapsing condition (Lescher, 1997), the temporal sequencing of engaging in alternate or substitute substance use remains unknown, given the lack of longitudinal studies. The age of onset for drug and alcohol dependence peaks around age 18 and rapidly declines after age 25 (Li, Hewitt, & Grant, 2004; Kessler et al., 2009)

yet it is unclear if patients who successfully overcome substance dependence develop a different or new addiction. Furthermore, data on whether recovered alcoholics transfer to excessive eating is also unknown. It is well known clinically, that patients who relapse typically relapse to their drug of choice, and yet it is unknown if addiction transfer occurs for typical substance users.

With respect to obesity or excessive eating behavior, the term "addiction" is used to denote an addiction to food. Therefore, among post-bariatric patients, the treatment itself, or the surgical changes in anatomy, are hypothesized to cause the patient to develop a new addiction (e.g., alcohol use) due to the lack of treatment for the underlying problem. Although the explanation seems logical, "addiction transfer" among post-bariatric patients has been criticized due to the lack of empirical support (Sogg, 2007). However, if food is conceptualized as a post-bariatric patient's "drug," the surgical constraints would not allow a post-bariatric patient to relapse to their drug of choice. This puts post-bariatric patients in a unique position, perhaps making a "transfer" more likely to occur, and perhaps particularly so if a patient also has a history of substance abuse. Given the high lifetime rates of substance dependence among bariatric candidates in combination with high rates of substance relapse, an examination of post-bariatric substance use is warranted.

Substance Use among Post-Bariatric Patients

Few studies have directly examined substance behavior among post-bariatric patients (Ertelt et al., 2008; Odom et al., 2010). In one study, Odom and colleagues (2010) recently surveyed postoperative patients regarding their concerns about alcohol or substance use. They found concerns over substance or alcohol use independently predicted weight regain. Preoperative substance use was not assessed, however.

Ertelt and colleagues contacted post-bariatric patients by mail 6-10 years after their surgery, asking them to complete a Post-Bariatric Surgery Appearance Questionnaire (developed for the purpose of the study). The authors found that a small proportion of participants developed alcohol use problems after surgery. However, many limitations were present, including small sample size (e.g., N = 70) and a lack of matched controls. The report also had a relatively low response rate (28%) given the selection factors of examining a substance-using population; it is logical that substance-using post-bariatric patients would be less likely to participate in the questionnaire. Furthermore, although the study examined rates of alcohol dependence and abuse, there was no information regarding the time of symptom emergence, or the temporal sequencing of events. Nonetheless, based on DSM criteria, the study found that 8.6% of respondents met criteria for alcohol dependence post-surgery (N = 6), and one individual met criteria for alcohol abuse. Additionally, 5.7% met retrospective screening criteria for alcohol dependence before and maintained their diagnosis after surgery (N = 4), while one participant met retrospective criteria for alcohol abuse, which stayed consistent after surgery. Two individuals spontaneously developed alcohol dependence after their bariatric surgery, and these participants did not identify alcohol problems or symptoms before their surgery.

Interestingly, although Ertlelt et al. conclude that low rates of substance use are identified in post-bariatric patients, they found that at least half of the participants surveyed (N = 38) endorsed that changes had occurred in their response to alcohol following their surgery. Of the 38 participants, 24 of them believed they became intoxicated more rapidly, and 14 endorsed feeling intoxicated after drinking less alcohol. Not a single participant endorsed the belief that it took them longer to become intoxicated or that it took more alcohol than before their surgery to become intoxicated.

Experimental evidence has found that post-bariatric patients may have increased sensitivity to alcohol for two reasons: the reduction in body weight and the rapid absorption producing higher blood-alcohol concentration to create increased feelings of inebriation during and shortly after drinking (Klockhoff, Naslund, & Jones, 2002). Two experimental studies have examined this effect in post-bariatric patients. Klockhoff and colleagues (2002) identified a higher and faster absorption of alcohol among female post-gastric bypass patients compared to controls matched on gender, age, and BMI who had not received weight loss surgery; however, the blood alcohol content (BAC) only remained higher among the bypass patients for 30 minutes after dosing. The authors suggest that the change in absorption may be a result of the smaller stomach size and the faster transfer of fluids into the jejunum as a result of gastric emptying. A more recent study replicated this effect in men and women and found that post-gastric bypass patients reached a higher BAC, peaked more quickly, and took longer to return to 0 (i.e., baseline) than controls (Hagedorn, Encarnacion, Bratt, & Morton, 2007), suggesting that gastric bypass surgery may alter the way alcohol is metabolized in both male and female post-bariatric patients. The increased sensitivity to alcohol, creating quicker feelings of inebriation, may serve as a strong reinforcer in post-bariatric patients, thus contributing to an increased risk for developing alcohol problems. Given that the lifetime rates of substance use are high among bariatric candidates, these findings may be particularly salient for post-bariatric patients who may have experienced drug or alcohol problems in the past, increasing the tendency for relapse after surgery.

Prevalence of Post-bariatric Patients enrolled in Substance Abuse Treatment

In 2006, Brighton Hospital, a comprehensive substance abuse treatment facility, began observing increased admissions of patients who reported histories of bariatric surgery (Saules et

al., 2010). In an effort to estimate the prevalence of post-bariatric patients in substance abuse treatment, the hospital instituted procedures to better track this variable in the electronic medical record (EMR) upon admission. Of 7,199 patients admitted between 2006 and 2009, 54 patients were identified as having a history of bariatric surgery (0.8% of the full sample). This pattern increased over time, with significantly more cases in 2009 (2%) than in earlier years of tracking. Notably, however, the original tracking identified only 51 bariatric cases. However, upon review of their charts, 3 cases originally selected as matched-controls were also identified as post-bariatric cases for the investigation. Therefore, roughly 6% of the randomly selected non-bariatric cases were actually post-bariatric cases, but the data were not entered into EMR. Extrapolating to the entire patient population at this facility, these data suggest that the actual prevalence of bariatric surgery patients enrolled in substance abuse treatment programs may actually be much higher than 6%, given that 6% of the randomly selected non-bariatric sample were identified as bariatric cases.

Chart reviews of the post-bariatric patients and matched-controls were conducted using a data tracking form developed to examine specific variables of interest. Charts were reviewed by one member of the research team, and a second member of the team reviewed the chart an additional time to scan for missing data the first reviewer was unable to identify. The investigation was conducted to generate future hypotheses, including hypotheses for the present investigation.

Saules et al. (2010) reported significant differences between the post-bariatric patients and non-bariatric cases. Post-bariatric patients were significantly more likely to be female, and although post-bariatric patients were equally likely to be diagnosed with alcohol dependence, they were significantly more likely be diagnosed with alcohol withdrawal.

Post-bariatric patients were found to have a significantly higher BMI than matched controls, but these groups did not differ on employment, marital status, race, depression anxiety, or substance abuse diagnostic categories. Post-bariatric patients were, however, less likely to be current smokers than controls.

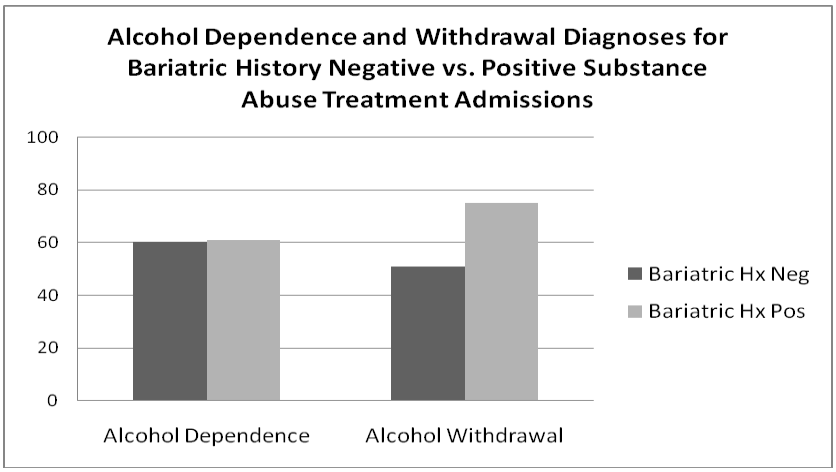


Figure 2. Alcohol Dependence and Withdrawal Diagnoses for Bariatric History Negative vs. Positive Substance Abuse Treatment Admission

The majority of post-bariatric patients sought treatment primarily for alcohol (62.3%), with 9.4% for alcohol plus another drug, 13.2% for opiates, 7.5% for benzodiazepines, 5.7% for polysubstance abuse, and one participant sought treatment for amphetamines. This distribution was significantly different than for control cases. Controls had higher percentages of opiate and polysubstance use whereas post-bariatric patients had higher alcohol, alcohol plus another drug, and benzodiazepine rates.

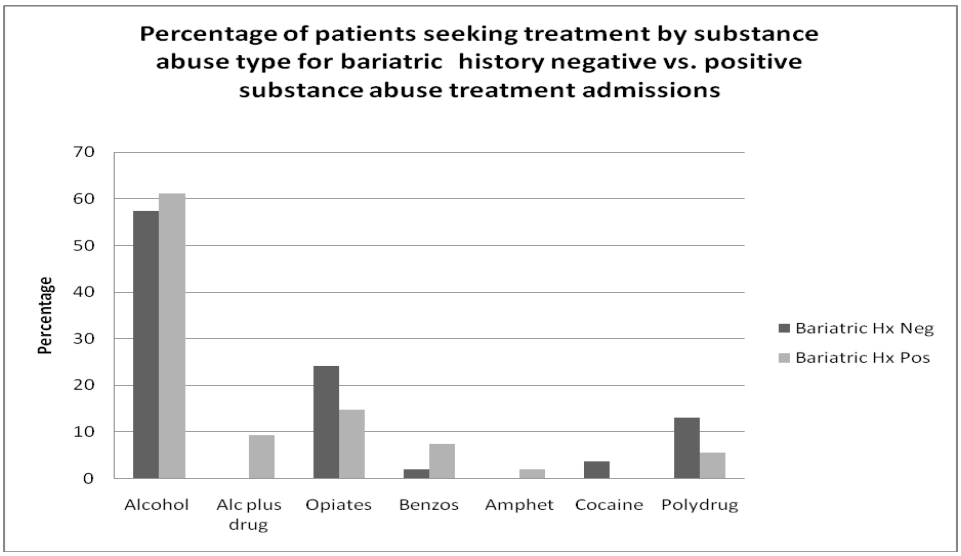
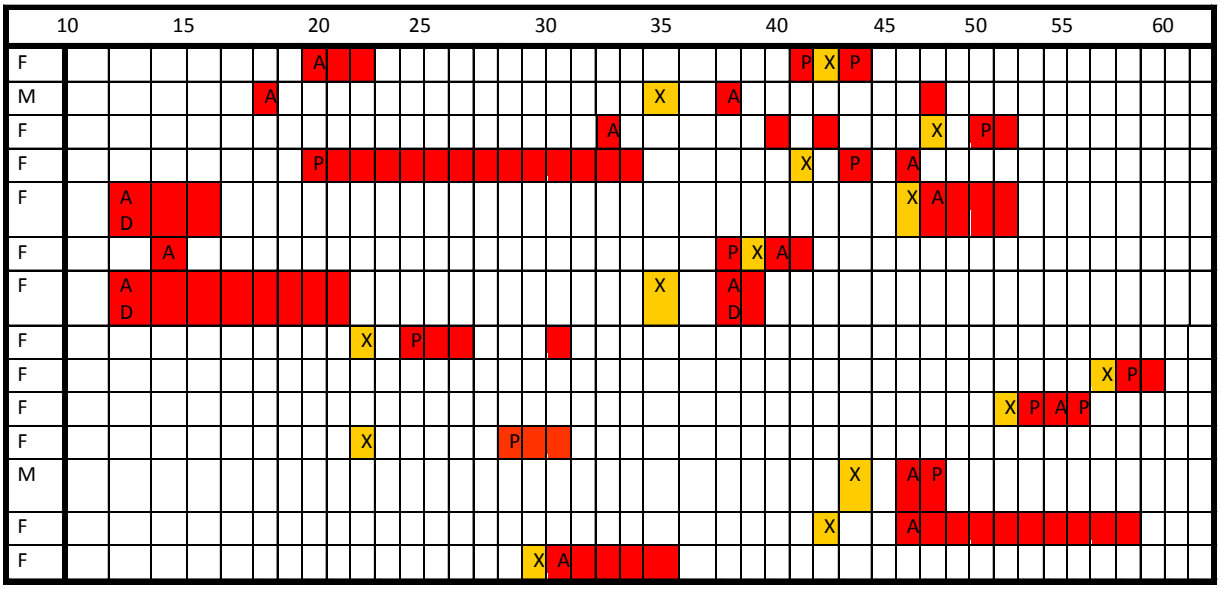


Figure 3. Percentage of Patients Seeking Treatment by Substance Abuse Type for Bariatric History Negative vs. Positive Substance Abuse Treatment Admission

When examining *only* the bariatric patients, a high proportion of patients (43.4%) were identified as initiating heavy substance use *after* their surgery, with no reported history of substance use before their surgery. Additionally, among the sample, 35.8% engaged in heavy use prior to their surgery, while 20.8% reported heavy use of one substance prior to surgery and began heavy use of another drug and/or alcohol after surgery. Among alcohol users, the majority (61.9%) engaged in heavy use prior to surgery, while this pattern was reversed for opiate (66.7%) and benzodiazepine users (89.5%), who initiated heavy use post-surgery.

A further analysis of the Saules et al. data, including the addition of 22 newly enrolled patients (Wiedemann et al., 2010) found patients initiating substance use prior to surgery (defined as "relapsers") were significantly more likely to use alcohol or marijuana after surgery, than patients with no reported history of substance use prior to surgery (defined as "new onset users": NOU). Furthermore, using semi-structured interviews with 20 post-bariatric patients enrolled at Brighton Hospital, Ivezaj, and colleagues (2010) found that the majority of patients

sought treatment for substance abuse only 5 years after their surgery. Interestingly, in contrast, a qualitative analysis suggests that patients typically developed substance use problems a year following their surgery (see figure 2), with several participants developing problems immediately after surgery.



