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Risk Factors for Alcohol Use Disorder Among Post-Operative Bariatric Surgery Patients

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Risk Factors for Alcohol Use Disorder Among Post-Operative Bariatric Surgery Patients

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Nursing

by

Donna Marie Krogh

2020

ABSTRACT OF THE DISSERTATION

Risk Factors for Alcohol Use Disorder Among Post-Operative Bariatric Surgery Patients

by

Donna Marie Krogh

Doctor of Philosophy in Nursing

University of California, Los Angeles, 2020

Professor Catherine Carpenter, Co-Chair

Professor Paul Macey, Co-Chair

Alcohol use disorder (AUD), is a chronic brain disease that covers two previously independent disorders, alcohol abuse and alcohol dependence (NIH National Institute on Alcohol Abuse and Alcoholism, 2020). Post-bariatric surgical patients represent a vulnerable population that may be at increased risk for AUD as AUD is estimated to occur in 10-15% of post-operative bariatric surgery patients as reported by the Mayo Clinic (Mayo Clinic, 2015), compared to 6.2% of the general adult population (Substance Abuse and Mental Health Services Administration (SAMHSA), 2015). Since the phenomenon of increased risk of alcohol use problem among post-bariatric surgery patients is not fully understood, this study was conducted to evaluate potential predictors of alcohol use problem among 212 post-bariatric surgery patients aged 25.1 to 80.3 years old (mean = 52.4 , SD = 12.0). The study was guided by the Meleis' Transition Theory framework and the Altered Dopamine Reward Theory, with predictor variables identified in the literature. The sample recruited from UCLA Health and the Kaighan

databases were predominantly female, non-Hispanic, White or Caucasian, non-smokers, had a college degree or higher, and underwent sleeve gastrectomy. An online survey was administered in English via Qualtrics which consisted of the following self-report measures: a demographic questionnaire, the Alcohol Use Disorders Identification Test, the Power of Food Scale, the Interpersonal Support Evaluation List-12, the Differentiation of Self Inventory-Revised, the Food Craving Inventory, and Drug Abuse Screening Test-20. Although 6.1% in the study population met the criteria for AUD (ie., were AUD-positive), 21.7% of the population had alcohol use problems (ie., were AUP-positive). Findings from independent samples test analyses supported a significant association between AUD-positive status and three predictor variables - addictive eating behavior, low differentiation of self and low social support, as well as a significant association between AUP-positive status and two predictor variables - drug abuse and addictive eating behavior. Findings from logistic regression analysis supported history of drug abuse, food craving and addictive eating behavior as predictors of AUP-positive status. Together, these findings support previous reports and suggest that individuals with history of drug abuse, addictive eating behavior, low differentiation of self, low social support may be at an increased risk for alcohol use problems, including AUD, following bariatric surgery. This study also highlights that compared to using AUD status as the basis for identifying at-risk individuals, using AUP status proved to be a more comprehensive as it incorporated history of hospitalization and/or counseling due to alcohol use and/or substance use. Now that sleeve gastrectomy has overtaken RYGB to become the leading type of bariatric surgery and given that the association between sleeve gastrectomy and AUD is not as well studied as the association between RYGB and AUD, AUP status may serve as a useful basis for identifying at-risk individuals in further studies.

DEDICATION

I dedicate this scholarly work to my family.

My steady and devoted husband Erik with unwavering commitment to academia and for the sacrifices he made to enable this moment in time.

My wonderful daughters who are so strong and fill my heart with love and joy. They urged me on throughout my PhD journey and made me want to become a mother they could be proud of.

My stepson Nick who has overcome the many challenges of an adopted child from the former Soviet Union. We share many of these challenges.

I honor and thank my mom, Jody Dawn for raising 3 children as a single parent and dedicating her life to give us the education she never had.

My now-deceased Father, Bob Kenyon, and his wonderful nurses who in caring for my Dad in his final days inspired me to pursue a nursing career.

I honor and thank my brothers, Darryl, Danny and Bobby, for being my kindred spirits; for filling my days with laughter, love, and support.

I also dedicate this dissertation to those who find themselves with severe alcohol use problems after bariatric surgery. I thank you for generously giving of your time and entrusting me with your life stories – a most powerful ember.

It is my resolve that this be one of many scholarly works to shed light on the human condition in an effort to give a voice to the vulnerable. This work is especially dedicated to my friend Kathi, who was not able to overcome this disease after bariatric surgery, and her family, who were left to bear the burden of her passing.

Table of Contents

DONNA MARIE KROGH, PHD CANDIDATE, MSN, CCRN
Curriculum Vitae
University of California, Los Angeles
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EDUCATION

PhD Nursing Research, University of California, Los Angeles, California 2014 - present
Bachelor of Science in Nursing, University of Central Florida, Orlando, Florida - 2005
Advanced Degree in Nursing, Brevard Community College, Cocoa, Florida - 2003
Associate of Science, Valencia Community College, Orlando, Florida - 2002

LICENSURE & CERTIICATES

BLS - Basic Life Support
American Heart Association expires: 7/2023

PALS – Pediatric Advanced Life Support
American Academy of Pediatrics

TNCC – Trauma Nursing Care Course, ENA-Emergency Nurses Association

ACLS - Advanced Cardiovascular Life Support
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RN – Registered Nurse, Board of Registered Nursing, expires: 1/31/2023 lic#: 682003 CA

CCRN – Certified Critical Care Nurse, American Association of Critical Care Nurses

AWARDS

Graduate Research Mentorship (GRM), UCLA Graduate Division, University of California Los Angeles - 2014-2015 "Alcohol Use Disorder in Postoperative Bariatric Patients: A Review of the Literature"

Graduate Summer Research Mentorship (GSRM), UCLA Graduate Division, University of California Los Angeles - 2014 "Medical follow up after bariatric surgery: Transfer addiction issues. General recommendations are needed for the prevention and treatment of Alcohol Use Disorder (AUD)

Volunteer Honorary Award-Patient Liaison, UCLA Medical Center, Santa Monica (2014)

Bright Star Award for Excellence, Cedars-Sinai Medical Center, Los Angeles (2006 & 2007)

Phi Theta Kappa Honor Society, Winter Park Chapter - 1999-2002

TEACHING EXPERIENCE& RESEARCH EXPERIENCE

Research Assistant, working under the supervision of PI Adey Nyamathi, ANP, PhD., FAAN providing interventions for Homeless Female Offenders Returning to the Community: Improving Hopeful Futures (Female Ex-Offender Mentoring in Care (FEM-CARE), NIH/NIDA R34 DA035409

- Support formerly incarcerated women who are homeless and in treatment for addiction by providing resources which promote health, education, career building, and financial assistance program awareness necessary to improve their post-treatment chances of success. Conducts groups and one-on- one interviews, which are structured around pilot study intervention. Trained and conducted weekly Dialectical Behavior Therapy (DBT) at Residential Drug Treatment (RDT) facilities located in and around Los Angeles County (i.e. Skid Row) for 6 months intervention to 4 cohorts.

Research Assistant, working under the supervision of PI Catherine Carpenter, PhD, MPH, Associate Professor of Medicine, Nursing & Public Health

- Working on studies of genes, food addiction, and obesity. Assisting with developing contacts with addiction treatment facilities, developing research proposals, obtaining references, and attending lectures. Current with reading material to ensure a full understanding of the conceptual framework that underlies studies.

Research Assistant, National Therapeutic Services

- 1-year In-patient treatment facility and Outpatient transitional facility.
- Drug screening, support groups and 1:1 interview

Teaching Assistant, University of California School of Nursing

- N152W Human Devel/Health Prom in Culturally Diverse Population
- N3 Human Physiology for Healthcare Providers & Laboratory
- N13 Introduction Human Anatomy & Laboratory Skills
- Clinical Skills Assessment

CLINICAL EXPERIENCE

COVID Crisis Intensive Care & Nurse Travel Nurse

- Kaiser Permanente Los Angeles Medical Center
- Harbor UCLA Medical Center
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TRAVEL CCRN

- Johns Hopkins Medical Center, Oncology Intensive Care Unit (ICU)
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- Los Angeles County-USC Medical Center; Cardiovascular ICU
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- St. Joseph Hospital, ICU
- St. John's Health Center, ICU
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- Long Beach Memorial Hospital, ICU

RN, Osceola Regional Medical Center, Osceola, Florida, 2005-2006

- Intensive Care Unit (ICU)
- Progressive Care Unit (PCU),

RN, Graduate Nurse Program, Orlando Regional Medical Center, MD Anderson & Arnold Palmer Children's Hospital, Orlando, Florida, 2003-2004

PRESENTATIONS

49th Annual Communicating Nursing Research Conference*, Innovations in Engagement through Research, Practice, and Education,* Disneyland Hotel, Anaheim, CA April 6-9, 2016

4th California Nursing Doctoral Conference, Feb 6th, 2016, Costa Mesa, Panel Discussion, 2016

Betty Ford Hazelden, Residential Program for Professionals in Recovery, Rotating Speaker 2011-Present

House of Hope, Residential Program for Re-entry, Rotating Speaker 2009-Present

Chapter 1 – Introduction

Statement of the Problem

Bariatric surgery, particularly Roux-en-Y gastric bypass (RYGB), is associated with increased risk of alcohol misuse and alcohol-related problems after surgery. Alcohol use disorder (AUD), is a chronic brain disease that covers two previously independent disorders, alcohol abuse and alcohol dependence (NIH National Institute on Alcohol Abuse and Alcoholism, 2020). It is estimated to occur in 10-15% of post-operative bariatric surgery patients as reported by the Mayo Clinic (Mayo Clinic, 2015), with up to 21% of post-operative RYGB patients meeting the criteria for AUD between 2 to 5 years post-surgery as reported in other studies (Cuellar-Barboza et al., 2015; King et al., 2012; Mayo Clinic, 2015, 2017; Mitchell et al., 2015; Suzuki, Haimovici, & Chang, 2012). Furthermore, post-bariatric surgical patients represent a vulnerable population that may be at high risk for AUD since the prevalence of AUD in this population exceeds the 6.2% prevalence of AUD that occurs in the general population (Substance Abuse and Mental Health Services Administration (SAMHSA), 2015). For reasons not completely understood, post-operative RYGB patients have the highest risk for AUD compared to patients who undergo other types of bariatric surgery (Conason et al., 2013; King et al., 2012; Suzuki et al., 2012). While 90% of AUD in the general population occurs in adults younger than 39-41 and in mostly men (Grucza et al., 2010; Ivezaj et al., 2017; Kessler et al., 2005), among samples of post-operative RYGB patients, those with AUD are mostly middle-aged females, which is the predominant group who undergoes bariatric surgery (King et al., 2012). This suggests that post-operative AUD may be a direct consequence of the RYGB procedure (Ivezaj et al., 2017). Further, post-operative RYGB patients represent over 90% of post-operative bariatric surgery patients in substance abuse treatment centers (Saules et al., 2010). These RYGB patients represent only 2-6% of individuals admitted to substance abuse treatment centers who have a history of bariatric surgery (Saules et al., 2010). One underlying reason for these low numbers of RYGB patients who are admitted to treatment centers could be that while these individuals may exhibit alcohol misuse as early as about 17 months after surgery and develop AUD at 3 years post-surgery, they may not seek admission at treatment centers for their alcohol-related

problems until 5 years post-surgery (Cuellar-Barboza et al., 2015). These data indicate the need for medical care professionals to provide long-term follow-up care for post-operative RYGB patients so that those who are experiencing alcohol-related problems know that they not are an isolated case, and that they are promptly connected to the appropriate resources to manage this adverse outcome.

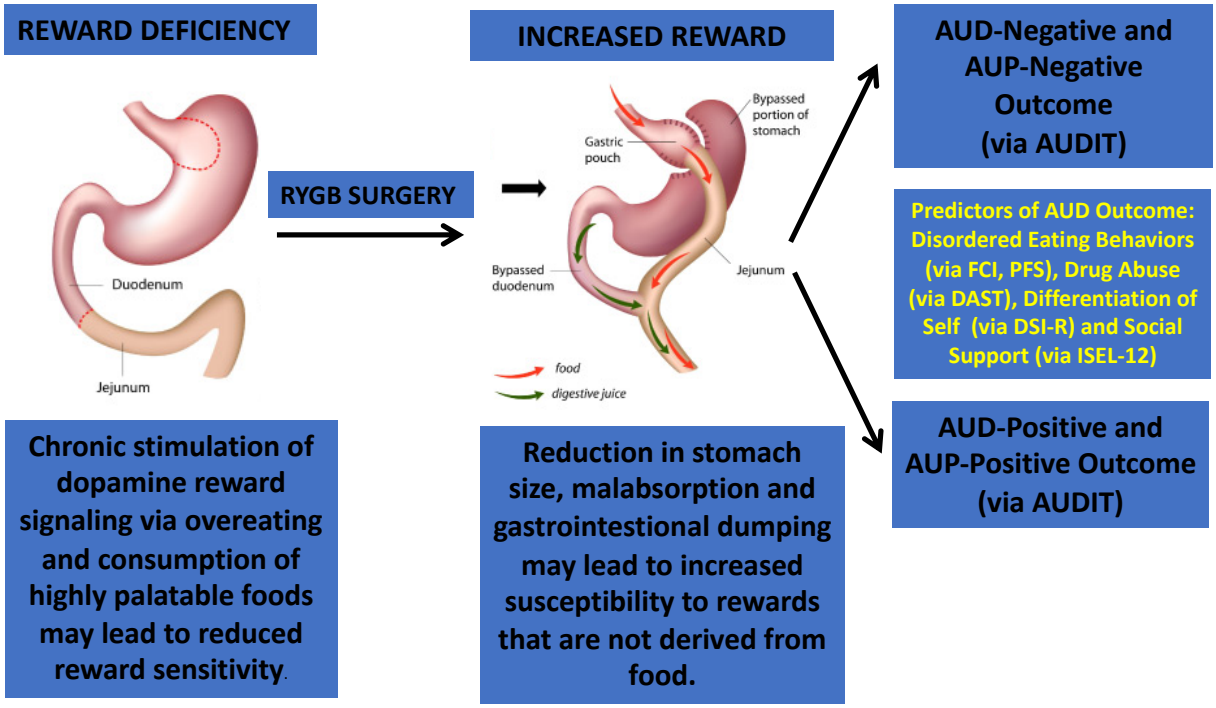
Individuals who undergo RYGB (or other types of bariatric surgery) typically do so as a last resort for achieving "normal" body weight, after failed attempts to eliminate excess body weight through diet and exercise. Because of their "higher" body weight, these obese individuals have often faced negative stereotypes by the general public (Puhl & Heuer, 2010). Generally, their heavy weight is viewed simply as lack of self-discipline, but in fact, obesity is a complex interaction of environmental and genetic factors (Carpenter, 2013; Carpenter, Wong, Li, Noble, & Heber, 2013). Some individuals may have become obese in part due to food addiction (Carpenter, 2012; Davis et al., 2011), and it is perhaps this underlying addictive behavior that predisposes a subset of post-operative RYGB patients to be susceptible to the addictive quality of alcohol and subsequently develop AUD. Along the lines of addictive behavior, drug use may also factor into the predisposition to developing AUD, as preoperative food addiction was identified as a predictor of post-operative substance use (alcohol, drugs) (Reslan, Saules, Greenwald, & Schuh, 2014). Thus, disordered eating behavior and drug abuse may correlate to an increased AUD risk among post-operative bariatric surgery patients.

After RYGB, the individual is physically capable of eating only small amounts of food due to the reduced stomach size. For vulnerable individuals, such those who were compulsive over-eaters or who constantly craved high sugary foods, having a significantly reduced stomach may change their relationship with food – such that the experience is less pleasurable than it used to be. For reasons not completely understood, they may develop an increased sensitivity to rewards that are not derived from food (e.g. alcohol, drugs) – which is the basis of the hypothesized "transfer addiction" or "cross addiction phenomenon (Blum et al., 2011). Whether these are the individuals who eventually become sensitive to the effects of alcohol and/or become addicted to alcohol thus leading to AUD, is not known. It is also possible that changes in social circumstances may contribute to the switch from food to alcohol. As an

obese individual, social interactions are typically limited due in part to stigmatization resulting from their weight. After bariatric surgery and subsequent weight loss, these previously obese individuals are showered with compliments and may become more outgoing. However, since eating is reduced, they may turn to taste of alcohol in social settings. Unbeknownst to them, the RYGB stomach allows for altered alcohol metabolism, such that they may feel the effects of alcohol much faster and after fewer drinks, and the effects last for much longer than pre-surgery (Brick, 2006; Hagedorn, Encarnacion, Brat, & Morton, 2007; Pepino et al., 2015). Without being cognizant of these physiological changes, such as in the absence of social support and/or low sense of individuality (low differentiation of self), they may quickly spiral towards AUD.

Overall, the data on RYGB-associated AUD highlight the need to better understand addictive behaviors and to determine which factors promote susceptibility to AUD among post-operative bariatric surgery patients. Since the risk factors for post-operative alcohol-related problems are not fully understood, this questionnaire-based study aims to examine potential predictors of AUD in this patient population. Based on previous reports of substance use among bariatric surgery patients, the potential predictors examined in this study are addictive eating behavior, consumption of sugary foods, drug abuse, low social support, and low differentiation of self. A proposed model for RYGB-associated AUD with the potential predictors that are being tested is described in Figure 1. It is important to note that during the course of this study, we also identified alcohol use problems (AUP). Thus, in the model, the outcomes are AUD (negative and positive) and AUP (negative and positive).