A = Alcohol D = Drugs P = Pain Medications

X = Bariatric Surgery **Red = Problematic Use**

Figure 4. Representative Sample (n = 14) of Trajectories of Substance Abuse Development Relative to Bariatric Surgery

Self-reported alcohol consumption per day was typically identified in patient's charts as a range (e.g., "a pint to a fifth of vodka per day"). To account for the range, a minimum and maximum number of standard drinks per drinking day were recorded. Most (83.3%), patients reported current drinking, yet not all patients were drinking daily. The percentage of post-bariatric patients currently drinking did not significantly differ versus controls. Post-bariatric patients, however, reported a statistically higher minimum number of drinks per drinking day,

and this effect was more pronounced among those diagnosed with alcohol dependence (reporting a higher minimum *and* maximum number of drinks consumed per drinking day than controls).

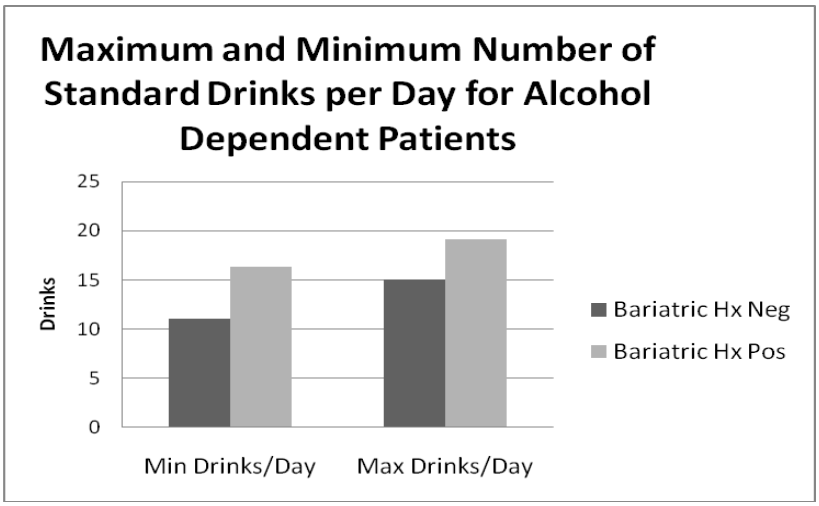


Figure 5. Maximum and Minimum Number of Standard Drinks per Day for Alcohol Dependent Patients

The investigation by Saules and colleagues was the first to report the prevalence rate of post-bariatric patients currently enrolled in substance abuse treatment and suggests post-bariatric patients may be over-represented in drug and alcohol treatment centers. The most striking finding suggests although bariatric and non-bariatric patients were equally likely to be diagnosed with alcohol dependence, the post-bariatric patients were significantly more likely to be diagnosed with alcohol withdrawal and consumed larger quantities of alcohol per drinking day (i.e., the lower and upper limit for post-bariatric cases was 19-50 drinks per drinking day, while controls averaged 15-34 drinks per drinking day). This finding is especially striking given the experimental evidence which suggests post-bariatric patients reach higher blood alcohol level (BAL) than controls (Hagedorn et al., 2001; Klockhoff, Naslund, & Jones, 2002), reach this level faster (Klockhoff, Naslund, & Jones, 2002), and take a longer time to return to baseline (Hagedorn et al., 2001).

Rationale for Present Study

The current evidence suggests there are significant differences in post-bariatric patients' substance use compared to non-bariatric substance use treatment seekers yet clearly more evidence is warranted to understand this phenomenon. It is unknown if post-bariatric patients in substance abuse treatment have unique treatment needs or whether unique variables may affect the course or prognosis of their substance use. Additionally, if post-bariatric patients are at risk for developing substance abuse, etiological factors should be identified and targeted during surgical preoperative evaluations or early post-operative assessments.

A more systematic replication of the findings by Saules and colleagues is warranted, given that several limitations present in their investigation. At times, patients' charts exhibited conflicting findings. For instance, a chart might note a patient was a smoker, and another record might report he or she was a non-smoker. In such cases, the default assumption was that the variable was present, but a more systematic approach to data collection would have been desirable. Additionally, information collected may have been influenced by the perceptions or biases of healthcare providers. Finally, there is some possibility of threats to validity as a result of circumstances surrounding the original collection of data later examined by this study in chart review. Specifically, a substantial amount of the data was collected upon intake to the hospital, at a time when patients would be expected to be in a state of active substance use and perhaps acute distress. Some evidence suggests that patients initially admitted for substance abuse treatment, as a result of this highly distressed presentation, may be more vulnerable to misdiagnosis. One study, for instance, found that these patients were frequently misdiagnosed with bipolar disorder due to the similarity between bipolar symptoms and those of active substance use (Goldberg, Garno, Callahan, Kearns, Kerner, & Ackerman, 2008). Systematic

data collection from patients currently enrolled and stabilized in treatment may provide a more reliable assessment of the patient's perceptions, history, and other variables that may be salient in meeting the needs of post-bariatric patients enrolled in substance abuse treatment programs.

Method

In February, 2009, this study received approval from the institutional human subjects review board at Eastern Michigan University and Providence Hospital and Medical Centers IRB to ensure safety and protection of the participants. Data collection was conducted from July 2009 till April 2011. All patients enrolled received an informed consent, which explained participants' rights, possible distress for participating, and the voluntary nature of the study.

Participants

A total of 57 post-bariatric patients, and 60 control (i.e., non-bariatric) substance abuse treatment patients were recruited for the purpose of this investigation. All participants were current patients who were voluntarily enrolled and are receiving treatment in Brighton Hospital's detoxification and rehabilitation programs. Brighton Hospital is the second oldest comprehensive drug and alcohol treatment program in the United States and receives patient referrals from a broad geographic range including Southeastern Michigan, Chicago, Indianapolis, Cincinnati, and Columbus OH (see http://brightonhospital.org/ for more information about the hospital and its various programs). All patients who reported receiving bariatric surgery were identified by staff members and asked to enroll in the study. An additional sample of 13 female control cases was also recruited in order to match participants for the number of drinks per day hypothesis (see below: hypothesis 2b).

Procedure

Members of Brighton Hospital's staff routinely assessed all patients currently enrolled in Brighton's rehabilitation, detoxification, or partial hospitalization programs from 7/02/2009 until 4/01/2011. History of bariatric surgery was routinely assessed at intake. If patients reported a history of weight loss surgery, they were asked to voluntarily participate in a research study. If they agreed, a member of Brighton Hospital's medical records personnel scheduled a meeting with a member of the research team to conduct a semi-structured interview. Recruitment was also conducted by a series of fliers posted throughout the facility and by staff who encountered patients who later reported receiving surgery. In order to recruit control participants, research staff were made available three days a week, at various scheduled times, and a series of announcements were made offering all patients the opportunity to participate. Research staff obtained informed consent from the patients and distributed the questionnaires. The patients later returned questionnaires to the research team or Brighton Hospital staff members.

Measures

The data analyzed for this investigation includes patient's EMR, chart review data, self-report questionnaire data and semi-structured interviews, the latter of which were only conducted with the post-bariatric patients as part of a larger study.

EMR. The data analyzed for hypothesis 2a includes data received from patients EMR. This database included all treatment seeking patients at Brighton Hospital from July 2009 to April 2011. This database included all relevant ICD-10 diagnoses (e.g., substance use disorders) and a field was added to track history of bariatric surgery.

Chart Review Data. A data tracking form was constructed to record all necessary information obtained from chart review forms. The variables of interest include: demographic

information, history of bariatric surgery, health information (e.g., height and weight, history of type II diabetes, hypertension), diagnoses, primary reason for treatment, history of sexual, physical or emotional abuse, smoking status (i.e., current, never, ex-smoker; if current, number of cigarettes per day), age of regular drug or alcohol use, age of first use and age of heavy use for each drug used, a report of all drugs ever used, and the minimum and maximum number of drinks per drinking day. During preliminary data collection, we identified a significant range in the number of drinks consumed per drinking day, as reported in patients' charts. Therefore, to account for this variability, we constructed variables called minimum and maximum of drinks per drinking day. A standard drink was defined as a 12oz can of beer, a 5oz glass of wine, and 1.5oz of hard liquor. If a chart indicated a variable was both present and absent, our default assumption was that it was indeed present. Any ambiguities were resolved by team consensus so that future decisions were made consistently and systematically by all chart reviewers.

Survey. All participants were asked to complete a survey assessing demographics, weight-related history, substance use (AUDIT-R; Fleming & Barry, 1990), quality of life (WHOQOL-BREF; Murphy, Herrman, Hawthorne, Pizone, & Evert, 2000), and behavioral excess.

Demographics. Information was obtained on a variety of demographic variables including age, gender, BMI (self-report of participants height and weight), race/ethnicity (self-report of participants ethnic background), years of education completed, relationship status (i.e., married, living with partner (same sex), living with partner (opposite sex), single (never married), divorced, remarried, widowed, separated, other), employment status (working full time greater than 35 hours per week, part-time regular hours, part-time irregular hours, unemployed-

student, unemployed-homemaker, unemployed-other, retired, disability, military), socioeconomic status (SES), and income.

Weight-related health history. Given that medical complications and comorbidities are common among the bariatric population, 10 items were constructed to assess weight-related health history. These items were meant to capture the timing and associated variables of surgery. Examples include, "What type of weight loss (bariatric) surgery have you had", "Were there any surgical complications" and "How old were you when you had bariatric surgery?" These items include a closed and open-ended response option and were only given to the post-bariatric patients. Additionally, all patients were assessed for several medical comorbidities commonly associated with obesity, such as type II Diabetes

Alcohol Use Disorders Identification Test (AUDIT-R; Fleming & Barry, 1990). The AUDIT-R is a 10-item measure designed to assess alcohol and substance use disorders. The original measure solely assessed alcohol use disorders (Babor, Fuente, Saunders, & Grant, 1992). The AUDIT-R is a modified version which includes other drugs (i.e., cocaine/crack, other stimulants, heroin or other opiates, marijuana, tranquilizers, hallucinogens) in order to assess a range of drug use. For instance, one modified item includes "How often would you have 6 or more drinks per day, 1 or more joints/lines/rocks/doses per day, or 3 or more pills per day." The first two items assess frequency and amount of use. All questions are scored by a 5-point Likert scale and responses range from not at all, monthly, weekly, several times/week, daily moderate use, daily heavy use. Number of doses of a substance per day provided response options of none, 1-2, 3-4, 5-6, 7-9, 10 or more. Scores range from 0 to 40, with higher scores reflecting more hazardous and severe drug or alcohol use. The original measure of the AUDIT has been

extensively researched and demonstrated high internal consistency and good test-retest reliability (see Reinert & Allen, 2007 for a review).

Substance use trajectories. Items were created by the authors to assess age of regular use, concern about use, and age when participant first sought treatment for drug and alcohol use. Examples include: "How old were you when you first began to regularly use alcohol?" and "When did you or others first become concerned about your alcohol/drug use?" Regular use was defined as two or more times per week. These items were included to better characterize the temporal sequencing of drug and alcohol problems participants were experiencing.

World Health Organization Quality of Life—BREF (WHOQOL; Murphy, Herrman, Hawthorne, Pinzone, & Evert, 2000). The WHOQOL-BREF assesses quality of life across four various domains: physical health, psychological health, social relationships, and environment. This 26-item measure is a shorter version of the original instrument (WHOQOL-100). Examples of these items include: "To what extent do you feel that (physical pain) prevents you from doing what you need to do?" and "Do you enjoy your life?" These items are scored on a 5-point scale ranging from 1 indicating "Not at all" to 5 "Very good." Items 4 and 26 are reverse-scored. Scores on this measure range from 26 to 130, with higher scores indicative of a better self-reported quality of life. Reliability for this measure was established based on internal consistency for the full scale (α = .84) and across each of the four domains (α = .80: physical health, .76: psychological health, .66: social relationships and .80: environment) (Aigner, Forster-Streffleur, Prause, Freidl, Weiss, & Bach, 2006). The test-retest reliability for the full scale (.76) and across four domains (.66 to .87) over a two to eight week period was also generally high (Murphy et al., 2000). Correlations between scores on the WHOQOL-100 and WHOQOL-BREF were high (r = .89 to .95). The WHOQOL-BREF shows good discriminant

validity between healthy and sick individuals as well (Murphy et al., 2000). A factor analysis confirmed the fit of the four domain model to the WHOQOL-BREF. Results indicate the physical health domain loads most heavily on the global quality of life, while the social domain loads the least (Murphy et al., 2000).

Behavioral Excesses. This investigation sought to explore whether other excessive behavioral tendencies (e.g., gambling) co-occur with post-bariatric surgery patients in substance abuse treatment. Therefore, a 7-item measure was constructed to capture the range of "behavioral excess." The measure asks: "During the four weeks before you came to Brighton, how often were you participating in each of the following activities" and answers include: internet surfing, gambling, videogame playing, sexual behavior outside of a committed relationship, eating sweets in amounts that most people would consider excessive, eating carbohydrates in amounts that most people would consider excessive, eating large amounts of food very late at night. Responses range from "Not at all" to "Nearly everyday, indicating 1 to 4, respectively. No items are reversed scored and scores range from 0 to 28, with higher scores reflecting greater behavioral excess. There are no established psychometric properties, as this measure was constructed solely for this exploratory phase of this investigation. This investigation will only focus on the following categories: internet surfing, gambling, videogame playing, and sexual behavior outside of a committed relationship, and compare frequency of behavior by comparing those who engage in several days or more, to those who report "not at all."

Semi-structured Interview. Post-bariatric participants also participated in a brief (i.e., 30 to 60 minute) semi-structured interview, as part of a larger investigation. The interview was designed by the current investigators in an effort to understand the pre-surgical screening process (e.g., what type of assessments the patient received, if alcohol use was systematically assessed in

the pre-surgical screening) before the bariatric surgery, in addition to examining factors and events that occurred after the surgery (see Appendix E for a copy of the full interview). Participants were asked about the relationship between eating behavior and alcohol/drug use: "are they connected in any way", "is one a substitute for another", or "do you think they are unrelated types of problems", and asked how they formed their impression. Participants were asked about their thoughts and impressions about why they encountered problems with drug or alcohol, and if they had any ideas of what might help post-bariatric patients avoid problems with drugs or alcohol. A member of the research team wrote the participant's responses verbatim during the interview; after the interview the research staff typed the patient's responses, including original quotations. The material was then coded to identify themes that emerged, as part of a larger investigation. For the purposes of the present report, the interview data were used to verify any inconsistencies between survey and chart review data, and permit a more valid classification of "relapse" versus "new onset" status. Given that our research team's preliminary findings revealed that a substantial number of patients report initiating heavy substance use after surgery (i.e., 43.4% Saules et al., 2010), it was anticipated that roughly half of patients would be classified what we define as "new onset users" (NOU). Participants were classified as "Relapsers" if they reported any history of regular substance use prior to their weight loss surgery. For example, a participant seeking treatment for cocaine abuse but reported a history of alcohol abuse prior to surgery, would be classified as a "relapser," whereas a patient who reported the spontaneous development of benzodiazepine abuse after surgery and no abuse of substances prior to weight loss surgery would be classified as a "new onset user." The classification of NOU and Relapser status was obtained from two variables—a question asked during the semi-structured interview which asks: "Do you feel like your problems with

alcohol/drugs began AFTER you had bariatric surgery? If yes, please describe how you began or increased your use of alcohol/drugs, and how you became concerned that it might be a problem for you," in addition to the substance use trajectory item in the questionnaires, which asks for the patients age at when they first engaged in regular substance use.

Specific Aims

The proposed investigation sought to replicate the previous findings from Saules and colleagues (2010), as well as incorporate and extend the pilot data from Izevaj et al. (2010) and Wiedemann et al. (2010). Given the finding that post-bariatric patients quickly develop problematic substance use after surgery, better characterization of the timing of substance development and how it may differ from non-bariatric patients is warranted (Hypothesis 1). Additionally, this investigation sought to understand associated features (e.g., type of substance use and frequency of substance use (Hypotheses 2a-2c), quality of life (Hypothesis 3)) of post-bariatric patients in substance abuse treatment, and how they may differ from non-bariatric substance-using patients. This investigation also sought to examine whether or not post-bariatric patients are more likely to engage in other forms of behavioral excess (e.g., gambling, excessive internet use) than controls, thus providing support for the theory of addiction transfer (Hypothesis 4). Last, the present study sought to examine etiological factors of spontaneous development (i.e., NOU) of substance dependence, post-surgery, or unique features of NOU status.

Hypotheses and Data Analyses

The data was analyzed using SPSS version 17.0 statistical software.

Hypothesis 1: Latency. Consistent with observations from qualitative interviews conducted with patients during the first wave of this study (Ivezaj et al., 2010), it was

hypothesized that post-bariatric patients would experience a shorter latencies between age of regular substance use, age when concerned about substance use, and age when the patient first sought treatment for substance abuse than patients who have not received weight loss surgery. This hypothesis was tested by conducting a *t*-test to examine group differences. Latency was examined by comparing the mean differences in time of post-bariatric patients and controls by examining three different ages: age of regular substance use, age when concerned about substance use and age when patient first sought treatment.

Hypothesis 2a: Alcohol withdrawal. It was hypothesized post-bariatric patients would be more likely to experience alcohol withdrawal. This hypothesis is consistent with this research team's previous findings which suggest post-bariatric patients were significantly more likely to be diagnosed with alcohol withdrawal than non-bariatric patients (Saules et al., 2010). A chi-square analysis was used to compare the groups and these data were exported from electronic medical records.

Hypothesis 2b: Number of drinks consumed. It was hypothesized that post-bariatric patients would consume a greater minimum and maximum quantity of drinks per day. This hypothesis was based on our research team's original findings which suggested that post-bariatric patients consume a greater maximum quantity of drinks per day than non-bariatric cases (Saules et al., 2010). For the purposes of this hypothesis, the participants with chart review data for self-reported minimum and maximum number of drinks per drinking day were included in this analysis. Given that there were significant differences between bariatric patients and controls on gender, and that there are well documented gender differences in alcohol intake, with women drinking less than men on average, (Nolen-Hoeksema, 2004; Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000) bariatric patients with reported alcohol use (n = 45) were matched on

gender. For testing this hypothesis only, Control participants were oversampled to yield enough female participants for matching (oversampled females n = 13). Then, the forty-five alcohol-using bariatric patients were matched with forty five control participants. Patients who provided a minimum and maximum number of drinks per day and who were diagnosed with alcohol dependence or withdrawal were selected for this analysis. A *t*-test was conducted to examine group differences.

Hypothesis 2c: Total number of substances. It was hypothesized that post-bariatric patients would use significantly fewer substances than patients who had not received weight loss surgery. This was also an attempt to replicate our research's team previous findings suggesting that post-bariatric patients tend to use alcohol and opiates, while control subjects report using multiple and a variety of other substances. The following substance categories were assessed: alcohol, cocaine/crack, other stimulants (Ritalin, Amphetamine, Adderall, Methaetamine, ect.), Heroin or other opiates, Tranquilizers (Xanax, Klonopin, Valium, GHB, Roofies, ect.), and Hallucinogens (LSD, Esctasy, Mushrooms, Ketamine) for a total of 7 substance categories that were compared. A *t*-test was conducted to explore group differences. This data was obtained from the AUDIT-R self-reported substance used.

Hypothesis 3: Quality of life. It was hypothesized that post-bariatric patients would endorse a poorer quality of life than patients who have not received weight loss surgery based on evidence that bariatric candidates experience a significantly poor quality of life. An ANOVA was used to examine group differences on the four domains of QOL: physical, psychological, social, and environmental.

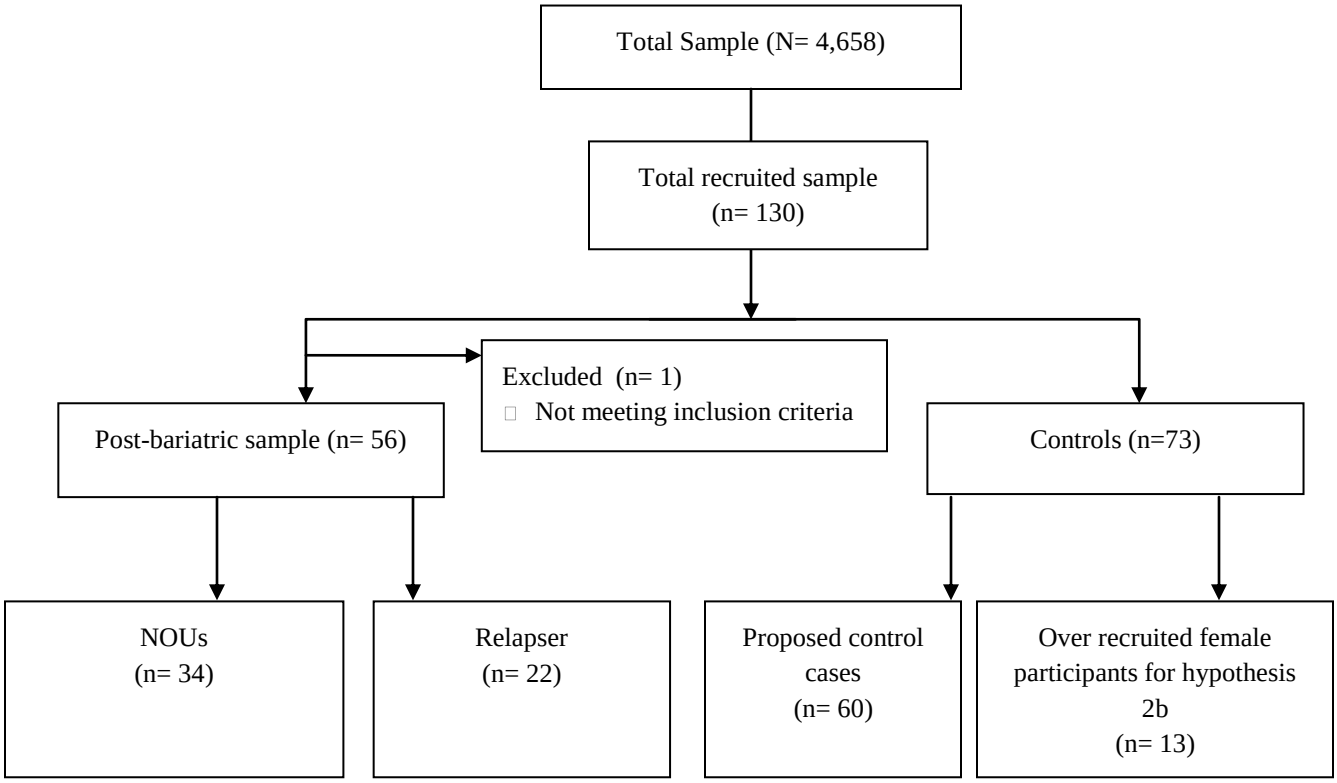
Hypothesis 4: Behavioral excess. The behavioral excess questions were originally included based on the addiction transfer theory which suggests that those who abstain from

excessive food intake may "transfer" their addictive behavior to another addiction thus replacing their "food addiction." Therefore, it was hypothesized that post-bariatric patients would endorse greater behavioral excess (e.g., gambling, excessive sexual behavior, video game play, internet use) than patients who have not received weight loss surgery. Each excessive behavior was examined separately, and tested categorically. The responses range from not at all, several days a week, more than half of the days, to nearly every day, therefore the response were dichotomized comparing, not at all (no), with several days a week to nearly every day (yes). A chi-square analysis was used to examine group differences.

Hypothesis 5: Exploratory analyses. Of the total post-bariatric sample that was recruited, 39.3% (n=22) were classified as Relapsers and 60.7% (n=34) were classified as NOUs. The proposed exploratory hypotheses sought to examine differences between these two sub-groups, yet given that the total responses for the questionnaires among Relapsers was low (n=19), statistical power was weak. However, several significant differences emerged when examining these groups, therefore, all of the proposed hypotheses will be replicated (i.e., hypothesis 1, 2b, 2c, 3 and 4) by comparing Relapsers and NOUs as the comparison group at the end of each section. It was hypothesized that Relapsers would be significantly more likely to engage in multiple substance use (e.g., alcohol and opiates), whereas NOUs would report less overall substance use.

Results

Participants



All participants were current male and female patients who were voluntarily enrolled in Brighton Hospital's detoxification, residential, and partial hospitalization programs. A total of 57 post-bariatric and 60 control (i.e., non-bariatric) substance abuse treatment patients were recruited. Initially, 83 control cases consented to participate, yet only 60 completed and provided questionnaire data, yielding a 72.29% rate of return. A total of 57 post-bariatric patients provided informed consent and participated in the interview portion of the study, but only 51 submitted questionnaire data, yielding an 89.47% full completion rate by post-bariatric patients. Therefore, for 5 of the bariatric participants, data are missing for the following variables: binge eating and associated symptoms, quality of life, depression and anxiety, smoking, alcohol and drug use, behavioral excesses. Several demographic variables that were

missing from the 5 patient's questionnaire data that could clearly be obtained from the patient's chart reviews (i.e., gender, race, age, height and weight, amount of weight lost from surgery) were retrieved and included in the final analyses. One post-bariatric patient received bariatric surgery for non-obesity related reasons, and therefore was excluded from the final analyses.

Post-bariatric Prevalence

During the duration of the study enrollment period (i.e., July 2009 to April 2011), a total of 4,658 patients were admitted to Brighton Hospital, 118 of whom received an ICD-10 diagnosis code of V45.86 for Status Post Bariatric Bypass in the electronic medical record. This yields a prevalence rate of 2.5% of all admissions with a recorded diagnosis of having received bariatric surgery. However, an additional 11 patients volunteered to be interviewed, whereupon both their self reports and the chart narrative supported that they had bariatric surgery, yielding a full sample of at least 129 bariatric patients, for a more accurate estimate of 2.8% of admissions with such a history. Notably, however, this is probably still an underestimate: if 11 of 56 bariatric cases (i.e., 19.6%) were not identified in the EMR, then roughly 20% of all true cases may have been missed. In addition, data from repeat admissions bolsters this conclusion. That is, among those bariatric cases with multiple admissions (n=49), 65.3% did not have a bariatric diagnosis entered in the EMR for all treatment episodes.

Of the 129 bariatric surgery patients identified (either from the EMR or by patients simply volunteering when they learned about the study), 56 were recruited and met criteria for the final study, yielding a 43.4% recruitment rate.

Of the post-bariatric sample (n=56), 91.1% identified as White, 3.6% were Black, 3.6% were "other" and 1.8% identified as Middle Eastern. Participants were 71.4% female, with a mean age of 44.80 years (SD= 9.49) and a current BMI of 31.18 (SD = 7.11). BMI did not

significantly differ by gender or racial status. The majority of patients received Roux-en-Y surgery (90.6%) while 3.8% received Bilipancreatic diversion with duodenal switch, one patient received the Lap-Band adjustable gastric banding, one patient received the vertical banded gastroplasty, and one received the gastric sleeve. Demographic variables of post-bariatric and control participants are summarized in Table 3. Additionally, significant differences emerged when comparing Relapsers and NOUs (see Table 5).

Table 3

Sample characteristics of post-bariatric patients versus controls[ab]

Demographic Variables	Post-Bariatric (n=56)	Controls (n=60)	Significance
Gender (% female)	40 (71.4%)	23 (38.3%)	**
Race (% white)	51 (91.1%)	51 (85%)	ns
Age	44.8 ±9.49	41.57 ±13.61	ns
Education (yrs)	14.39 ±2.1	13.79 ±2.12	ns
BMI	31.18 ±7.11	25.31 ±4.55	**
Marital status			*
Married or living with partner	33 (62.5%)	16 (26.7%)	
Single	9 (16.07%)	16 (26.7%)	
Divorced or Separated	8 (14.29%)	19 (31.67%)	
Widowed	3 (5.4%)	2 (3.33%)	
Other	1 (1.8%)	0 (0%)	
Employment status			ns
Working full time (>35 hours/week)	20 (36.4%)	15 (26.8%)	
Economic status			ns
Barely enough to get by	9 (17.6%)	12 (22.2%)	
Enough, but no more	18 (35.3%)	13 (24.1%)	
Solidly middle class	14 (27.5%)	15 (27.8%)	
Plenty of extras	6 (11.8%)	8 (14.8%)	
“Luxuries”	2 (3.9%)	2 (3.7%)	
Don’t know/unsure/prefer not to say	2 (3.9%)	4 (7.4%)	
Annual household income			ns

>150 thousand	5 (10%)	4 (7.8%)
100-149 thousand	7 (14%)	8 (15.7%)
75-99 thousand	3 (6%)	6 (11.8%)
50-74 thousand	17 (34%)	9 (17.6%)
25-49 thousand	10 (20%)	5 (9.8%)
10-24 thousand	3 (6%)	8 (15.7%)
<9 thousand	2 (4%)	2 (3.9%)
Don't know/unsure/prefer not to say	3 (6%)	9 (17.6%)

* = $p < .05$, ** = $p < .01$

[a]Values are expressed as n(%) or *M*±*SD*. [b]N=116 except for employment (n=111), economic status (n=105) and income (n=101).