Proposed Model for RYGB-associated AUD



Modified from Blackburn, A.N., Hajnal, A., and Leggio, L. (2017) The gut in the brain: the effects of bariatric surgery on alcohol consumption. Addiction Biology, 22:1540-1553

Figure 1: Proposed model for RYGB-associated AUD

The proposed model for RYGB-associated AUD is as follows: before surgery, many individuals with obesity experience reward dysregulation. As previously described, consumption of highly palatable foods (foods rich in sugar, fat and salt) and larger meals can lead to chronic stimulation of dopamine reward signaling, which may result in reduced reward sensitivity and subsequently result in overeating (Blackburn, Hajnal, & Leggio, 2017). After RYGB, the individual's relationship with food and eating may be altered – the reduction in stomach size, and subsequent malabsorption and gastrointestinal dumping may make eating a less "pleasurable" experience than it used to be. This may result in an increased sensitivity to rewards that are not derived from food (e.g. alcohol) among post- operative RYGB patients (Blackburn et al., 2017), though it is not fully understood which subset of post-operative RYGB patients "switch" from food to alcohol, and why this occurs. The RYGB procedure and its

concomitant physiological and physical changes pave a challenging journey that requires significant commitment to dietary and wellness regimen and a strong social support network to achieve positive outcomes and weight management. One may speculate that changes in social circumstances, whereby significant weight loss promotes increased self-confidence through compliments and improved body image and increased social interactions, may require post-operative RYGB patients to adjust to eating tiny portions when socializing. As an alternative to eating or perhaps to supplement eating, they may turn to alcohol. Because of physiological changes in the RYGB stomach, these individuals experience altered alcohol metabolism, which makes them feel the effects of alcohol faster, after fewer drinks, and with longer lasting effects. Social support could help guide post-operative individuals through stressful personal and professional situations such as coping with jealously, divorce and work promotion. The subset of post-operative RYGB patients who experience AUD (as measured by the Alcohol Use Disorders Identification Test, AUDIT) are denoted as "AUD-Positive Outcome" and "AUP-Positive Outcome." This group of individuals may exhibit addictive eating behavior, strong craving for sugary foods, and drug abuse as measured by the Food Craving Inventory (FCI), Power of Food Scale (PFS) and Drug Abuse Screening Test (DAST-20), respectively. This subset of individuals who experience AUD may also lack social support (as measured by the Interpersonal Support Evaluation List-12, ISEL-12) – and in the absence of supportive friends and family, these individuals may be unaware of the magnitude of their harmful behaviors or they may be purposely consuming alcohol to substitute for the good feeling that they used to derive from food. In addition, this subset of individuals who experience AUD may also exhibit low sense of self or low differentiation of self (as measured by the Differentiation of Self Inventory-Revised, DSI-R).

Purpose of the Study

The purpose of this study is to better understand the mechanisms underlying the vulnerability of a subpopulation of postoperative bariatric surgery patients to AUD. The main research question is to determine risk factors that predict AUD among post-operative patients in general, and specifically among sleeve gastrectomy and RYGB patients. Variables that will be assessed include: craving of high sugary food, addictive eating behavior, interpersonal support, drug abuse, and differentiation of self. To address the purpose of the study, a questionnaire-based cross-sectional study was formatted in Qualtrics and emailed to bariatric surgery patients in the UCLA and Kaighan databases.

Specific Aims and Hypotheses

Specific Aim 1: Determine if disordered eating behaviors, such as food craving and addictive eating behavior are predictors of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative

(defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Among 141 RYGB patients, pre-operative food addiction was identified as a predictor of post-operative substance use (alcohol, drugs) (Reslan et al., 2014). In a study sample with almost 93% RYGB patients, individuals with pre-operative problems with High-Sugar/Low-Fat Foods and/or High Glycemic Index foods had higher risk for developing substance use disorder (alcohol, drugs) (Fowler, Ivezaj, & Saules, 2014).

Specific Aim 2: Determine if lack of social support is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are

AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Among a study sample containing almost 70% of RYGB patients, pre-surgery lower interpersonal support (lower sense of belonging) was predictive of AUD post-surgery (King et al., 2012).

Specific Aim 3: Determine if low differentiation of self is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: There are no published studies on the relationship between differentiation of self and AUD risk. However, an individual who is an alcoholic or addict is thought to have low differentiation of self, whereas someone who is an alcoholic/addict in recovery is believed to have high differentiation of self (Rubalcava, 2019).

Specific Aim 4: Determine if drug abuse is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping:

Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping:

Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Studies on drug abuse and AUD risk typically look at drug use under the umbrella of substance use, where substance use refers to alcohol use, drug use and smoking (Fogger & McGuinness, 2012; Ivezaj, Saules, & Schuh, 2014; Li & Wu, 2016; Mitchell et al., 2015; Saules et al., 2010; Tedesco, Hua, Lohnberg, Bellatorre, & Eisenberg, 2013; Wiedemann, Saules, & Ivezaj, 2013). The King et al study (2012) reported that preoperative recreational drug use may increase postoperative AUD risk. In another study of 54 bariatric surgery patients enrolled in a substance abuse treatment program for alcohol and/or drug, 35.8% had a history of heavy use of drugs and/or alcohol, 43.4% were new-onset heavy users, and 20.8% of the preoperative heavy users switched to a different drug and/or alcohol after surgery than what they used before surgery (Saules et al., 2010). Furthermore, adults with no history of using opiates, benzodiazepine were more likely to begin using those drugs after surgery, compared to alcohol and cigarettes (Saules et al., 2010).

Significance of the Study

This study will advance our understanding of food and alcohol addiction in the context of obesity and bariatric surgery. Existing data suggest an association between bariatric surgery and AUD. However, the mechanism underlying this relationship is not fully understood. This study aims to examine how

addictive eating behaviors, consumption of sugary foods, social support, drug abuse, and differentiation of self may be predictors of AUD among the subpopulation of post-operative bariatric surgery patients. The study also aims to identify differences in alcohol use problems risk between patients who underwent sleeve gastrectomy and RYGB.

Background

Obesity

Obesity and its associated morbidity, mortality and economic burden constitute a public health concern in the U.S. Obesity, defined as having a body mass index (BMI) of over 30 kg/m^2 (Centers for Disease Control and Prevention, 2011) has a prevalence rate of 35% among adults (Ogden, Carroll, Kit, & Flegal, 2012). Obesity is most common among women (36.1%), adults aged 40-59 years old (39.5%), and non-Hispanic blacks (47.8%) (Ogden et al., 2012). Chronic health conditions that are associated with obesity include hypertension, type 2 diabetes, cancer of certain sites and cardiovascular diseases (Garvey, 2013). Among obese individuals, these health burdens are linked to increased risk of death – over 112,000 excess deaths due to cardiovascular disease, over 15,000 deaths due to cancer, and over 35,000 excess deaths for other reasons (Flegal, Graubard, Williamson, & Gail, 2007). Overall, this leads to an annual economic burden estimated to be $147 billion (Finkelstein, Trogdon, Cohen, & Dietz, 2009) and obesity-related absenteeism cost of $3.4 billion to $6.4 billion (reviewed in Trogdon, Finkelstein, Hylands, Dellea, & Kamal-Bahl, 2008).

The etiology of obesity is not well understood, but it is believed to be due to a complex interaction of the environment and genetic predisposition that results in storing excess energy as body fat (Carpenter et al., 2013; Pepino, Stein, Eagon, & Klein, 2014). Other factors contributing to obesity include high caloric intake, physical inactivity, food addiction and medications (Pi-Sunyer, 2009; Rayner & Lang, 2009; von Deneen & Liu, 2011; Zhang et al., 2014). Obesity may also stem from overconsumption of sweets due in part to a dysregulation of the process that modulates sweetness preference as an individual progresses from youth to adulthood (Pepino et al., 2016). Unlike normal weight individuals who exhibit an age-related decline in preference for sweet foods, obese individuals

lack this progression, which may heighten their preference for and consumption of sweets (Pepino et al., 2016).

A neurocircuitry model for obesity states that in a healthy, normal weight individual, there is a balanced interaction among the reward-saliency, motivation-drive, learning-memory and inhibitory-control circuits (Volkow, Wang, & Baler, 2011; Zhang et al., 2014). However, in vulnerable individuals, consumption of large quantities of palatable foods alters this balance, which may result in a reinforced value of foods and a weakened inhibitory control. Further, continued exposure to high-calorie diets may affect conditioned learning, which could reset reward thresholds. Thus, in at-risk individuals, exposure to foods or cues conditioned to the foods may result in a lower perception of reward – which is supported by hyporesponsivity of the reward circuitry in many individuals with obesity (Arora & Anubhuti, 2006; Lenard & Berthoud, 2008). Exposure to foods or cues conditioned to the foods may also result in over-activation of the reward-saliency and motivation-drive circuits, and decreased activity of the inhibitory-control circuit. Overall, this leads to impulsivity and a lessened ability to inhibit compulsive food intake in vulnerable individuals (Zhang et al., 2014).

Dopamine is an important neurotransmitter for the reward-saliency circuit (Zhang et al., 2014). Dopamine release from the ventral tegmental area plays a role in reinforcement for feeding (Salamone, Cousins, & Snyder, 1997; Wise & Bozarth, 1984), and dopamine release in the dorsal striatum can impact food ingestion and meal pleasantness (Rothemund et al., 2007). Like individuals with drug addiction, individuals with obesity have decreased dopamine receptor 2 (D2) availability in the striatum (Volkow et al., 2011). Lower D2 levels correlate with higher BMI in obese individuals (Haltia et al., 2007; Wang et al., 2001), which supports the idea that decreased D2 activity promotes feeding and increases the risk for obesity (McFarland & Ettenberg, 1998). With fewer D2 receptors, obese individuals may have to eat more to experience the rewarding effects of food intake, which could lead to overeating (Barry, Clarke, & Petry, 2009; Stice, Spoor, Bohon, Veldhuizen, & Small, 2008; Wang et al., 2002). Alternatively, chronic overeating may lead to elevated dopamine levels through downregulation of D2 receptors. This in turn may lead to tolerance to the pleasurable effects of food (Wang, Volkow, Thanos, & Fowler, 2004).

Together, downregulation of D2 receptor and propensity for compulsive engagement in rewarding behaviors encompass 'reward deficiency syndrome,' a concept that was coined by Blum and colleagues (Blum, Cull, Braverman, & Comings, 1996; Blum, Sheridan, et al., 1996).

The incentive sensitization theory of addiction states that craving and desire arise from an incentive not pleasure, and that the primary contributor to addiction is a sensitization to the incentive effects in response to reward-associated stimuli (Robinson & Berridge, 2008). Thus, for vulnerable individuals, repeated exposure to potentially addictive substances can change brain cells and circuits so that they are hypersensitive to such stimuli (Robinson & Berridge, 2008). Persistent incentive sensitization could result in long-term "wanting" for the stimuli even after its discontinuation (Robinson & Berridge, 2008), which in turn may lead to relapse.

Bariatric Surgery

Bariatric surgery is recognized as the gold standard treatment for morbid obesity and obesity-related conditions (Dimick et al., 2014), as it often results in significant weight loss and improvements in weight-associated health effects (Blackburn et al., 2017). The most widely used eligibility criteria for bariatric surgery are those that were established by the National Institutes of Health (Svensson et al., 2013). These guidelines state that bariatric surgery is restricted to individuals who have a BMI $\geq$ 40 kg/m^2, or who have a BMI between 35-40 kg/m^{2}and severe type 2 diabetes or other high-risk comorbidities (Svensson et al., 2013). Given that bariatric surgery is an invasive treatment option, the prospective candidate undergoes a detailed pre-surgical assessment that covers medical, psychological and behavioral factors (Sogg & Mori, 2004). The pre-surgical assessment may cover: medical history – to assess the individual's overall health, alcohol use, smoking history and ability to understand medical regimens; weight, diet and nutrition history – to gather data on the onset and course of their weight problem, and on possible triggers that may have contributed to obesity as well as diet attempts, exercise regimen; eating behaviors – to document food intake and habits such as binge eating and eating when not hungry; support networks and relationships – to determine what sort of support system and relationships the individual has; and psychiatric functioning – to determine if the individual has any major mental

illnesses and to assess history of impulsive or self-harming behavior such as substance abuse (Mayo Clinic, 2017; Sogg & Mori, 2004).

As shown in Figure 2, the common types of bariatric surgery techniques are RYGB, sleeve gastrectomy, vertical banded gastroplasty and gastric banding (Blackburn et al., 2017). For RYGB, a small portion of the stomach is attached directly to the small intestine, so that food bypasses most of the stomach and the entire duodenum. Thus, RYGB has restrictive and malabsorptive properties - only a small amount of food can fit into the altered stomach, and absorption in the small intestine is reduced (Blackburn et al., 2017). With the sleeve gastroectomy procedure, removal of more than half of the stomach results in a thin vertical sleeve. In vertical banded gastroplasty, a small stomach pouch is created by using a band and staples. The adjustable gastric band procedure involves placing an adjustable band around the upper stomach to restrict the amount of food consumed and create a feeling of fullness after consuming small amounts of food (Spadola et al., 2015).

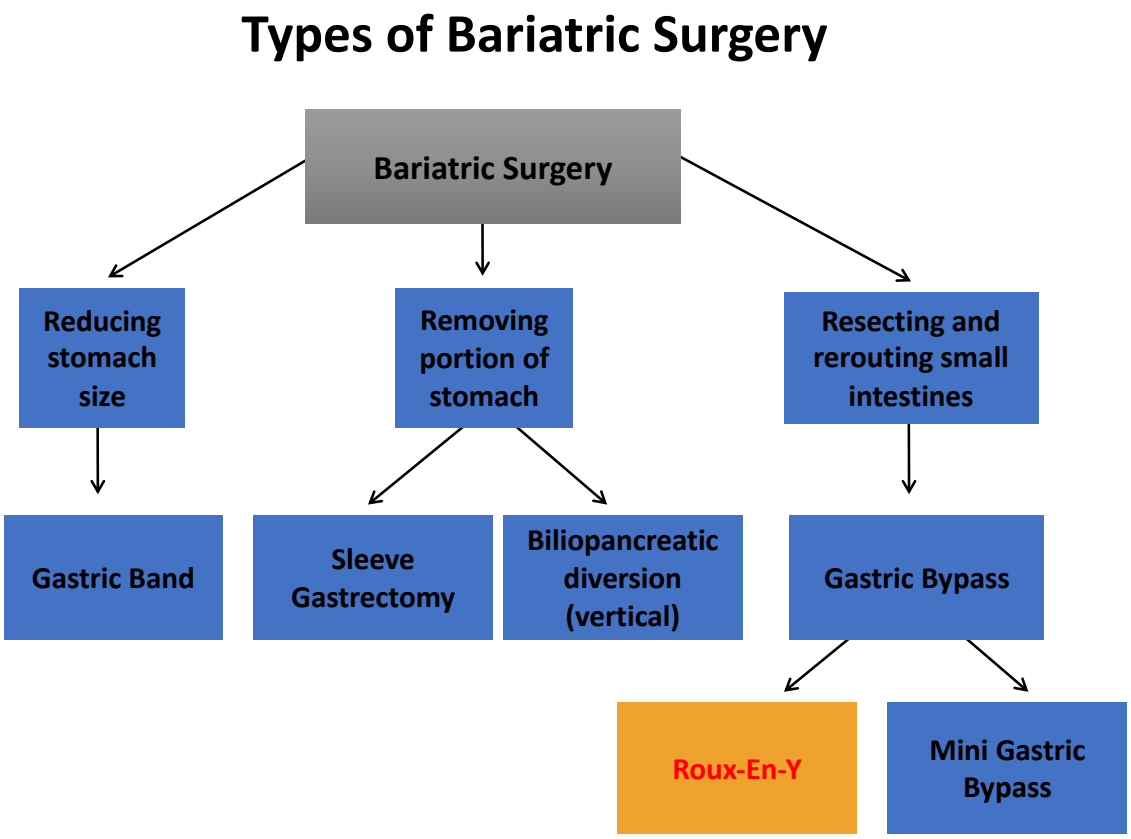


Figure 2: Types of bariatric surgery

Bariatric surgery can be categorized into three types – reducing the stomach size (gastric band), removing a portion of the stomach (sleeve gastrectomy and biliopancreatic diversion) and resecting and rerouting the small intestine (Roux-en-Y and mini gastric bypass).

For many years, RYGB was the most common type of gastric bypass surgery, as it provides significant and durable weight loss at long-term follow-up (Paluszkiewicz et al., 2012). However, from 2013 through 2016, RYGB has been overtaken by the gastric sleeve – accounting for 19% and 58% of annual gastric bypass surgeries, respectively (American Society for Metabolic and Bariatric Surgery (ASMBS), 2016). It is not clear why this shift in prevalence of bariatric surgery type has occurred, but it could be an indication that health professionals are performing the RYGB less often to reduce

complications that occur from RYGB including AUD. One positive outcome of this shift is that it could potentially limit the incidence of RYGB-associated AUD.

As patients navigate the post-bariatric surgery journey, they may experience significant lifestyle adjustments that includes coping with internal and external eating behavior stimuli, changes in food preference, and interpersonal challenges (Benson-Davies, Davies, & Kattelmann, 2013). With regard to food preference and eating behavior among post-operative RYGB patients, there is no consensus. Among post-operative RYGB patients, there is a significant reduction in craving for sweets and fast food (Pepino, Bradley, et al., 2014), no change in preference for food high in sugar content and high in protein content at 3 months (Primeaux et al., 2015), a reduction in starchy food consumption at 6 months (Trostler, Mann, Zilberbush, Avinoach, & Charuzi, 1995), no change in the drive to consume foods craved at 12 months post-surgery (Sudan, Sudan, Lyden, & Thompson, 2017), and a reduction in consumption of sweets and high calorie foods at 24 months (Kenler, Brolin, & Cody, 1990).

To help patients maintain positive outcomes after bariatric surgery, social support in the form of family and friends, co-workers, bariatric support groups, has been identified as an important component of successful lifestyle change, and a driver of positive results in weight management (Geraci, Brunt, & Marihart, 2014; Geraci, Brunt, & Marihart, 2014; Klem, Wing, Lang, McGuire, & Hill, 2000). Social support through interpersonal relationships promotes self-esteem and self-acceptance, and provides affection, intimacy and interpersonal communication (Adelman & Albrecht, 1987). Social support helps post-operative bariatric surgery patients manage stressful work-related or family-related situations, and develop new norms for interpersonal relationships (McMahon et al., 2006). Some of the interpersonal circumstances and challenges that they may experience include social isolation, divorce, and changes in social group (Ogle, Park, Damhorst, & Bradley, 2015; Sogg & Gorman, 2008). Other interpersonal changes may include adjusting from being “invisible” to “visible”, responding to compliments and attention, and becoming more sociable. After 1 year post-surgery, bariatric surgery patients cite that weight loss and other effects of bariatric surgery impact personal and professional relationships. In addition, a change in the dynamics of friendship may occur whereby friends become jealous of the

individual's weight loss. Some post-operative bariatric surgery patients cite that they experience diminished family support over time (Benson-Davies et al., 2013). This may include a decrease in support for their improved lifestyle, and less consideration during meal preparations and social activities – whereby large amounts of unhealthy foods are made available and events planned are centered around food/eating.