Several follow up analyses were conducted to evaluate group differences in pre-treatment substances used, eating behavior, and psychological factors. Controls were significantly more likely to report ever smoking, smoking in the last month, reporting current cocaine and marijuana use, while post-bariatric patients were significantly more likely to report a history of sexual abuse. These data are summarized in Table 4.

Table 4

Substance-related and psychological characteristics of post-bariatric patients and controls[ab]

Follow-up Variables	Post-Bariatric (n=51)	Controls (n=59)	Significance
Smoke ever	31 (60.8%)	47 (79.7%)	*
Smoke in the last month	23 (53.5%)	39 (72.2%)	*
Alcohol use (current)	39 (76.5%)	45 (80.4%)	ns
Cocaine use (current)	2 (4.2%)	11 (20.4%)	*
Stimulants (current)	4 (8.3%)	6 (11.1%)	ns
Heroin or opiate use (current)	22 (44%)	27 (50%)	ns
Marijuana use (current)	10 (20.4%)	20 (37%)	*
Tranquilizer use (current)	26 (53.1%)	22 (40.7%)	ns
Hallucinogen use (current)	0 (0%)	4 (7.5%)	ns
AUDIT alcohol score	29.69 ±8.71	27.5 ±10.36	ns
AUDIT drug score	25.57 ±12.05	26.26 ±10.37	ns
FTND total	6.09 ±2.11	5.40 ±2.07	ns

Anxiety total	12.46 ±6	11.09 ±6.6	ns
Depression total	14.84 ±6.24	12.43 ±7.34	ns
Physical abuse	16 (50%)	13 (31.7%)	ns
Emotional abuse	15 (51.7%)	16 (38.1%)	ns
Sexual abuse	19 (51.4%)	11 (25%)	*

* = $p < .05$

[a]Values are expressed as n(%) or *M*±*SD*. [b]N=110 except for the following variables: smoke past month (n=97), alcohol use (n=107), cocaine (n=102), other stimulants (n=102), heroin/opiates (n=104), marijuana (n=103), tranquilizer (n=103), hallucinogen (n=103), FTND (n=61; i.e., current smokers only), AUDIT alcohol (n=79), AUDIT drug (n=66), anxiety (n=102), depression (n=103), physical abuse (n=73), emotional abuse (n=71), sexual abuse (n=81)

Table 5

Substance-related and eating behavior characteristics of Relapsers and NOUs[ab]

Eating and Substance Variables	Relapsers (n=19)	NOUs (n=32)	Significance
Pre-operative binge eating	14 (73.7%)	13 (40.6%)	*
Pre-operative binge eating + loss of control over eating	12 (85.7%)	12 (85.7%)	ns
Binge Eating Disorder	11 (57.9%)	9 (28.1%)	*
Smoke ever	15 (78.9%)	16 (50%)	*
Smoke in the last month	10 (58.8%)	13 (50%)	ns
Alcohol use (current)	16 (84.2%)	23 (71.9%)	ns
Cocaine use (current)	1 (5.6%)	1 (3.3%)	ns
Stimulants (current)	2 (12.5%)	2 (6.3%)	ns
Heroin or opiate use (current)	10 (52.6%)	12 (38.7%)	ns
Marijuana use (current)	7 (41.2%)	3 (9.4%)	*
Tranquilizer use (current)	13 (72.2%)	13 (41.9%)	*
Hallucinogen use (current)	0 (0%)	0 (0%)	ns
AUDIT alcohol score	29.58 ±7.65	29.74 ±9.38	ns
AUDIT drug score	25.69 ±13.39	25.47 ±11.22	ns
FTND score	6.0 ±2.65	6.15 ±1.73	ns

* = $p < .05$

[a]Values are expressed as n(%) or *M*±*SD*. [b]N=51 except for the following variables: loss of control (n=28), smoked last month (n=43), cocaine (n=48), other stimulants (n=48), heroin/opiates (n=50), marijuana (n=49), tranquilizer (n=49), hallucinogen (n=50), FTND (n=23), AUDIT alcohol (n=35), AUDIT drug (n=28)

Hypothesis I: Latency.

Hypothesis 1 was partially supported given that there were significant differences in the age that post-bariatric patients engaged in substance use and quickly attended treatment after acknowledging concerns, yet did not differ in the time from regular substance use to treatment seeking age, and the age at which they began to regularly use substances and developed concerns. Three independent sample t-tests were conducted to compare post-bariatric patients and controls on the mean difference in duration of time (in years) in three variables: age when engaged in regular drug/alcohol use, age when self or others became concerned about drug/alcohol use, and age when first sought treatment. Post-bariatric patients reported first using drugs (29.64 years, *SD* = 11.85 vs. 19.71, *SD* = 9.15) and/or alcohol (29.31 years, SD = 13.48 vs. 18.39, SD = 6.57) regularly at significantly later ages than controls, t (95) = 5.148, $p < .001$ (alcohol), t (73) = 4.093, $p < .05$ (drugs). On average, post-bariatric patients also first became concerned about their alcohol/drug use (39.18 years, *SD* = 11.89 vs. 26.93, *SD* = 12.14) at a significantly later age, t (103) = 4.784, $p < .001$, and first entered drug/alcohol treatment (41.87 years, *SD* = 10.21 vs. 33.55, *SD* = 13.70) at a later age than controls, t (105) = 3.531, $p < .001$. However, the first part of this hypothesis was not supported; the latency between regular use and concern about use did not significantly differ between post-bariatric patients and controls, t (102) = .66, $p = .511$, nor did the duration from regular use to age of treatment seeking t (104) = -.65, $p = .517$. As hypothesized, however, post-bariatric patients did report a shorter latency from age of concern to age of treatment seeking t (103) = -2.197, $p < .05$ (see Figure 5).

While NOU's reported a significantly later age of concern (41.35, *SD* = 9.94 vs. 32.72, *SD* = 13.23) when compared to Relapsers, t (49) = -1.72, $p < .05$, there were no differences on

any other age or latency variables. Follow-up descriptive analyses were conducted to examine the mean age of concern, relative to age at the time of bariatric surgery. On average, post-bariatric patients reported it took them 1.6 years (*SD* = 1.62) after their bariatric surgery to become concerned about their drug and/or alcohol problem. Interestingly, among Relapsers, the average time sober prior to their surgery was 9.18 years (*SD* = 8.37) with 64.3% of Relapsers reporting no substance use 5 years or more prior to surgery. These analyses were replicated within the total sample to explore the potential effects of gender, by comparing men and women and were also examined within *only* the control group and results yielded no significant differences.

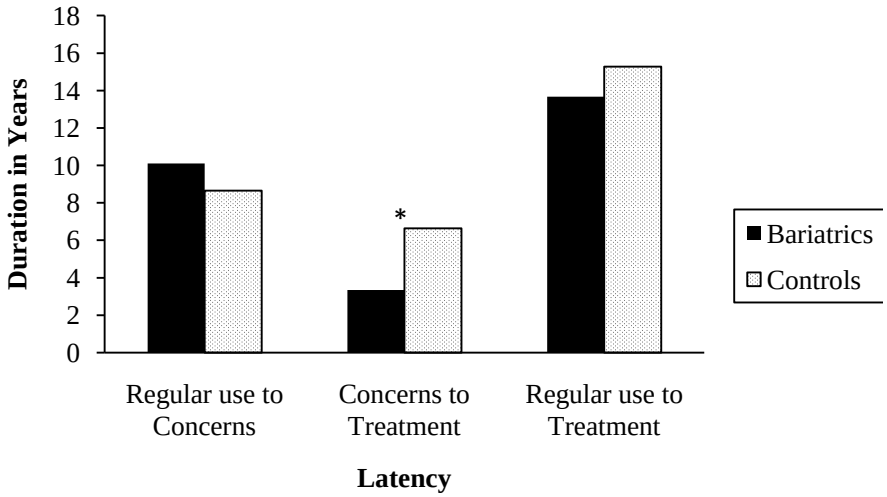


Figure 6. Latency between regular substance use, concern about substance use, and age of first treatment episode
Note. N = 104, N = 105, N = 106, respectively. *$p < .05$.

Hypothesis 2a: Alcohol Withdrawal

It was expected that post-bariatric patients would be more likely to be diagnosed with alcohol withdrawal compared to the total treatment sample. Consistent with the prior report by Saules et al. (2010), post-bariatric patients were compared to all non-bariatric patients at

Brighton Hospital in alcohol withdrawal diagnosis; data were obtained from electronic medical records of all patients admitted during the time of this study. A 2 X 2 (Bariatric status X Alcohol Withdrawal Diagnosis Yes/No) chi-square analysis was conducted. As hypothesized, results indicate that post-bariatric patients were significantly more likely to be diagnosed with alcohol withdrawal: 55.9% of bariatric patients were diagnosed with alcohol withdrawal while only 29% of the non-bariatric sample was diagnosed as such χ^2 (1, N = 4658) = 31.78, $p < .001$. Post-bariatric patients were also compared with controls on alcohol dependence and significant differences emerged. Specifically, 68.8% of post-bariatric patients were diagnosed with alcohol dependence, while only 54.6% of controls were so diagnosed χ^2 (1, N = 4658) = 7.41, $p < .01$.

Hypothesis 2b: Number of Drinks Consumed.

Contrary to this hypothesis there was no significant difference for the minimum number of drinks per drinking day. There was a trend suggesting that bariatric patients may consume a greater maximum number of drinks per drinking day (p = .073), with bariatric patients reporting an average maximum number of 19.05 (SD = 11.01) and controls reporting 15.26 (SD = 8.66) drinks per drinking day.

Additionally, no significant differences were observed between Relapsers and NOUs on the minimum or maximum number of drinks per day (p = .117, for both); Relapsers reported a mean number of 15.97 (SD = 11.85) minimum drinks per drinks per drinking day, and 22.51 (SD = 12.13) total maximum drinks per drinking day, NOUs reported a mean number of 11.81 (SD = 6.11) minimum drinks per drinking day and 16.94 (SD = 10.10) maximum drinks per drinking day. Statistical power for this analysis was weak, however, with alcohol use data only retrieved from 17 Relapsers and 27 NOUs.

Hypothesis 2c: Number of Total Substances.

It was expected that control participants would be use significantly more substances that post-bariatric patients, however, the current findings did not find support for this hypothesis. An independent samples t-test was conducted to compare post-bariatric patients and controls on the total number of substances used. Contrary to expectation that control participants would engage in greater variety of substance use than post-bariatric participants, results indicated that post-bariatric cases and controls did not differ on the total number of substance used t (105) = -1.246, p = .215. Interestingly, however, significant differences were found between Relapsers and NOUs. Relapsers reported using significantly more substances than NOUs, t (49) = 2.336, p < .05

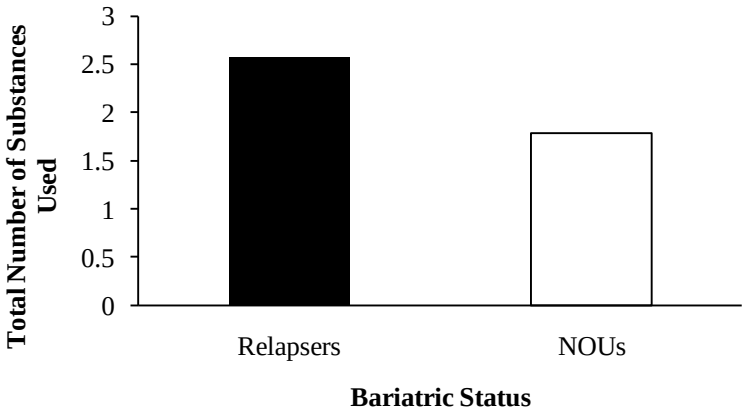


Figure 7. Total number of substances used
Note. N = 51, n = 19, n= 32, for Relapsers and NOU's, respectively. *p < .05.

Hypothesis 3: Quality of Life.

It was expected that post-bariatric patients and controls would differ on the four domains of quality of life; physical health, psychological, social and environmental. Therefore a one-way ANOVA was conducted to explore differences on mean scores in each domain. This hypothesis was partially supported; post-bariatric patients reported significantly poorer psychological

quality of life, t (105) = -2.551, $p < .05$, yet did not differ on the other three domains, t (105) = -.972, p = .333 (physical health), t (105) = -1.092, p = .277 (social), t (105) = -.037, p = .971 (environmental). To ensure the relationship between psychological quality of life and bariatric status was not solely a function of gender or BMI differences between groups, bivariate correlations were inspected; neither variable was significantly associated with quality of life. Furthermore, there were no significant differences on the stand-alone items which assess general QOL, t (105) = -1.288, p = .502, or and general health, t (105) = -1.140, p = .257.

Within the psychological QOL domain, however, there were significant differences when examining the individual items. Post-bariatric patients reported significantly poorer QOL scores on each of the following items: "How much do you enjoy life?', t (105) = -2.12, $p < .05$; "Are you able to accept your bodily appearance?", t (105) = -2.06, $p < .05$; "How satisfied are you with yourself?", t (105) = -2.20, $p < .05$; and "How often do you have negative feeling such as blue mood, anxiety, or depression?", t (104) = -2.25, $p < .05$.

No significant differences were observed between Relapsers and NOUs on any of the QOL variables.

Figure 8. Differences in quality of life in bariatric cases versus controls
Note. N=107. *$p < .05$

Hypothesis 4: Behavioral Excess.