Addiction

An early definition of addiction was '"giving over" or being "highly devoted" to a person or activity' (Alexander & Schweighofer, 1988), or habitually engaging in a behavior (Levine, 1978), with positive or negative implications (Sussman, Lisha, & Griffiths, 2011). More recently, addiction has been seen as more disease-like, with neurobiological underpinnings -imbalance of the central nervous system (Bechara, 2003, 2005; Di Chiara, 2002; Feltenstein & See, 2008; Goodman, 2009; Heather, 1998; Sussman & Sussman, 2011; Volkow, Koob, & McLellan, 2016). The neurological changes that are associated with addiction result in desensitization of reward circuits, stronger conditioned responses, weakened inhibitory control, and weakened self-regulation (Volkow et al., 2016). Thus, an individual with addiction may experience a low ability to feel pleasure, as well as enhanced cravings for items and negative emotions when a craving is not satisfied (Volkow et al., 2016).

Addictive behaviors include alcohol consumption, tobacco smoking, drug use, and eating (Gowing et al., 2015). The 12-month prevalence of addictive behaviors among the general adult population ranges from 2% for eating to 15% for cigarette smoking (Sussman et al., 2011). The primary reinforcing characteristics of addictive substances are activated by the mesolimbic dopamine system (Salamone, 2003). As with drug use, the rewarding effects of overconsumption of food involve dopamine activation (Peciña & Smith, 2010; Volkow, Wang, Fowler, & Telang, 2008). There are five elements of addiction: engagement in the behavior to achieve appetitive effects (action to achieve outcomes such as arousal, pain reduction), preoccupation with the behavior (excessive amount of time spent on planning and engaging in the addictive behavior), temporary satiation (period of time when the urge/craving is not there), loss of control (the addictive behavior becomes increasingly automatic and difficult to predict),

and suffering negative consequences (such as financial loss, lowered self-esteem, physical discomfort) (Sussman & Sussman, 2011). Addiction can be classified into two groups: i) substance addiction, which involves ingesting products to directly manipulate pleasure – for example, cigarette smoking and eating disorders (Schaef, 1987) and ii) process addiction, which involves exposure to "mood altering events" to achieve pleasure and become dependent (Robinson & Berridge, 2000; Schaef, 1987) – for example Internet use to escape when feeling lonely or anxious (Young, 1999).

Food Addiction

The construct of food addiction is highly controversial, as it based on the premise that food has an addictive potential and that some individuals can develop clinically harmful patterns of food consumption (Finlayson, 2017; McFadden, 2010). Currently, there is no clear scientific support for addictive biochemical properties in foods, and a clinical syndrome for food addiction has not been defined (Finlayson, 2017).

An early definition of food addiction is that it is a phenomenon whereby an individual is highly sensitive to one or more foods that are regularly consumed and develops a pattern of symptoms that are associated with other addictive processes (Randolph, 1956). Food addiction can also be described as a chronic relapsing disorder of cravings for food or food-related substances so as to obtain feelings of euphoria or to improve negative emotions (Gold & Sternbach, 1984; Ifland et al., 2009; Tarter, Ammerman, & Ott, 1998; von Deneen & Liu, 2011). Food addiction shares behavioral and neurobiological qualities with substance abuse and dependence, and classic brain pathways and areas associated with drug addiction have also been linked to food addiction (Carpenter, 2013). Studies have established that "wanting' food (appetite) rather than "liking" of a food (palatability) is modulated by the dopamine reward system (Berridge, 1996; Carpenter, 2013; Nasser, 2001). When an individual is "wanting" or craving a food, there is a notable change in fluctuation of dopamine levels (Berridge, Ho, Richard, & DiFeliceantonio, 2010). By comparison, when an individual is "liking" a food, the dopamine levels remain relatively constant (Berridge et al., 2010). The brain reward circuit dynamics that generate

"wanting" and "liking" of food reward varies by individual, and it confers varying degrees of compelling motivation to overeat (Berridge et al., 2010).

Food craving, defined as "an intense desire to eat particular foods that is much greater than normal feelings of hunger" and overeating are two addictive behaviors that may be determinants of obesity (Carpenter, 2013). However, the complex relationship between food addiction and obesity has led to a lack of consensus about whether food addiction may underlie obesity and/or whether obesity may drive food addiction in individuals who were not addicted to food prior to weight gain (Berthoud & Zheng, 2012; Carpenter, 2013).

Foods that are believed to be addictive are those that are high in fats, sugar and salt (De Ridder et al., 2016). The finding that healthy subjects with no history of alcohol or drug dependence who had a sweet taste preference had alcohol-related problems suggests a link between addictive foods (sweet) and alcohol intake (Carpenter et al., 2013; Lange, Kampov-Polevoy, & Garbutt, 2010; Leggio et al., 2011). The estimated prevalence of addiction-like behavior pertaining to food is 26% in the general adult population (Gearhardt, Boswell, & White, 2014) (Ye et al., 2013), 10-25% among overweight and obese individuals in the general population (reviewed in Leigh & Morris, 2016), and 40% among obese individuals seeking bariatric surgery (Meule, Rezori, & Blechert, 2014).

Alcohol Use Disorder

A diagnosis of AUD is made when an individual has any two of the 11 symptoms of alcohol abuse and alcohol dependence within the same 12-month period, as outlined in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013; National Institute on Alcohol Abuse and Alcoholism, 2016). The sub-classifications of AUD are mild, moderate or severe, depending on the number of criteria that are met (American Psychiatric Association, 2013). In the general adult population, the 12-month and lifetime prevalence of AUD are 13.9% and 29.1%, respectively (Grant et al., 2015). The prevalence rates of alcohol abuse and dependence are 1.7% and 1.2% respectively, among middle-aged women in the general population, the age group that predominantly undergoes bariatric surgery (Grant et al., 2004).

Among post-operative bariatric surgery patients, some recover successfully from the surgery, whereas an estimated 10-15% of patients experience AUD (Mayo Clinic, 2015). For reasons not completely understood, AUD is most common among RYGB patients as compared to other types of bariatric surgery patients. There is a lack of understanding of what predisposes RYGB patients to alcohol misuse after surgery, and there are currently no reports that specifically assessed AUD risk factors among RYGB patients. Studies have shown that risk factors for bariatric surgery-associated AUD (and bariatric surgery-associated substance use disorder) include having pre-operative AUD, having a pre-operative lower sense of belonging (perceived ability of someone to do things with) having pre-operative problems with high sugar/low-fat foods and/or high glycemic index foods, having pre-operative food addiction, being male, having a younger age at time of bariatric surgery, and undergoing RYGB (Conason et al., 2013; Fowler et al., 2014; King et al., 2012; Reslan et al., 2014; Spadola et al., 2015; Suzuki et al., 2012).

While there is a lack of understanding of what predisposes a subset of RYGB patients to alcohol misuse after surgery, there appears to be a critical time period for post-RYGB-associated AUD. Studies have shown that 8% to 21% of RYGB patients meet the criteria for AUD within two to five years post-surgery (Cuellar-Barboza et al., 2015; King et al., 2012; Mitchell et al., 2015; Suzuki et al., 2012). In the landmark paper, King and colleagues reported that there was a significant increase in the risk of AUD among RYGB patients from 7.6% prior to surgery to 9.6% at 2 years post-surgery (King et al., 2012). More recently, a case story detailing a patient's post-RYGB experience includes their development of a "severely relapsing AUD" within 2 years after the surgery (Foulds & Sellman, 2016).

It is possible that AUD is an outcome of the RYGB procedure because of altered alcohol metabolism. In a 2006 study, researchers reported that two drinks in post-operative RYGB patients have alcoholic affects like four drinks in non-RYGB women (Brick, 2006). These results were supported by another report, which showed that compared to age- and BMI-matched controls, post-operative RYGB patients experienced higher peak blood alcohol levels (Hagedorn et al., 2007). Further, post-RYGB patients reach peak blood alcohol faster and take longer to return to baseline (Hagedorn et al., 2007). In a more recent study, post-operative RYGB patients experienced faster increase in blood alcohol

concentrations, two-fold higher peak blood alcohol, and greater feeling of drunkenness compared to non-RYGB controls (Pepino et al., 2015). These post-RYGB effects of alcohol may be accounted for in part by the anatomical change that occurs through the RYGB procedure. In RYGB, the portion of the stomach that is circumvented, is the part that secrets alcohol dehydrogenase, an enzyme that metabolizes alcohol (Lee, Chau, Yao, Wu, & Yin, 2006). Thus, it is likely that the alcohol metabolism process is altered, or maybe even reduced, in post-operative RYGB patients. This physiological change increases the potential of alcohol to become an addictive substance in vulnerable individuals. Further, in post-operative RYGB patients, the gastric pouch empties rapidly, especially for liquids, which increases alcohol absorption in the jejunum (Horowitz, Collins, Harding, & Shearman, 1986).

To treat and recover from alcohol-related problems, post-operative bariatric surgery patients may seek help from substance abuse treatment programs. In a 2010 report, 2%-6% of admissions to substance abuse treatment programs were post-bariatric surgery patients, and of these, more than 90% have undergone the RYGB procedure (Saules et al., 2010). The RYGB patients in the treatment centers are probably the individuals who experience the most severe symptoms of alcohol-related problems. The remaining individuals may be isolated in thinking that they are the only person with such problems and have not sought help in recovering from alcohol misuse (Ivezaj et al., 2017).