It was expected that post-bariatric patients would endorse other excessive behaviors yet this hypothesis was not supported. Excessive internet use was reported by 38% of post-bariatric participants, and 50.9% of controls, χ^2 (1, N = 105) = 1.77, p = .129. Excessive gambling use was reported by 12% of post-bariatric cases and 19.6% of controls, χ^2 (1, N = 106) = 1.15, p = .211. Excessive video game play was reported by 22% of post-bariatric cases and 19.6% of controls, χ^2 (1, N = 106) = .09, p = .476, and excessive sexual behavior was reported by 12% of post-bariatric cases and 19.6% of controls, χ^2 (1, N = 107) = .92, p = .252.

Discussion

This study examined the proportion of substance abuse treatment patients with a history of bariatric surgery. Findings indicate that 2.8% of the total treatment seeking sample at Brighton Hospital was positive for bariatric surgery history, consistent with an earlier report from our research team (Saules et al., 2010). As in that earlier report, again it seems that this estimate may not fully capture the magnitude of this phenomenon. Specifically, bariatric status

was not entered into the EMR for 11 of the 56 bariatric patients who were recruited for the present study; in other words, approximately 20% of identified cases failed to have this surgical history status entered into the EMR. Extrapolating from these figures, if the total of 118 cases identified from EMR data is actually 20% under the true number of bariatric patients who were admitted, then the "true" number of cases may be roughly 148 patients (i.e., 148-(148*.2)=148-29.6≈118), which would yield an estimated prevalence of 3.2% (148/4568). While the exact rate cannot be known, it is clear that not all cases were entered into the EMR, so the prevalence estimate of 2.8% is, if anything, an underestimate. Incomplete data entry is also suggested by the finding that among the bariatric cases that had multiple treatment admissions 65.3% failed to be diagnosed during one or more of their admissions. This suggests that the actual prevalence of post-bariatric surgery patients in substance abuse treatment may be much higher than what we are able to estimate from the available data. Therefore, post-bariatric development of substance use disorders may be even more pervasive than the current investigation directly observed.

To put our prevalence estimate in context, an estimate of the proportion of the general population that has had bariatric surgery would be helpful. Although the total number of bariatric surgeries performed to date is unknown, a recent report by Nguyen and colleagues (2011) estimates that approximately 54.2 procedures were performed per 100,000 adults in 2008. Additionally, the ASMBS estimate of surgeries performed suggests that less than one percent of those who are medically eligible are receiving bariatric surgery (ASMBS). While it is difficult to translate these estimates to a clear underestimate of the proportion of the general population with a bariatric surgery history, they do not translate to even close to 2.8% of the general population. Therefore, the present study provides additional support that post-bariatric surgery patients may be overrepresented in substance abuse treatment facilities.

The primary aim of this investigation was to examine differences between post-bariatric surgery patients enrolled in substance abuse treatment versus non-bariatric substance abuse treatment patients. Several unique demographic differences emerged when examining these two groups. Notably, post-bariatric surgery patients were significantly more likely to be female. These findings are consistent with evidence by Saules and colleagues (2010) and coincide with data that females are more likely to receive bariatric surgery (Poulose et al., 2004; Smoot et al., 2006). It is well known that men are overrepresented in substance abuse treatment programs (Dawson, 1996). Therefore, female post-bariatric patients who seek substance abuse treatment may represent an atypical group and consequently may have unique treatment needs. The implications of potential treatment needs will be discussed later.

Post-bariatric patients were also significantly more likely to be currently married or living with a partner, whereas non-bariatric patients were more likely to be single, divorced or separated. Few empirical studies have examined post-operative relationship status among weight loss patients. The current investigation found that 62.5% of post-bariatric patients were married or living with a partner, which is consistent with the majority of studies finding roughly 54-78% of post-bariatric patients are married (Guisado-Macías, Vaz Leal, López-Ibor, Rubio, & Garcia Caballero, 2004). Anecdotally, weight loss surgery patients often report concerns about relationship stability and risk of divorce after surgery (Applegate & Friedman, 2008), but data from a well-designed follow-up studies suggests that marital relations may actually improve after surgery (Hafner, 1991; Rand et al., 1984). Interestingly, the data suggest that for patients who report poor relationship quality prior to surgery, the trend tends to continue after surgery, with the majority of relationships remaining stable (Applegate & Friedman, 2008).

The current study had low statistical power for comparing the small sample of Relapsers to the larger NOU group. It is important to note that although the minimum power requirement was not achieved, significant differences were found, suggesting these two groups may have separate etiologies and treatment needs. First, it is notable that 60% of the post-bariatric patients were classified as NOU's; further study of this group is warranted. A better understanding of predictors of new onset substance use is warranted.

Primary Research Hypotheses

When do post-bariatric patients develop problematic substance use? Post-bariatric patients reported a significantly later onset for the development of their substance use disorder, despite not differing from control substance abuse patients on current age. Specifically, post-bariatric patients began first using substances regularly, becoming concerned about their substance use, and first entering treatment at a significantly later age than their non-bariatric counterparts. These findings suggest that "typical" (i.e., non-bariatric) substance abusers first encounter problematic substance use at a younger age, consistent with the epidemiological findings of typical substance use trajectories. Specifically, those who encounter problematic substance use tend to first develop problems around age 18 and this effect tends to decline after age 25 (Kessler et al., 2009; Li, Hewitt, & Grant, 2004). Therefore, post-bariatric patients tend to first encounter problematic substance use at a time in life that is not normative for new onset development. Two of the main hypotheses, however, were not supported. The latency between onset of regular use and concerns, and the latency between regular use and treatment seeking, did not significantly differ between bariatric and non-bariatric substance abuse treatment patients.

There was a significant difference regarding the latency between age of development of concerns and treatment seeking age; post-bariatric patients experienced a shorter latency between

concerns about substance use and treatment seeking. The "telescoping" effect suggests that gender differences emerge in the course and development of problematic alcohol use (Piazza, Vrbka, Yeager, 1989). More specifically, this research examines onset, or initiation of "landmark events" in alcohol-related problems among treatment-seeking samples and finds that women tend to develop problematic use later in life than men, yet quickly develop problems and seek treatment more expeditiously (Keyes, Martins, Blanco, & Hasin, 2010; Randall, Roberts, Del Boca, Carroll, Connors, & Mattson, 1999). Given that our post-bariatric sample was predominantly female, perhaps these findings are best explained by the "telescoping" effect associated with gender, rather than something unique about bariatric surgery patients who develop post-surgical substance use. However, the results did not find evidence of telescoping when examining the total sample, and the control sample, therefore it appears these results may be related to bariatric status, rather than gender.

Alternatively, pre-surgical obesity may serve as a protective factor against the development of substance use disorders. As previously discussed, substance abuse and obesity in the general population do not appear to be significantly related, although these findings are often inconsistent. Additionally, post-bariatric patients may have greater exposure to medical professionals if they participate in post-surgical care which may contribute to greater access to medical intervention.

Although Relapsers reported using alcohol earlier and becoming concerned about their substance use at an earlier age, NOU's and Relapsers did not significantly differ on any of the latency ages. However, more power may be needed to detect significant differences between these groups, as there were only 16 (out of 23) Relapsers who provided data for all of these variables. In one respect, a history of substance abuse could be a risk factor for post-surgical

substance relapse which may also mean that Relapsers could be more likely to identify their post-surgical substance use as problematic and thus seek treatment more quickly. However, it may be relevant to examine the bariatric population in general to examine those with pre-surgical problematic substance use who do *not* develop post-surgical substance abuse. A recent dissertation examined a wide sampling of post-bariatric surgery patients and found that the majority (70%) of patients who had problematic substance use before surgery did not relapse afterwards (Ivezaj, 2011).

Are post-bariatric substance abuse treatment patients more likely than "typical" substance abuse treatment patients to be diagnosed with alcohol use disorders? Post-bariatric patients were significantly more likely to be diagnosed with alcohol withdrawal than were their non-bariatric counterparts. Contrary to the previous report by Saules and colleagues (2010), bariatric patients in this study were also more likely to be diagnosed with alcohol dependence. Therefore, results from the current investigation suggest that post-surgical alcohol use may confer high risk for the development of alcohol use disorders, both dependence and withdrawal. This observation of high reinforcing properties of alcohol among bariatric patients (inferred from high rates of alcohol-related diagnoses) is buttressed by experimental studies that suggest post-bariatric surgery patients have an increased sensitivity to alcohol. For instance, a recent case-crossover study (Woodard, Downey, Hernandez-Boussard, & Morton, 2010) examined bariatric patients pre- and post-operatively at three and six months follow-up and found that bariatric surgery patients had a breath alcohol level well above the legal limit (i.e., above 0.08) after drinking a single glass of wine. These findings are particularly salient given that the bariatric patients served as their own controls, affording a within subject examination of changes in bariatric patients' alcohol metabolism pre- and post-surgery. Consistent with prior

findings (Hagedorn, Encarnacion, Bratt, & Morton, 2007; Klockhoff, Naslund, & Jones, 2002), the researchers found that the post-bariatric patients experienced a higher peak breath alcohol content (BAC) and took longer to return to baseline than prior to surgery. Interestingly, these patients also reported an increased total number of symptoms of intoxication after surgery. Therefore, the authors suggest because post-bariatric patients' bodies respond differently to alcohol these patients may be less able to identify when they become intoxicated after surgery, which may lead to overindulgence. Maluenda and colleagues (2010) recently used a similar design to examine the effect of alcohol among a sample of bariatric patients who received the Laparoscopic Sleeve Gastrectomy procedure, and consistent with the aforementioned studies, alcohol absorption was significantly altered after surgery. In part, physiological changes in the absorption and response to alcohol for post-bariatric patients may explain the differences observed in alcohol use disorders in the present study. The current findings therefore indicate that bariatric surgery patients may be at risk for developing alcohol-use disorders after surgery. However, all bypass patients have the same altered physiology as a byproduct of surgery, but clearly, not all develop post-surgical substance use disorders. Therefore, further research to advance our understanding of which bariatric patients are most at risk for the development of post-surgical substance use disorders is warranted.

Contrary to these findings is a recent report which examined rates of lifetime and current alcohol use disorders and found that bariatric surgery patients had prevalence rates that were comparable to the general population (Suzuki, Haimovici, & Chang, 2010). The study however had several limitations, most notably, a poor response rate of only 9%; thus, the actual emergence of post-surgical alcohol abuse may actually be much greater, as there may be a

response bias. Future research is warranted to examine substance use disorders among treatment and non-treatment seeking samples of post-bariatric patients.

Contrary to the findings by Saules and colleagues (2010), in the current investigation post-bariatric patients did not differ significantly from controls in the minimum or maximum number of drinks per day consumed. There were several limitations present however; the previous report was able to match participants to controls on age, gender, and time of admission, while the present investigation was only able to match participants on gender. For instance, one study found that transitional life events can affect the course of alcohol dependence—events such as marital transitions and becoming a parent positively contributed to the likelihood of recovery from alcohol dependence (Dawson, Grant, Stinson, & Chou, 2006). Additionally, Pabst and colleagues (2011) recently reported on age-related differences in DSM-IV criteria for alcohol dependence, such that those 18-24 years of age were significantly more likely to meet criteria for the "larger/longer" and "time spent" criteria. In sum, age of the participants may have affected the results. Future research should attempt to replicate the previous findings by Saules et al. as it is unclear if post-bariatric alcohol use is more severe than that experienced by the general treatment population.

Do post-bariatric patients use fewer substances than the "typical" substance user?

Bariatric and non-bariatric substance abuse treatment patients did not differ statistically significantly in the total number of substances used between. Interestingly, an examination of the *types* of substances used revealed significant differences. Specifically, controls reported current use of cocaine/crack and marijuana, and lifetime use of cigarettes, significantly more than the post-bariatric sample. These differences could be a function of the time at which post-bariatric patients are developing problems with substances. Given that the majority developed

problematic use after surgery, significantly later in life than controls, perhaps post-bariatric patients did not have a long enough history of abuse to become exposed to more types of substances. Furthermore, a limitation to the substance use categories was that the opiate category includes both heroin *and* prescription substance use. Therefore, this may account for the lack of observable differences between the two groups, as opiates may be more readily available to post-bariatric patients who are likely to have received post-surgical pain medications. Relapsers reported using significantly more substances than NOUs. Therefore it seems that new onset development is associated with less varied drug use. In particular, Relapsers reported more significant marijuana and tranquilizer use, in addition to reporting a greater likelihood of ever smoking cigarettes. Relapsers may have more experience with different types of drugs, as they have a longer history of substance use. However, in terms of overall severity of substance abuse, the two groups appear similar, as there were no significant differences in the AUDIT total severity scores

Do post-bariatric patients experience a poorer quality of life? While post-bariatric patients did not report a significantly poorer physical health, social or environmental quality of life, they did however report worse *psychological* quality of life. While it is generally accepted that the morbidly obese, particularly surgical candidates, report a significantly decreased quality of life (van Nunen et al., 2007; Sarwer et al., 2005), post-surgical outcomes of QOL are less understood. For instance, several reviews suggest that the data on health-related quality of life among post-bariatric patients are often fraught with methodological limitations, such as age, gender, time since surgery, and amount of weight lost (Bocchieri, Meana, & Fisher, 2002; van Hout & van Heck, 2009; van Nunen et al., 2007). The present study however did not find that

age or gender was significantly associated with QOL. Furthermore, while the bariatric sample had a significantly higher BMI, it was not related to any of the QOL dimensions.

Interestingly, the present study did not find differences between the post-bariatric sample and controls on the physical domain of QOL which is somewhat inconsistent with prior research related to health-related quality of life. For instance, a recent study found that HRQOL improved at one-year post-surgical follow-up and these results were maintained at 5-year follow-up; however, the authors report that scores did not reach the level of the age and gender-standardized general population and that QOL did not improve significantly between 1 and 5 year follow-ups (Helmiö, Salminen, Sintonen, Ovaska, & Victorzon, 2011). The present investigation did not assess for pre-surgical QOL it is unknown if there was a change (or presumably an improvement) in QOL after surgery. However, in general, those in the morbidly obese category tend to experience the poorest QOL (Sarwer et al., 2005; van Nunen et al., 2007).