Differentiation of Self

Differentiation of self is one of the concepts in the Bowen Theory on human functioning. Differentiation of self refers to the degree of separation between an individual's intellectual (thoughts) and emotional (feelings) functioning. In this theory, these two systems can be characterized as being differentiated from each other or undifferentiated from each other ((Bowen, 1976; Haber, 1984). Differentiation of self evolves from the family relationship system, and a person's level of differentiation is usually set by the time they leave the family of origin (Haber, 1984). A high level of differentiation of self refers to a strong sense of self-identity, whereby the individual has life principles that are not easily influenced by others and are not compromised for immediate gratification (Haber, 1984) (. By contrast,

complete undifferentiation of self refers to a lack of self-identity, whereby the individual is incapable of being an individual in a group (Kerr & Bowen, 1978).

Bowen's scale of differentiation describes the difference in level of differentiation among a group of people. This scale is primarily of a theoretical importance, and is not designed to for assigning individuals to an exact level or for defining clinical diagnosis (Kerr & Bowen, 1978). The scale is a continuum that consists of a human functioning profile at the lowest possible level of differential of self (0 on the scale) through the highest theoretical level of differentiation of self (100 on the scale) (Kerr & Bowen, 1978). This model assumes that everyone has some degree of undifferentiation or fusion, and it defines how one adapts to stress (Kerr & Bowen, 1978). The scale is divided into four ranges of functioning are 0-25, 25-50, 50-75, and 75-100 (Kerr & Bowen, 1978).

Individuals at the 0-25 range on the scale have a low level of differentiation of self. They exhibit a fusion of intellectual and emotional functioning; they are unable to distinguish feeling from fact and tend to make decisions based on what "feels good" instead of what is "thought to be good." Further, they are unable to take on the "I" position, and do not exhibit a distinct personal principles. They also tend to be part of dependent relationships through which they get love, approval and self-definition (Haber, 1984). Individuals in the 25-50 range on the scale have a moderate level of differentiation of self. They have the ability to raise their level of differentiation, unlike those in the 0-25 range (Kerr & Bowen, 1978). Individuals at the 50-75 range on the scale have a good level of differentiation of self. They have a sufficiently developed intellectual system and so they can make a few decisions on their own and they hold fairly well-defined opinions and beliefs (Kerr & Bowen, 1978). Levels of differentiation in the 75-100 range on the scale are believed to be hypothetical (Haber, 1984). These individuals are believed to have a solid sense of self identity. They can easily distinguish between the intellectual and emotional systems, and utilize a value system to independently pursue life goals and be an individual in a group (Kerr & Bowen, 1978) . They can either move toward or move away from others in relationships without losing their own identity (Haber, 1984).

Social Support

There are several definitions of social support, all of which vary in terms of the approach to define social support (what elements are included) and whether social support is perceived versus objective (they place more emphasis on defining social support in cognitive terms or on the actual nature of the interpersonal transactions). The underlying commonality in these definitions is that social support is used by an individual to protect them self against high stress situations and that social support is provided to the individual by family members, friends, colleagues, and others (*Social Support: Theory, Research and Applications*, 1985). An early conceptual definition of social support system is that these systems consist of "continuing social aggregates that provide individuals with opportunities for feedback about themselves and for the validations of their expectation of others" (*Social Support: Theory, Research and Applications*, 1985). Over time, social support was recognized as a multi-dimensional construct, and tools that were developed to measure social support assessed different categories of social support which include "emotional support, esteem support, belonging support, network support, appraisal support, tangible support, instrumental support and informational support." However, it is important to note that it is unclear which characteristics are likely to be typical of those high or low social support (*Social Support: Theory, Research and Applications*, 1985). Perceived social support refers to the individual's belief that they can obtain help or empathy when it is needed, and their degree of satisfaction with the support that they perceived to be available.

Chapter 2 – Literature Review

State of the Science

To explore the association between bariatric surgery and AUD, a systematic review of the literature was conducted. As reported in review articles (Azam, Shahrestani, & Phan, 2018; Li & Wu, 2016), six studies examined AUD in study samples that consisted of individuals who underwent one of types of bariatric surgery patients (Adams, Gabriele, Baillie, & Dubbert, 2012; Black, Goldstein, & Mason, 2003; Buffington, 2007; King et al., 2012; Suzuki et al., 2012; Wee, Mukamal, et al., 2014), and four studies specifically evaluated AUD among individuals who underwent RYGB (Alfonsson, Sundbom, & Ghaderi, 2014; Cuellar-Barboza et al., 2015; Ertelt et al., 2008; Mitchell et al., 2001). As opposed to evaluating AUD as a specific outcome, under the broader heading of alcohol use, one study examined alcohol use among RYGB patients (Woodard, Downey, Hernandez-Boussard, & Morton, 2011), and four studies looked at alcohol use among a mixed population of bariatric surgeries or unspecified type of surgery or sleeve gastrectomy only (Changchien, Woodard, Hernandez-Boussard, & Morton, 2012; Klockoff, Naslund, & Jones, 2002; Maluenda et al., 2010). Also of interest, there are several reports on multiple types of substances use after bariatric surgery: tobacco use and substance use disorders among US veterans who underwent bariatric surgery (Adams et al., 2012); substance use (alcohol, cigarettes, drugs) among weight loss surgery patients, 60% of whom underwent RYGB (Clark & Saules, 2013); alcohol, cigarettes, drug use among weight loss surgery patients, 65% of whom underwent RYGB (Conason et al., 2013); substance use among weight loss surgery patients, 94% of whom underwent RYGB (Fowler et al., 2014); tobacco, alcohol, illicit drug use among weight loss surgery patients, 69% of whom underwent RYGB (Heinberg & Ashton, 2010); alcohol and drug use among RYGB patients (Ivezaj et al., 2014); substance use disorder among RYGB patients (Pulcini, Saules, & Schuh, 2013; Reslan et al., 2014); alcohol, cigarettes, drug use among bariatric surgery patients (Saules et al., 2010); substance use disorder among bariatric surgery patients (Sockalingam et al., 2013); tobacco, alcohol, drug use among bariatric surgery patients (Tae et al., 2014); substance use disorder and AUD among weight loss surgery patients (Wiedemann et al., 2013); alcohol, drug use among RYGB patients (Odom et al., 2010; Yanos,

Saules, Schuh, & Sogg, 2015); substance use among nurses who underwent bariatric surgery (Fogger & McGuinness, 2012); substance abuse, alcohol abuse among bariatric surgery patients (Ostlund et al., 2013); alcohol use, cigarettes among RYGB patients (Lent et al., 2013); substance abuse, alcohol use, drug abuse among veterans who underwent bariatric surgery (Tedesco et al., 2013); cigarettes, alcohol use among bariatric surgery patients (Hawke et al., 1990) and RYGB patients (Diniz Mde, Moura, Kelles, & Diniz, 2013); alcohol, nicotine, drug use among bariatric surgery patients (Scheffel, Daskalakis, & Weiner, 2011); cigarettes, alcohol, NSAIDs among RYGB patients (Wilson, Romagnuolo, Byrne, Morgan, & Wilson, 2006); AUD, non-AUD substance use disorder among RYGB patients (Mitchell et al., 2015).

Among the articles reviewed, ten studies reported increased susceptibility of RYGB patients to AUD/alcohol use problems (Cuellar-Barboza et al., 2015; Ertelt et al., 2008; Hagedorn et al., 2007; King et al., 2012; Klockhoff, Naslund, & Jones, 2002; Mitchell et al., 2015; Suzuki et al., 2012; Wiedemann et al., 2013; Woodard et al., 2011); five studies reported either no association or a negative association between RYGB and AUD (Alfonsson et al., 2014; Burgos et al., 2015; Lent & Swencionis, 2012; Ribeiro de Amorim et al., 2015; Wee, Mukamal, et al., 2014); seven studies identified risk factors for substance use disorders (drugs, alcohol) among post-operative bariatric surgery patients (de Araujo Burgos et al., 2015; Fowler et al., 2014; Ivezaj et al., 2014; Kanji, Wong, Akioyamen, Melamed, & Taylor, 2019; King et al., 2012; Reslan et al., 2014; Svensson et al., 2013).

Evidence supporting an association between RYGB and increased risk for AUD/alcohol use problems

Several studies suggest that a sub-population of post-operative RYGB patients have increased risk for developing AUD, and the critical time period for this phenomenon is 2 to 5 years post-surgery (Cuellar-Barboza et al., 2015; King et al., 2012; Mitchell et al., 2015; Suzuki et al., 2012). Alcohol consumption is reduced during the first year after surgery among post-operative RYGB patients (Conason et al., 2013; King et al., 2012; Svensson et al., 2013), but from 2 years onwards, the increased risk for alcohol-related problems in this population continues to persist (Cuellar-Barboza et al., 2015; Ertelt et al.,

2008; King et al., 2012; Mitchell et al., 2001; Suzuki et al., 2012; Svensson et al., 2013; Wiedemann et al., 2013). Post-operative RYGB patients meet the criteria for AUD by 3 years and are admitted to an addiction treatment facility at about 5 years (Cuellar-Barboza et al., 2015).

Population-level assessment of RYGB-associated AUD

One of the first studies to examine AUD among post-operative bariatric surgery patients was conducted by Mitchell and colleagues (Mitchell et al., 2001). In this cross-sectional study, alcohol use among 78 RYGB patients was evaluated at 13-15 years post-surgery (Mitchell et al., 2001). Without explaining the distinction between alcohol abuse and dependence, the authors reported that 5.1% of patients had alcohol abuse (compared to 2.6% before surgery), and 2.6% of patients had alcohol dependence (compared to 10.3% before surgery (Mitchell et al., 2001). Thus, the percent of patients with alcohol abuse doubled after surgery, whereas the percent of patients with alcohol dependence decreased after surgery (Mitchell et al., 2001).

A similar study was performed by Ertelt and colleagues (Ertelt et al., 2008) on 70 RYGB study participants, though the timeline was shorter, at 6-10 years post-surgery (Ertelt et al., 2008). The results indicated that less than 3% of RYGB patients developed AUD, and 54.3% reported altered response to alcohol after the surgery - 34.3% reported feeling intoxicated faster, and 20% reported feeling intoxicated with fewer drinks (Ertelt et al., 2008).

King and colleagues' Longitudinal Assessment Bariatric Surgery-2 study was the impetus that brought mainstream attention to the phenomenon of study. This 2012 study differed in several ways from those by Mitchell et al. (2001) and Ertelt et al. (2008) i) in that it had 1,945 participants, which was almost 30 times more than those other studies, ii) it involved 10 bariatric surgery centers, as opposed to only one in the other two studies, iii) it was based on the Alcohol Use Disorders Identification Test (AUDIT), which is one of the most respected assessment tools (King et al., 2012). By contrast, the other two studies used M-FED and a newly developed, unvalidated questionnaire, iv) it evaluated alcohol use frequency and AUDs at one and two years post-surgery, whereas the other two studies had a much later time point, and v) it included patients who underwent different types of bariatric surgeries, as opposed to

the other two studies that focused only on RYGB patients. One of the main results of the study by King and colleagues (King et al., 2012) was that the prevalence of AUD was significantly higher in the second year post-surgery than one year after surgery, at 9.6% and 7.6%, respectively. One plausible explanation for this notable difference in prevalence between 1 and 2 years post-surgery may be that there is a dopamine withdrawal effect. Since dopamine release is triggered in the brain's reward pathway during pleasurable activities such as eating and drinking, an increased vulnerability for AUD in post-operative bariatric surgery patients may be due to changes in the brain dopamine system. This hypothesis is supported by altered dopamine D2 receptor availability in the ventral striatum and caudate nucleus of RYGB patients (Dunn et al., 2010; Steele et al., 2010). Interestingly, these areas of the brain were previously linked with alcohol's rewarding effects (Boileau et al., 2003), and susceptibility for alcohol use and abuse (Thanos et al., 2005; Thanos et al., 2004; Volkow & Wise, 2005). In the studies by Steele and colleagues (Steele et al., 2010) and Dunn and colleagues (Dunn et al., 2010), PET scans on the patients pre-operatively, and post-operatively at 6-7 weeks, which was a much earlier time-point, revealed altered dopamine receptor level. It is important to note that the studies contradicted each other, such that Steele and others reported increased dopamine receptor availability, whereas Dunn and colleagues reported decreased receptor availability (Dunn et al., 2010; Steele et al., 2010). Further, when compared to patients who underwent AGB and SG surgical procedures, the RYGB patients were significantly more at risk for AUDs in the second year post-surgery (5.6%, 6.5% and 9.1%, respectively) (King et al., 2012). The regression models demonstrated that AUD-associated risk factors include male gender, smoking, younger age, regular alcohol consumption, history of AUD and recreational drug use (King et al., 2012). Interpersonal support was shown to be protective against AUD – a lower sense of belonging pre-surgery was predictive of AUD post-surgery (King et al., 2012).

Building upon the data in the King and colleagues' report, the study by Suzuki and colleagues (Suzuki et al., 2012), confirmed that post-surgical AUD appears to be specific to the RYGB procedure (Suzuki et al., 2012). In this prospective study of 51 patients who underwent either RYGB surgery or LAGB surgery at least two years ago, 10% reported alcohol abuse or dependence at 2-5 years post-

surgery (Suzuki et al., 2012). This rate was consistent with the prevalence of AUD in the general population - 8.5% overall, 12.4% in men and 4.9% in women (Hasin, Stinson, Ogburn, & Grant, 2007). However, after surgery, the age at onset of AUD is significantly lower than the general population, suggesting a role of bariatric surgery in AUD onset (Suzuki et al., 2012). Another important finding in this study is that when compared to patients who underwent LAGB, RYGB patients demonstrated a significant likelihood of having post-operative AUD (21.4% vs 0%, respectively) (Suzuki et al., 2012). Thus, these novel data suggest that post-surgical AUD may be specifically associated with RYGB, and confirms what was previously reported (King et al., 2012).

Similar to the study by Suzuki and colleagues (2012), Conason and colleagues (2013) performed a prospective longitudinal study with 155 participants who had either laparoscopic RYGB (LRYGB) surgery or laparoscopic adjustable gastric band (LAGB) (Conason et al., 2013). The authors reported that substance use (e.g., alcohol, cigarettes, recreational drugs) significantly increased at 24 months follow-up, when compared to baseline, and at 1-, 3-, and 6-month follow-up (Conason et al., 2013). Participants with LRYGB reported decreased alcohol use at 1-month and at 3-month when compared to baseline. However, alcohol use increased significantly at 24 months when compared to baseline and at 12-months (Conason et al., 2013). Unlike LRYGB patients, no significant difference in alcohol use was observed in LAGB patients. Overall, participants undergoing bariatric weight loss surgery reported a decreased substance use after surgery, followed by an increase in subsequent follow-ups, with a significant increase from baseline to 24-month follow-up (Conason et al., 2013). Also, participants undergoing LRYGB reported significant increases in alcohol use at 24-month follow-up, compared to baseline and 12 months (Conason et al., 2013). There were no differences in alcohol use between time periods among those with LAGB. The findings support the association between bariatric surgery (particularly LRYGB) and subsequent AUD. However, caution should be taken because patients may have underreported substance use to be seen as eligible candidates for surgery, which may have biased the results. There was also a high drop-out rate at 24 months, thus there may have been bias due to differential drop-out (Conason et al., 2013). Notably,

there was no control group to determine if changes in substance use were due to other factors unrelated to the surgery.

One study that included a control group to evaluate the association between bariatric surgery and AUD was performed by Cuellar-Barboza and colleagues (Cuellar-Barboza et al., 2015). In this study, alcohol consumption patterns before and after RYGB were evaluated among 823 RYGB patients who were admitted to an AUD treatment center (Cuellar-Barboza et al., 2015). For comparison, AUD was also evaluated among 122 patients without a history of bariatric surgery (controls) (Cuellar-Barboza et al., 2015). The results demonstrated that participants in the RGYB group met AUD criteria at a significantly younger age than the control group, 19.1 years versus 24.9 years (Cuellar-Barboza et al., 2015). Moreover, they resumed or initiated drinking 1.4 years after surgery, and met criteria for AUD at 3.1 years after surgery (Cuellar-Barboza et al., 2015). Furthermore, RYGB participants reported significantly fewer drinks of alcohol per day and fewer drinking days per week before surgery, when compared to the month prior to treatment (after surgery) (Cuellar-Barboza et al., 2015). Regression models demonstrated that neither, age, gender or BMI were strong predictors of post-surgery number of drinks per day (Cuellar-Barboza et al., 2015). Further, RYGB participants resumed or initiated drinking at about 17 months post-surgery, met AUD criteria at an average of 37 months, and reported a significantly higher number of drinks per day and drinking days per week after surgery (Cuellar-Barboza et al., 2015).

Also in 2015, Mitchell and colleagues published their study on alcohol use among 201 RYGB patients who were part of the LABS-2 cohort (Mitchell et al., 2015). Within three years post-RYGB, 18.4% of the patients developed AUD as measured by AUDIT and 8% of the patients developed AUD as measured by SCID (Mitchell et al., 2015).

Biological/psychological assessment of RYGB-associated AUD/alcohol use problems

As reviewed by Spadola and colleagues (Spadola et al., 2015), the increased risk for problematic alcohol use in post-operative bariatric surgery patients may be accounted for by psychological and physiological factors (Spadola et al., 2015). Previous studies have demonstrated that drug abuse and overeating elicit similar responses from the nervous system (Kenny, 2011; Volkow & Wise, 2005; Wang,

Volkow, Thanos, & Fowler, 2004). This shared pathway is one of the factors underlying the hypothesized "addiction transfer" model, which describes how an individual may transition from a food "addiction" to a drug/alcohol "addiction" post-surgery (McFadden, 2010).

Hagedorn and colleagues (Hagedorn et al., 2007) performed a key study that revealed that alcohol metabolism differed significantly between RYGB participants and non-surgical controls (Hagedorn et al., 2007). This study included 17 non-surgical controls and 19 individuals who had undergone RYGB approximately 10 years ago, and who had reached a stable body weight within average two years of surgery (Hagedorn et al., 2007). The results indicated that the mean peak alcohol breath level (BrAL) was significantly higher in the RYGB (0.08%), when compared to controls (0.05%). Between 15-140 minutes, the BrAL data for each 5-minute interval was significantly higher in the gastric surgery group, compared to the control group (Hagedorn et al., 2007). Overall, Ppost-operative RYGB participants demonstrated higher peak BrAL levels and longer times to zero BrAL, when compared to controls (Hagedorn et al., 2007).