The current QOL scores among both groups (i.e., post-bariatric and controls) were considerably low; in fact, QOL scores obtained in all domains for both groups were considerably lower than community norms (Hawthorne, Herrman, & Murphy, 2000). Therefore, the QOL findings may be specific to substance users. QOL has not been heavily investigated among substance abuse treatment populations, with less than 100 studies on QOL among substance users published in the last 20 years (Laudet, 2011). Laudet suggests that the majority of studies that assess QOL among substance users have primarily been conducted among alcohol dependent patients. More specifically, several reviews suggest that QOL is very poor among alcohol dependent participants (Donovan, Mattson, Cisler, Longabaugh, & Zweben, 2005; Foster, Powell, Marshall, & Peters, 1999; Laudet, 2011) and perhaps among opiate-dependent

individuals (De Maeyer, Vanderplasschen, & Broekaert, 2010). However, for unknown reasons, QOL in addiction research is still in the infancy stage and therefore future research is warranted.

The difference in psychological quality of life among post-bariatric patients and controls however is quite notable as the QOL scores obtained from the control substance abuse subjects were already considerably low. The WHOQOL-BREF measure taps constructs within the psychological QOL domains such as bodily image and appearance, negative feelings, positive feelings, self-esteem, spirituality, religion, and personal beliefs, thinking, learning, memory, and concentration. The individual items that were significantly different in the psychological QOL domain were "enjoying life," "bodily appearance," and "negative feelings such as blue mood, anxiety, or depression." Therefore, it appears that the differences observed are not solely due to concerns about body image or appearance.

Additionally, no significant differences were observed between Relapsers and NOUs on any of the QOL variables. Therefore, the QOL differences between bariatric patients and controls are likely due to bariatric status rather than the chronicity of the substance use disorder.

Are post-bariatric patients engaging in other excessive behaviors? Contrary to expectations, post-bariatric patients and controls did not differ on any of the behavioral excess variables. The assessment of behavioral excesses in this study suffered from several limitations. The behavioral excess questionnaire was created by the researchers therefore reliability, validity, and normative data are unavailable. Therefore, the development of a behavioral excesses measure is warranted.

Additionally, excessive, or compulsive shopping behavior wasn't included in the questionnaire. Excessive shopping in particular may be salient for post-bariatric patients given the significant reduction in weight for the majority of patients. It would not be surprising,

therefore, that among those who do achieve significant weight loss would need to acquire clothes that fit them appropriately. Although compulsive shopping has not been systematically investigated among post-bariatric patients a recent dissertation examined post-operative problematic shopping among the pre-surgical binge eaters and found that higher pre-surgical binge eating scores predicted post-operative shopping/buying behaviors (Cook, 2011). Cook suggests that compulsive shopping among post-bariatric patients may be a way to manage emotions, as in general there are high rates of Axis I disorders, such as depression or anxiety. Alternatively, increased engagement in excessive shopping behavior could be a consequence of increased exposure by virtue of having to purchase new clothing as they lose weight. For instance, the cue exposure or cue reactivity literature suggests that exposure to environmental stimuli contributes to the behavioral response. Although the behavioral theory of the effect of cues on behavior has generally been applied in substance addiction (Niaura, 2000), it has also been applied to eating-disordered patients (Giel, Teufel, Friederich, Hautzinger, Enck, & Zipfel, 2011; Jansen, 1998).

During the qualitative interview within this investigation several patients enrolled in this study disclosed excessive shopping behavior, post-surgery. However, excessive shopping was not systematically assessed in either the interview or survey portion of the study and discussion of shopping behavior was only brought up if a participant disclosed the behavior. Therefore, future research should systematically assess excessive or compulsive shopping behavior in post-bariatric patients.

The addiction transfer theory suggests that patients who overcome an addictive disorder may subsequently develop another addiction, thus "transferring" their addictive tendencies based on the assumption that an underlying addictive pathology is driving the behavior. The current

findings do not support the notion that addiction transfer for the development of *other* excessive behaviors (e.g., gambling), occurs among post-bariatric patients, as post-bariatric patients did not significantly differ when compared to controls. However, a major limitation to this finding is that pre-surgical behavioral excess was not assessed. Therefore, it is unknown if the patient's behavior deviated from their previous pattern, or if the current rates are typical for the sample.

It is possible that pre-surgically, bariatric patients may tend to use food as a coping mechanism or, said differently, it may be their "drug of choice." Interestingly, roughly half of the post-bariatric patients in this sample reported binge eating behavior (i.e., eating within a 2-hour period what most people would regard as an unusually large amounts of food) prior to surgery, with 85% of those reporting binge eating also indicating feelings of loss of control, and approximately 39% of the total bariatric sample meeting full criteria for BED prior to receiving surgery. This is consistent with previous research on retrospective reporting of BED among bariatric surgery candidates' ranges, which ranges from 37.5% to 49% (Niego, Kofman, Weiss, & Geliebter, 2007). Our investigation did not directly examine whether pre-operative binge eating predicts post-surgical substance use. Guisado and Vaz Leal (2003) compared morbidly obese bariatric surgery candidates with and without binge eating disorder and found that pre-operative binge eaters reported significantly more symptoms of alcohol dependence *after* surgery. Future research should examine pre-surgical eating behavior to determine if perhaps post-bariatric patients are "transferring" a food addiction to post-surgical substance use. While prospective studies have examined rates of lifetime and current rates of substance abuse among bariatric patients (Kalarchian et al., 2007; Mauri et al., 2008; Mühlhans, Horbach, & de Zwaan, 2009; Rosenberger, Henderson, & Grilo, 2006), longitudinal studies in particular are needed to

understand if perhaps eating behavior manifests differently after surgery, or perhaps is "transformed" into problematic substance use, or another form of addiction.

Significant differences emerged regarding binge eating behavior and BED rates within Relapsers and NOUs. Specifically, Relapsers were more likely to report binge eating and meet criteria for BED. The average time sober prior to surgery among Relapsers was 9.18 years, with 64.3% of Relapsers reporting no substance use 5 or more years prior to surgery. This suggests that the majority of bariatric patients in this sample were not actively using substances during the pre-surgical process. Relapsers therefore may have used food as a coping strategy prior to seeking surgery and subsequently relapsed to drugs or alcohol *after* surgery when food was no longer able to be "abused." Future research is warranted to examine what risk factors may relate to NOU status. In particular, assessment of food addiction and trajectories of substance use may be helpful to understand the unique emergence of post-surgical substance use after surgery.

Treatment Implications. Post-bariatric patients may require tailored treatment given the significant differences that emerged when comparing them to general substance-using treatment patients. The majority of post-bariatric patients were female, married or living with a partner, and many developed problems with alcohol and other drugs significantly later in life. Consequently, in a group therapy setting (which is common for many substance abuse treatment programs), bariatric patients many of whom may have only recently developed problematic use, may have trouble relating to other patients with such different demographic factors and those with a long and more pervasive history of substance use.

The average time it took for post-bariatric patients to become concerned about their substance use—relative to their age of surgery—was only 1.6 years (SD = 1.62). Whether or not the aforementioned differences identified in developmental trajectories are a consequence of

gender or perhaps of bariatric status, post-bariatric patients often receive post-surgical care related to surgery. Post-surgical assessment of substance use among bariatric patients is therefore suggested during routine follow-up visits with the bariatric treatment team. This may allow physicians an opportunity to intervene if a patient is struggling with post-surgical addiction.

Additionally, evidence from the present study suggests that post-bariatric patients in substance abuse treatment may be more likely to experience alcohol withdrawal, in addition to alcohol dependence. Therefore, many post-bariatric patients in substance abuse treatment may need detoxification services to safely overcome problems with alcohol. At a minimum, post-surgical recommendations made to bariatric candidates could include psychoeducation regarding substance use after surgery. The American Association of Clinical Endocrinologists, the Obesity Society, and the American Society for Metabolic and Bariatric surgery all conclude that current drug or alcohol use should serve as an exclusionary criterion for bariatric surgery however anecdotally participants within this study reported that the pre-surgical screening period did not have a significant impact on their behavior post-surgery. Ivezaj and colleagues (in press) recently explored the qualitative interview data from this investigation and found that roughly 71% of representative sample (n = 24) reported recommendations that include more information of the associated risks of substance use *post*-surgery. Therefore, perhaps psychologists or other health-care providers may have a more effective role after surgery, particularly when post-bariatric patients are transitioning and experiencing major changes.

The differences in psychological QOL and sexual abuse history reported by post-bariatric patients may highlight the need for increased psychological care after bariatric surgery. These results are consistent with evidence that bariatric surgery patients have elevated rates of sexual

abuse/attack when compared to non-bariatric samples (Mahony, 2010). The reporting of sexual abuse among the post-bariatric population itself is so varied that rates range from 16-32%. The current investigation did identify a significantly elevated rate when comparing post-bariatric patients to controls with roughly half (51%) of post-bariatric patients indicating a history of sexual abuse. However, the finding itself may be an underestimate, given that this variable was not systematically assessed, but rather, could only be noted as present if it was so indicated in the patients' charts. Although the examination of post-bariatric patient's abuse history was not a primary aim of this investigation, future research should assess how abuse or perhaps trauma, more generally, relates to psychological quality of life within this population. Additionally, given that trauma history, or post-traumatic stress disorder, was not assessed, future research should investigate these variables among a substance-using post-bariatric sample.

Limitations

The current investigation had several limitations that should be noted. The generalizability of these findings may be limited to post-bariatric surgery patients who are similar to the study's sample characteristics. For instance, the study sample consisted primarily of middle-aged, Caucasian, females. Furthermore, the bariatric and control groups were limited to current inpatient substance abuse patients—which are not reflective of the majority of substance users, particular those who do not seek treatment. Future research should examine post-bariatric patients who are in other types of substance abuse treatment programs, in addition to non-treatment seeking populations. Additionally, the present study was not able to match participants on variables such as race, age, sex, and time of admission as the previous report by Saules and colleagues (2010) was able to do.

Another limitation of this investigation was the assessment of several of the relevant variables. Questions that assessed age of onset for substance abuse were asked retroactively through a self-report questionnaire; therefore, the accuracy of the patients' estimates may be questionable. Furthermore, the time at which patients were recruited to participate in the current investigation was not systematic—therefore patients may have participated during their first day of treatment, while others may have been recruited after receiving several months of care. Patients who are initially admitted may appear highly distressed which may impact their responses. Lastly, the current study was sufficiently powered to detect significant mean group differences for the majority of hypotheses, yet in several instances, desired power was not achieved. Therefore, caution is advised with respect to the exploratory analyses, particularly those comparing NOU's and Relapsers.

Conclusion

Overall, findings suggest that post-bariatric patients may be overrepresented in substance abuse treatment programs. Post-bariatric patients in such programs are more likely to be female, married or living with a partner, have poor psychological quality of life, are more likely to have histories of sexual abuse, develop problematic substance use later in life, develop problematic substance use shortly after surgery, and seek treatment quickly after acknowledging concern regarding their addiction. Longitudinal research is needed to examine a more accurate trajectory of substance development among bariatric patients, particularly in relation to the patient's age at surgery. Specifically, it may be relevant to examine when post-bariatric patients develop problematic substance with respect to the age at which they became obese. These findings may highlight the need for tailored treatment for post-bariatric patients who are currently in substance abuse treatment, as they are more likely to experience an alcohol use disorder; in addition, they

report a significantly poorer psychological quality of life and are more likely to report a history of sexual abuse. Additionally, post-bariatric patients are disproportionally diagnosed with alcohol dependence and withdrawal when compared to the general substance-using treatment population. These findings may highlight the need for tailored treatment for post-bariatric patients who are currently in substance abuse treatment as they are more likely to experience alcohol use disorders, in addition to reporting a significantly poorer psychological quality of life and a history of sexual abuse. Future research should attempt to replicate these findings, ideally in a larger and more diverse sample.

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Appendices

Appendix A
Demographic, Weight-Related History and Substance Trajectory Questionnaire

A. Background Information

1. How old are you? _____ years

2. Are you…

☐ Female
☐ Male
☐ Transgender

3. Please check the box(es) below which correspond to the racial/ethnic groups you belong to:

☐ Black or African-American
☐ White or Caucasian
☐ Hispanic or Latino/a
☐ Native American
☐ Asian or Asian American
☐ Middle Eastern
☐ Other (Please Specify: _____

4. How many years of education have you completed? _____ years
(NOTE: Completing High School or its equivalent = 12 years)

5. What is your current relationship status?

☐ Married
☐ Living with partner (same sex)
☐ Living with partner (opposite sex)
☐ Single (never married, not living with partner)
☐ Divorced
☐ Remarried
☐ Widowed
☐ Separated
☐ Other (Please Specify: _____

6. What is your current employment status?

☐ Working full time (>35 hours/week)
☐ Working part-time, regular hours
☐ Working part-time, irregular hours
☐ Unemployed - student
☐ Unemployed - homemaker

☐ Unemployed – other
☐ Retired
☐ Disability
☐ Military

7. What is the economic status of your current household?

☐ We have barely enough to get by
☐ We have enough to get by, but no more
☐ We are solidly middle class
☐ We have plenty of "extras"
☐ We have plenty of "luxuries"
☐ Don't know/unsure/prefer not to say

8. What is your annual household income?

☐ >$150,000
☐ $100,000-$149,000
☐ $75,000-$99,000
☐ $50,000-$74,000
☐ $25,000-$49,000
☐ $10,000-$24,000
☐ <$9,000
☐ Don't know/unsure/prefer not to say

B1. Weight-related Health History

1. What type of weight-loss (bariatric) surgery have you had?

☐ LAP-BAND adjustable gastric banding (LAGB)
☐ Roux-en-Y gastric bypass
☐ Vertical banded gastroplasty ("stomach stapling")
☐ Biliopancreatic diversion with duodenal switch (BPD)
☐ Don't know, not sure

If you are not sure, please provide some details about what you can recall about the procedure that you had:

2a. Were there any surgical complications? No ☐ Yes ☐

2b. If you experienced any complications, please describe what happened:

Actual or approximate DATE

3a. What was the date of your bariatric surgery? ___ /____ / ___

3b. How old were you when you had bariatric surgery?**.....**_____years old

3b. How old were you when you first begin to regularly
use alcohol?....._____years old
NOTE: Regular use = 2 or more times per week
Check here if not applicable ☐

3c. How old were you when you first begin to regularly
use drugs? ....._____years old
NOTE: Regular use = 2 or more times per week
Check here if not applicable ☐

3d. When did you or others <u>first become concerned</u>
about your alcohol/drug use? **.....**_____years old

3e. How old were you the first time you entered
alcohol/drug treatment? ....._____years old

4a. Before you had any form of weight loss surgery, had you been diagnosed with any of the conditions listed below? (Check all that apply)

☐ Chronic pain
☐ Diabetes (Type II)
☐ GERD (Gastroesophageal reflux disease)
☐ Hypertension (High Blood Pressure)
☐ High Cholesterol

☐ Infertility
☐ Obesity Hyperventilation Syndrome (OHS)
☐ Osteoarthritis
☐ Sleep Apnea
☐ Urinary Stress Incontinence (involuntary loss of urine that occurs during physical activity, such as coughing, sneezing, laughing, or exercise)

4b. If you checked any boxes in the previous question, please indicate the extent to which the condition has changed since your weight loss surgery.

	Worsened	Unchanged	Improved	No longer a problem
Chronic pain	☐	☐	☐	☐
Diabetes	☐	☐	☐	☐
GERD	☐	☐	☐	☐
High Blood Pressure	☐	☐	☐	☐
High Cholesterol	☐	☐	☐	☐
Infertility	☐	☐	☐	☐
OHS	☐	☐	☐	☐
Osteoarthritis	☐	☐	☐	☐
Sleep Apnea	☐	☐	☐	☐
Incontinence	☐	☐	☐	☐

5. How tall are you? _____ feet and _____ inches

6. What is/was your highest adult weight (not including pregnancy)? _____ pounds
What year were you at your highest weight? _____

7. What did you weigh just before your weight loss surgery? _____ pounds

8. What is your weight now? _____ pounds

9. What do you consider to be your ideal weight? _____ pounds

Appendix B
AUDIT-R

Substance Use (AUDIT-R)

1. Before entering treatment, how often did you have any of the following:

	Not at all	**Monthly**	**Weekly**	**Several times/ week**	**Daily Moderate Use**	**Daily Heavy Use**
Alcohol	☐	☐	☐	☐	☐	☐
Cocaine/crack	☐	☐	☐	☐	☐	☐
Other Stimulants (Ritalin, Amphetamine, Adderall, Methamphetamine, etc.)	☐	☐	☐	☐	☐	☐
Heroin or other opiates (Vicodin, Darvon, Codeine, OxyContin, Fentanyl, Methadone, LAAM, BUprenorphine, Suboxone, Oxycodone, Oxycontin, etc.)	☐	☐	☐	☐	☐	☐
Marijuana (Weed, Blunts, Hash)	☐	☐	☐	☐	☐	☐
Tranquilizers (Xanax, Klonopin, Valium, GHB, Roofies, etc.)	☐	☐	☐	☐	☐	☐
Hallucinogens (LSD, Ecstasy, Mushrooms, Ketamine, etc.)	☐	☐	☐	☐	☐	☐

2. Before you started treatment, on a day when you would drink any alcohol or use other drugs, how many drinks (alcohol), lines (cocaine), rocks (crack), joints (marijuana), doses (heroin) or pills would you typically take?

	None	**1-2**	**3-4**	**5-6**	**7-9**	**10 or more**
Alcohol	☐	☐	☐	☐	☐	☐
Cocaine/crack	☐	☐	☐	☐	☐	☐
Other Stimulants (Ritalin, Amphetamine, Adderall, Methamphetamine, etc.)	☐	☐	☐	☐	☐	☐
Heroin or other opiates (Vicodin, Darvon, Codeine, OxyContin, Fentanyl, Methadone, LAAM, BUprenorphine, Suboxone, Oxycodone, Oxycontin, etc.)	☐	☐	☐	☐	☐	☐
Marijuana (Weed, Blunts, Hash)	☐	☐	☐	☐	☐	☐
Tranquilizers (Xanax, Klonopin, Valium, GHB, Roofies, etc.)	☐	☐	☐	☐	☐	☐
Hallucinogens (LSD, Ecstasy, Mushrooms, Ketamine, etc.)	☐	☐	☐	☐	☐	☐

3. Before you started treatment, how often would you have 6 or more drinks per day, 1 or more joints/lines/rocks/doses per day, or 3 or more pills per day?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

4. During the year before you started treatment, have you found that you were unable to stop drinking or using other drugs once you had started? By this, we mean that you planned to only use a certain amount, but unintentionally used more than that.

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

5. During the year before you started treatment, how often did you fail to do what was normally expected of you because of drinking alcohol or using other drugs?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

6. During the year before you started treatment, how often did you need a drink or drug first thing in the morning to get yourself going after a heaving drinking or drug use episode the night before?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

7. During the year before you started treatment, how often did have a sense of guilt, regret, or remorse after drinking or using drugs?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

8. During the year before you started treatment, how often were you unable to remember what happened the night before because you had been drinking or using other drugs?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

9. Have you or someone else been injured as the result of your drinking or other drug use?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

10. Before you started treatment, had a relative, friend, doctor, or other health care worker expressed concern about your drinking or drug use, or suggested you should cut down?

Alcohol
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Drugs
- ☐ Never
- ☐ Less than monthly
- ☐ Monthly
- ☐ Weekly
- ☐ Almost daily
- ☐ Daily

Appendix C
Behavioral Excess Questionnaire

G. Behavioral Excesses

During **the four weeks before you came to Brighton**, how often were you participating in each of the following activities:

	Not at all	**Several days a week**	**More than half the days**	**Nearly every day**
Surfing the internet for more than two hours (not for work purposes)	☐	☐	☐	☐
Gambling (any type)	☐	☐	☐	☐
Videogame playing	☐	☐	☐	☐
Sexual behavior outside of a committed relationship	☐	☐	☐	☐
Eating sweets in amounts that most people would consider excessive	☐	☐	☐	☐
Eating carbohydrates in amounts that most people would consider excessive	☐	☐	☐	☐
Eating large amounts of food very late at night? If yes: • Check here ☐ if you would wake up and eat **after** you had already gone to bed. • Check here ☐ if you would typically do this **before** you went to bed?	☐	☐	☐	☐

Appendix D
WHOQOL-BREF

Quality of Life (WHOQOL-BREF)

The following questions ask how you feel about your quality of life, health, or other areas of your life. **Please choose the answer that appears most appropriate.** If you are unsure about which response to give to a question, the first response you think of is often the best one. Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life **in the last four weeks.**

		Very poor	Poor	Neither poor nor good	Good	Very good
1.	How would you rate your quality of life?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2.	How satisfied are you with your health?	1	2	3	4	5

The following questions ask about **how much** you have experienced certain things in the **last four weeks**.

		Not at all	A little	A moderate amount	Very much	An extreme amount
3.	To what extent do you feel that (physical) pain prevents you from doing what you need to do?	1	2	3	4	5
4.	How much do you need any medical treatment to function in your daily life?	1	2	3	4	5
5.	How much do you enjoy life?	1	2	3	4	5
6.	To what extent do you feel your life to be meaningful?	1	2	3	4	5

		Not at all	A little	A moderate amount	Very much	Extremely
7.	How well are you able to concentrate?	1	2	3	4	5
8.	How safe do you feel in your daily life?	1	2	3	4	5
9.	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about how completely you experienced or were able to do certain things **in the last four weeks**.

		Not at all	A little	Moderately	Mostly	Completely
10.	Do you have enough energy for your everyday life?	1	2	3	4	5
11.	Are you able to accept your bodily appearance?	1	2	3	4	5
12.	Do you have enough money to meet your needs?	1	2	3	4	5
13.	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14.	To what extent do you have the opportunity to do leisure activities?	1	2	3	4	5

		Very poor	Poor	Neither poor nor good	Good	Very good
15.	How well are you able to get around, physically?	1	2	3	4	5

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16.	How satisfied are you with your sleep?	1	2	3	4	5
17.	How satisfied are you with your ability to perform your activities of daily living?	1	2	3	4	5
18.	How satisfied are you with your capacity to work?	1	2	3	4	5
19.	How satisfied are you with yourself?	1	2	3	4	5
20.	How satisfied are you with your personal relationships?	1	2	3	4	5
21.	How satisfied are you with your sex life?	1	2	3	4	5
22.	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23.	How satisfied are you with the conditions of your usual living place?	1	2	3	4	5
24.	How satisfied are you with your access to health services?	1	2	3	4	5
25.	How satisfied are you with availability of transportation?	1	2	3	4	5

The following question refers to how often you have felt or experienced certain things in the last four weeks.

		Never	Rarely	Quite Often	Vey often	Always
26.	How often do you have negative feelings such as blue mood, despair, anxiety, or depression?	1	2	3	4	5

Appendix E
Semi-Structured Interview

Date:_____ Participant ID: _____

Interviewer:_____ Date of Bariatric Surgery: _____

Type of Surgery:_____

Brighton Admission Date:_____

Brighton Bariatric Project
Semi-Structured Interview

My name is _____. I am working with researchers from Brighton Hospital and Eastern Michigan University to gather information about why some people who have had bariatric surgery experience problems with alcohol and other drugs. You may have already participated in the Survey portion of this project, where we asked you a lot of questions about your surgery, substance use, efforts to control your weight, and related psychological factors. If you did complete the survey, I would first like to go over it with you, to see if you had any questions about the items on the survey, or if you would like to add any additional information to what you told us on the questionnaires.

<INTERVIEWER: USING A COPY OF THE PARTICIPANT'S SURVEY, IDENTIFIED ONLY BY SUBJECT CODE, GO OVER SALIENT QUESTIONS, ESPECIALLY THOSE PERTAINING TO SURGERY vs. ADDICTION TIMING AND ASK FOR CLARIFICATION ABOUT ANY ITEMS THAT WERE SKIPPED OR ANSWERED IN AN INCONSISTENT OR UNCLEAR MANNER, RECORD ANY NEW INFORMATION DIRECTLY ON THE SURVEY COPY, NEXT TO THE ITEM(S) TO WHICH THE COMMENTS PERTAIN>

Now, I would like to ask you to tell me about the type of screening process you went through before your bariatric surgery?

1. Do you recall where you had the surgery and who did the pre-surgical screening?
2. Do you recall what types of assessments you had?
3. Do you recall if you were asked about your use of alcohol or other drugs?
4. If so, what information did you share with the person who was doing the evaluation?

5. And, if you were asked, did you share complete information about your use of alcohol or drugs? Did you tell the person about the types and amounts of alcohol/drugs you might have been using at that time? Why or why not?

6. If you were using alcohol/drugs at that time, but did not reveal it, was it because you were concerned about how it might impact whether you would be allowed to have the surgery? If yes, tell me more about that…

7. Were you asked about your family history of alcohol or drug use? If yes, what do you recall being asked, and what did you say?

8. Were you asked about whether you engaged in "binge eating"? By that, we mean eating large amounts of food in short periods of time, and feeling like you couldn't control your eating behavior.

9. What other types of things were your treatment providers concerned about before they authorized surgery? What kind of information did you provide in response to those concerns?

Now, I would like to know a bit about what has happened since your surgery.

10. What sorts of recommendations were you given about behavioral changes to make so that you could have the best possible outcome from the surgery?

11. What kinds of behavioral changes were you able to make to support your weight loss efforts after the surgery?

12. How much weight did you lose after the surgery?

13. Have you gained any of the weight back? If so, how much? Why do you think this happened?

14. We are particularly interested in the timing of bariatric surgery relative to the development of your substance abuse problems. Were you aware of or concerned that you might have a problem with drugs or alcohol before you had bariatric surgery? If yes, please tell me a bit about that.

15. Before your surgery, had other people expressed concerns about your use of alcohol or drugs? If yes, please tell me more about that.

16. Had you ever had alcohol or drug treatment before your surgery? If yes, please tell me more about your experiences with treatment.

17. Do you feel like your problems with alcohol/drugs began AFTER you had bariatric surgery? If yes, please describe how you began or increased your use of alcohol/drugs, and how you became concerned that it might be a problem for you.

18. What do you think the relationship is between your eating behavior and alcohol/drug use?

    a) Are they connected in any way?

    b) Is one a substitute for another?

    c) Or do you think they are unrelated types of problems?

    If Yes, please tell me about how you formed that impression.

19. Are there any other thoughts, observations, or impressions you can share that might help us better understand why some people enter substance abuse treatment after they have had bariatric surgery?

20. Do you have any ideas about what might help post-bariatric surgery patients avoid problems with alcohol or other drugs?

Appendix F
Chart Review Data Form

Admission Dates (year of admission:_____)		**Demographics (circle)**	
Admission Date:	Discharge Date:	Age:	Marital Status: M (1) S (2) D (3) W (4) Other:_____ (5)
Rehab Admission:	Rehab Discharge:	Gender: M(1) F(2)	Education: 12=HS 14=Some college 16=Bach. 17=Some grad. 18=Masters
Detox Admission:	Detox Discharge:	Employ.: Y(1) N(2)	Emp. Type: FT(1) PT(2) Unemp.(3) Student(4) Other=_____(5) Unk(-9)
IOP Admission:	IOP Discharge:	Height (inches):	Race: B(1) W(2) Other=_____(3) Unk(-9)
Partial Admission:	Partial Discharge:	Weight (in lbs):	Sex. orient: Hetero (1) Homo(2) Bi(3) Other(4)_____ Unk(-9)

Physical Health				**Gastric Bypass and Trauma History**			
Chronic Pain: (type)_____	Y(1)	N(2)	Unk(-9)	Year of Surgery:			
Diabetes (II):	Y(1)	N(2)	Unk(-9)	Weight Lost (in lbs):			
GERD:	Y(1)	N(2)	Unk(-9)	Surgery Type:	Roux en-Y(1) Lapband(3)	Intestinal(2) Unk(-9)	
Hypertension:	Y(1)	N(2)	Unk(-9)	Physical Abuse:	Y(1)	N(2)	Unk(-9)
High Cholesterol:	Y(1)	N(2)	Unk(-9)	Emotional Abuse:	Y(1)	N(2)	Unk(-9)
Osteoarthritis:	Y(1)	N(2)	Unk(-9)	Sexual Abuse:	Y(1)	N(2)	Unk(-9)

Mental Health/Treatment	
DSM-IV diagnoses	
Primary reason for treatment 1=Alc. 2=Alc.+drug 3=Opiates 4=Bz 5=Poly 6=Amp. 7=Cocaine	
Family Hx of Mental Illness?	Family_substanceHX: Yes(1) No(2) Unk.(-9) Family_subtype: _____ Family_mentalHX: Yes(1) No(2) Unk.(-9) Family_mentaltype= _____
# of previous tx. eps./Year of tx. -9=Unk	
# of Didactic Sessions (blue)	
# of Family Sessions (pink)	Do not enter—will be obtained from Rosa
Suicidality hx?	Suicide_currentplan: Yes(1) No(2) Unk.(-9) Suicide_currentideation: Yes(1) No(2) Unk.(-9) Suicide_pastattempt: Yes(1) No(2) Unk.(-9)
Legal troubles?	Legal_troubles: Yes(1) No(2) Unk.(-9) Legal_type: _____

Substance Use	
Current Smoker?	Y(1) N(2) Ex(3) Unk.(-9) Smoking_quit: (year, if quit)_____ Cigarettes_perday= (20=1ppd.)_____
Drugs/Alc used: Self-report data, **CIRCLE** all drugs used, 1=Yes 2=No	Alc THC Cocaine/Crack Amphet Methamphet Heroin Methadone Other Opiates (Specify): _____ Benzos Barbs PCP Other: _____
Age of onset / heavy use, for each drug UNDERLINED above, if known	Alc __/__ THC __/__ Cocaine/Crack __/__ Amphet __/__ Methamph __/__ Heroin __/__ Methadone __/__ Other Opiates __/__ Specify:_____ Benzos __/__ Barbs __/__ PCP __/__ Other: _____ __/__
Admission drug screen CIRCLE ALL POSITIVE	Alc THC Coca PCP Amph Methadone Opt BZ Barb Other: _____

AOD Frequency	Alc_min / Alc_max =_____/_____ (if min max same – enter twice) Drug_frequency (days in a week)=_____

Appendix G
Informed Consent

St. John Health/Providence Hospital and Medical Centers
CONSENT TO PARTICIPATE IN A RESEARCH STUDY
AND
AUTHORIZATION TO USE OR DISCLOSE PROTECTED HEALTH INFORMATION FOR RESEARCH

TO BE CONDUCTED

AT

PROVIDENCE HOSPITAL AND MEDICAL CENTERS

Title: Prevalence and quality of life among post gastic bypass patients in a substance abuse treatment program

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This form contains information about a research study. You understand that you are being asked to participate in a research study being conducted through an unfunded collaboration between Brighton Hospital and Eastern Michigan University. If you choose to participate in this research study, you should clearly understand all information contained in this consent before you agree to participate by signing your name to the last page. One of the investigators or a research assistant will explain the study to you, answer any questions you may have, and witness your signature to this consent form. After you sign the form, you will be given a copy, and an additional copy will remain in your medical chart.

You understand that this is a research study. You have been asked to participate because you are a patient who has reported having had some form of weight-loss ("bariatric") surgery in the past, meet study requirements, and are being seen at Brighton Hospital and Medical Center. If you have never had weight loss surgery, you are being asked to participate as a comparison, or "control", participant, so that we can compare the experiences of those who have had the surgery with those who have not.

All subjects participating in research must volunteer, and be informed about the purpose, risks, benefits if any, and alternatives. If you have any questions about this research or the document, please ask.

Background and Purpose

The purpose of this research study is to gain a better understanding of how common it is for individuals who have had weight loss ("bariatric" or "gastric bypass") surgery to experience problems with substance abuse and dependence. We also aim to better understand the factors which might contribute to some weight-loss surgery patients being more likely to experience substance abuse or dependence.

Total participation time will be approximately two to three hours, which will include completing some questionnaires and an interview. You can choose to do either or both parts of the study (the interview and/or the survey), but we hope you will consider doing both. Both parts are expected to take less than one hour each to complete.

☐ Check here if you are volunteering to participate in the SURVEY portion of the study.

☐ Check here if you are volunteering to participate in the INTERVIEW portion of the study.

☐ Control Participant, Interview not applicable (**NOTE:** Control participants are not eligible for the INTERVIEW part of the study, simply because the interview will be asking about experiences directly related to the weight loss surgery itself, which Control participants will not have experienced.)

Study Description, Location, And Duration

This study is designed to help us to better understand why some weight-loss surgery patients encounter problems with alcohol or other drugs.

You will be asked to complete a survey that will include items about your history of substance abuse, weight problems, weight control efforts (including surgery, if applicable), quality of life, mood, anxiety, personality, identity, and your physical health. We estimate that it might take up to one hour to complete the survey, but some people may take considerably less time.

We will gather data from your medical record regarding your diagnoses and progress in treatment at Brighton, but this information will be de-identified so that the privacy of your health information will be protected. By this we mean that we will not use information about you that could be linked back to your identity. Once your information leaves Brighton Hospital, there will be no way for anyone to figure out who provided it.

To help with this process, throughout the study, the researchers ask that you DO NOT put your name on any of the study materials, so that your confidentiality can be protected. We will assign a confidential participant identification number to your materials so that we can link them together for data analysis purposes.

If you have ever had bariatric surgery, you will also be asked to participate in an interview about the factors that you feel may have contributed to your substance abuse problems and reasons for seeking treatment. The antecedents, functions, and consequences of eating and substance use behaviors will be assessed during these interviews. This interview will also take about one hour, although we are happy to hear what you have to say if you wish to talk longer.

We would like to audiotape these interviews so that the information you share can be transcribed accurately, but you do not have to agree to taping in order to participate. If you do not wish to be taped, the interviewer will simply take notes. If you agree to be audiotaped, there is a separate place for you to sign, giving us permission to do so, at the end of this form.

We hope to recruit up to 100 men and women in this study. However, part of the purpose of this study is to understand how common it is for weight-loss surgery patients to encounter substance use problems. Because we do not know this, it is difficult to determine how many people will be eligible for the study, and how long it might take to enroll them.

Possible Risks And Discomforts

Risks are minimal, aside from the potential for breach of confidentiality. To minimize this risk, information which leaves the premises of Brighton Hosptial will not include your name, but will instead be labeled with a unique study participation code.

While risks are anticipated to be minimal, you might still experience some emotional discomfort in talking or thinking about the problems you have experienced in both managing your weight and controlling substance use. Upon your request, Dr. Saules can inform Brighton Hospital Staff of any distress or concerns you might have so that they can be addressed within the treatment program by qualified staff.

For Women of Childbearing Potential. *Because this study only involves talking and filling out forms, there are no anticipated risks for your child. Therefore, even if you are pregnant or breast feeding, you may participate in this study.*

Benefits

There may be no direct benefit to you in participating in the study. It is possible, however, that you might find it interesting to reflect upon your experiences as you answer questions about your efforts to control your weight and manage your use of alcohol and/or other drugs. Participating in the study might spark ideas about recovery that you could follow up on with your treatment providers at Brighton Hospital. However, no direct benefits can be guaranteed. Nonetheless, the

information you provide is likely to be of benefit to others who might encounter struggles managing weight and addictions in the future. It is hoped that the information we learn from this study will help us to better identify pre-weight-loss-surgery candidates who are at risk for developing substance abuse problems and inform efforts to prevent post-surgical problems with substance abuse or other addictions.

Alternative Treatments

This study does not involve any form of treatment, so there are no alternatives that would be appropriate to suggest. You should not regard the interviews as a form of therapy, although it might feel good to have a chance to talk about the problems you have experienced. As noted above, if you wish us to release information you tell us to your Brighton Hospital treatment staff, we can do that with your permission. You do not have to participate in this study to continue to receive services at Brighton Hospital.

Voluntary Participation

You understand that your participation in this study is voluntary and that your refusal to participate will cause no penalty or loss of benefits that you would otherwise receive. If you decide to participate, you may change your mind about being in the study, and may quit at any time without penalty or loss of benefits regarding your future care. If new information becomes available during the study that may affect your willingness to continue in the study, your doctor and/or his/her associate will discuss this information with you. Also, your doctor may stop your participation at any time if he/she feels that is in your best interest.

Compensation

No funds have been set aside for injured research subjects. While medical care is available should an injury occur, the cost will be billed to you or your insurer in the ordinary manner. You will be compensated, however, for taking the time to participate in this study. If you decide to complete the questionnaire packet, you will be given a $10 Target gift card. If you decide to also do the interview, we will give you a second $10 gift card. You can do either or both of these aspects of the study. We hope that you will consider doing both, so that we can obtain complete information about your experiences.

There are no costs to you for participating in this study.

Confidentiality Of Records

The principal investigators will have access to your medical records and your test results. While absolute confidentiality cannot be guaranteed, you understand that all medical records and research material that could identify you will be kept as confidential as possible within state and federal laws. You also understand that your medical records could be examined by the Institutional Review Board (a group of medical and lay people at this hospital charged with protecting human subjects' rights) or government agencies in order to verify the data collected during this research study. If the results of this study are presented in any public forum, you will not be identified by name.

All responses and personally identifiable information will be kept confidential by being stored in separate locked secure cabinets and password protected computer files. You will be given an identification number to use throughout the study to protect your confidentiality. However, to ensure that you are using the same number throughout the study, the principal investigator will keep a log of personally identifiable information and identification numbers. Only the investigators will have access to this log, and we will store it in a secure locked cabinet separate from your individual responses. Once all data has been collected, this log will be destroyed. Information from this study may be reported or published in aggregated form, but you will not be identified in any publications or presentations.

The information you provide strictly for purposes of this research project will NOT be shared with Brighton Hospital staff unless you specifically request that we do so, in writing, using Brighton Hospital's standard release of information form. We are happy to share this information with your treatment staff, however, if you wish us to do so and authorize release of information.

Findings from this study may be published in scientific journals and may also be presented at professional conferences. You will not be identified in any of these presentations or publications, even if you allow us to quote some of what you tell us. Instead, we will either present information in aggregate (group) form, or we will use an alias (fake name or ID number) for you.

Questions Regarding this Study

If you have any questions about your rights as a subject in this clinical research study, you may contact the IRB (Institutional Review Board) office at 248 849-8889 at Providence Hospital and Medical Center.

If you have any questions regarding the study procedures, your role as a participant, or any injury or distress that you feel might be due to study participation, you may contact Dr. Karen Saules (734.487.4987 or ksaules@emich.edu) or Denise Bertin-Epp (810.225.2572 or depp@brightonhospital.org).

Authorization to Use and Disclose Protected Health Information (PHI)

Your participation in this study will require the use and disclosure of certain medical and other information about you. You will not be able to participate if you do not agree to the use and disclosure of your information.

The protected health information (PHI) that may be used or disclosed includes:

- All information collected during the research study as described in this form,
- The information that is contained in any medical record that is created during your participation in this research, and
- Other information in your medical record that may be considered related to your participation in this research, which may include: your medical history, physical examination results, laboratory test results or other test results (like an x-ray, scan, biopsy, EKG).

Who may see, use, or disclose your PHI:

☑ The researchers and members of the research team

☑ Other health care providers or employees of St. John Health who provide services to you for this study

☑ Representatives of the Institutional Review Board, the FDA (Food and Drug Administration), or other governmental agencies involved in research monitoring

☑ Members of the safety monitoring board

☑ Other agencies as required by law

❑ The sponsor, _____

❑ A clinical research organization, or other agent of the sponsor

❑ A laboratory outside of St. John Health System

What This Authorization Means

You understand that we cannot guarantee that your protected health information shared or disclosed under this Authorization could not be additionally shared or disclosed by the individual or organization that receives the information, and the privacy of your PHI may no longer be protected by the law.

You have the right to not agree to disclose your PHI. However, if you do not agree by signing this Authorization, you will not be able to participate in this research study.

If you do sign below, you have the right to withdraw your permission at any time, but you must do so in writing. You may send the written withdrawal to:

Karen K. Saules, Ph.D.

Eastern Michigan University

Psychology Clinic

611 W. Cross St.

Ypsilanti, MI 48197

You may no longer be allowed to participate in the research if you withdraw your permission. Also, you understand that any information collected before written notice of withdrawal is received will be shared as you have agreed.

You have the right to review your PHI. However, if you agree to participate in the research study and sign below, you will not be able to look at your research information until the research study is completed.

You will receive a copy of this document, the Consent to Participate in a Clinical Research Study and Authorization to Use or Disclose Protected Health Information for Research.

Expiration Date

Your authorization (permission) to use and disclose your health information will continue indefinitely, subject to the procedures and limits described in this form. Your health information will only be used for the purposes defined within this consent and authorization form.

Other Considerations

You have fully discussed and understand the purpose of this clinical research study and how it will be carried out. You have been allowed to ask questions about the study and all of your questions have been answered. You have read this consent form or had the complete form read to you and understand it. You know that your participation in this study is fully voluntary and you may withdraw at any time. If you refuse to participate or later withdraw from the study, it will not affect your care in any way. You also understand that by consenting to participate in this study, you are not waiving any other legal rights you may have because you are a subject in this study or as a patient at Providence Hospital & Medical Center.

Your signature below acknowledges that you voluntarily agree to participate in this clinical research study, and you will receive a signed copy of this form.

_____ _____ _____

Signature of Research Participant Date

_____

Printed Name of Research Participant

_____ _____ _____

*Signature of Witness Date

_____ _____ _____

Signature of Person Obtaining Consent

_____

Printed Name of Person Obtaining Consent

Permission to audiotape: By signing below, you consent to having you study interview audiotaped. You understand that the tape will not be associated with your name or other identifying information, and that it will be erased after the information has been transcribed.

_____ _____

Participant Signature Date

Permission to quote audiotaped material: By signing below, you consent to having the investigators quote material from you in presentations or publications. You understand that these quotes will not be associated with your name or other identifying information. Instead, the investigator will make up an alias (a fake name or number) to associate with your comments.

_____ _____

Participant Signature Date

***Witness**

*****Use when participant has had this consent form read to them (i.e., illiterate, legally blind, translated into foreign language).