Another biological study that relates alcohol use and RYGB was reported by Klockhoff and colleagues (Klockhoff et al., 2002). In this study, the researchers analyzed absorption, distribution and elimination of ethanol in 12 RYGB participants, as compared to 12 non-surgical control participants (Klockhoff et al., 2002; Pandit, Mercer, Overduin, la Fleur, & Adan, 2012). Compared to the control group, RYGB patients demonstrated significantly higher peak mean BAC; maximum blood-ethanol concentration (Cmax) with an earlier onset median time to peak (tmax), when compared to the control group (Klockhoff et al., 2002). In the 10-minutes and 20-minutes interval after initial ethanol dose, participants in the gastric bypass group demonstrated a significantly higher mean BAC, when compared to the control group (Klockhoff et al., 2002). At other time intervals, the mean BAC data did not differ significantly between groups. The study findings demonstrated that ethanol absorption occurs at a higher rate with a higher peak among RYGB women, when compared controls (Klockhoff et al., 2002). The absorption was higher and faster in the first 30 minutes post-dosing of ethanol in RYGB women (Klockhoff et al., 2002).

Woodard and colleagues (Woodard et al., 2011) also demonstrated a relationship between the metabolism of alcohol and RYGB (Woodard et al., 2011). In this study, the researchers analyzed whether RYGB leads to altered alcohol metabolism, using pre-operative measures as matched controls. The study included 19 morbidly obese patients who underwent RYGB (Woodard et al., 2011). In this study, there was no significant difference in time to reach 0% BAC (sober time) between pre-operative and 3-month follow-up (Woodard et al., 2011). However, the time to reach 0% BAC between pre-operative (49 minutes) and 6-months follow-up (88 minutes) was significantly different (Woodard et al., 2011). The findings support the hypothesis that RYGB alters alcohol metabolism post-surgery, when compared to pre-operative measures. Pre-operative peak BAC was significantly lower when compared to peak BAC at 3 and 6-months follow-up (Woodard et al., 2011).

In addition to altering the effects of alcohol consumption, RYGB may also lead to an increased vulnerability for AUD through changes in the brain dopamine system, the brain's reward pathway during pleasurable activities such as eating and drinking. Others have suggested this hypothesis, but there is no clearly defined answer. PET imaging studies of post-RYGB patients have revealed altered dopamine D2 receptor availability in the ventral striatum and caudate nucleus (Dunn et al., 2010; Steele et al., 2010). It is important to note that while these studies contradicted each other – increased dopamine receptor activity in 80% of the post-RYGB patients (Steele et al., 2010) and decreased dopamine receptor activity in 100% of the post-RYGB patients (Dunn et al., 2010) – the studies were done at approximately 1 month – 3 months post-surgery, which is much earlier than the time when AUDs are known to be prevalent among PBS patients. Thus, the early post-surgery timeline may partially account for the variability in these results. Also, since the presence of AUD was not evaluated in the 4-5 post-RYGB patients in either studies (Dunn et al., 2010; Steele et al., 2010), an important unanswered question from these reports is whether there is a correlation between dopamine signaling and AUD.

Evidence against an association between RYGB and AUD/alcohol use problems

There are a few studies that reported that there was either no association or a negative association between RYGB and AUD, with the most recent reports published in 2015. A retrospective study of the electronic charts of 562 gastric banding patients and 97 RYGB patients showed that at the two-year post-surgery follow-up, alcohol use decreased from 24% to 9% (Burgos et al., 2015). Similarly, a prospective, case-series study of 119 RYGB patients by the same research group revealed that 2.2% of patients were high-risk alcohol use pre-operatively, whereas only 1.4% had likely dependency post-surgery (Ribeiro de Amorim et al., 2015). Both of these studies showed no increase in the prevalence of abusive alcohol intake and/or probable dependence in the post-operative period compared to the pre-operative period.

Wee and colleagues (Wee, Mukamal, et al., 2014) examined alcohol use among 541 patients who underwent either RYGB, AGB, SG/other procedure (Wee, Mukamal, et al., 2014). At baseline, approximately 16% of participants undergoing bariatric surgery had high-risk drinking behaviors (Wee, Mukamal, et al., 2014). There were no significant differences in high-risk alcohol drinking between baseline and follow-up post-surgery measures. The authors reported that at 1-year after bariatric surgery, 70% of RYGB patients and 48% of AGB patients experienced improved risky drinking behavior (Wee, Mukamal, et al., 2014). In fact, at this time point, the prevalence of high-risk drinking decreased compared to baseline (17% vs 13%) (Wee, Mukamal, et al., 2014). Among participants who completed the two-year interview, the prevalence of high-risk drinking also decreased (15% vs 13%) compared to baseline (Wee, Mukamal, et al., 2014). After bariatric surgery, compared to baseline, 7% and 6% of participants reported the new development of high-risk drinking in the 1-year and 2-year follow-up, respectively (Wee, Mukamal, et al., 2014). There were no significant differences in new development of high-risk alcohol drinking or amelioration of high-risk drinking between gastric bypass and gastric banding. Overall, the study findings showed that 1 out of 6 patients undergoing bariatric surgery have reported high-risk alcohol drinking behaviors at baseline (Wee, Mukamal, et al., 2014). Prevalence of high-risk alcohol drinking did not change from baseline to 1 year and 2 year follow-up (Wee, Mukamal, et al., 2014). It should be considered that overall, there was no significant difference in new development

of high-risk drinking behavior or amelioration between the RYGB and LAPB. There was a high attrition from baseline to 1 year (69%) and 2 year (60%) follow-up (Wee, Mukamal, et al., 2014).

Alfonsson and colleagues studied alcohol use among 129 Swedish RYGB patients, pre- and post-surgery (Alfonsson et al., 2014). The results indicated that at post-surgery, patients had a prevalence of alcohol problems of 5.4%, which was much lower than the 14% prevalence rate that was observed pre-surgery (Alfonsson et al., 2014).

Together, these data support findings from the previous report by Lent and colleagues (Lent & Swencionis, 2012). This prospective study was conducted to examine alcohol use frequency among 155 RYGB patients at 6-12 months before surgery and about 35 months post-surgery (Lent & Swencionis, 2012). The results indicated a significant decrease in the frequency of alcohol use post-surgery. Among the study participants, 72.3% endorsed any alcohol use one year prior to surgery (Lent & Swencionis, 2012). At post-surgery, 10% less study participants endorsed alcohol use (Lent & Swencionis, 2012).

Risk factors for bariatric surgery-associated AUD

There are no studies that specifically examined risk factors for AUD among post-RYGB patients. However, as reported in review articles (Briegleb & Hanak, 2020; Kanji et al., 2019; Spadola et al., 2015), several risk factors for post-operative substance use disorder/substance misuse (alcohol, drugs) among bariatric surgery patients have been identified:

i) In a study sample that consisted of 70% RYGB patients, pre-operative lower sense of belonging and pre-operative AUD were identified as predictors of post-operative AUD (King et al., 2012). Other predictors of post-operative AUD include male sex, family history of substance abuse, younger age at time of surgery, smoking, regular alcohol consumption (King et al., 2012).

ii) In a study sample with almost 93% RYGB patients, individuals with pre-operative problems with High-Sugar/Low-Fat Foods and/or High Glycemic Index foods had higher risk for developing substance use disorder (alcohol, drugs) (Fowler et al., 2014).

iii) In a study sample of 143 RYGB patients, predictors of post-operative substance use disorder (alcohol, drugs) identified were family history of substance use, poor coping skills and potential life stressors (Ivezaj et al., 2014).

iv) In a study of 141 RYGB patients, pre-operative food addiction was identified as a predictor of post-operative substance use (alcohol, drugs). Other predictors of post-operative substance use disorder were age at survey, age at time of surgery, lower percent total weight loss, subjective hunger, environmental responsiveness to food cues and post-operative nocturnal eating (Reslan et al., 2014).

v) In a study sample of 2010 bariatric surgery patients, male gender, baseline smoking, baseline alcohol consumption were identified as risk factors of alcohol abuse (Svensson et al., 2013).

vi) In a study of 276 bariatric surgery patients (33% of whom underwent RYGB), male gender, age of 45 or more, and pre-operative BMI less than 40 kg/m^2 were linked to post-operative alcohol use (de Araujo Burgos et al., 2015).

vii) A systematic review of fifty-eight studies revealed that post-operative increased substance use disorder was associated with surgery type, personal history or family history of substance use disorder, coping skills or life stressors, age, male gender, and alcohol sensitization after surgery (Kanji et al., 2019).

Gaps in the Literature

Lack of patient history of alcohol use. In most studies, the baseline questionnaires mainly focused on the previous year alcohol use, and not use in the remote past, which limits our understanding of actual alcohol history of use/misuse. This makes it difficult to determine if AUD after bariatric surgery is a relapse or if it is a new phenomenon at baseline.

Lack of details on statistical approaches. Several of the articles reviewed did not include details on the statistical analysis, which makes it difficult to assess how rigorous the analysis was and if the conclusions were strong.

Incomplete understanding of the mechanisms underlying this phenomenon. Bariatric surgery is one of the most common treatments for obese adults. It is important to understand the etiology obesity and apply that knowledge to post-surgical outcomes in post-operative bariatric surgery patients. As we

continue to grapple with a lack of clear understanding of the mechanism(s) underlying RYGB-associated AUD, it will remain difficult to predict the subgroup of RYGB patients who are susceptible to AUD.

Implications for Future Research

Study population. Substance use outcomes studies that have more diversified patient populations are warranted (Spadola et al., 2015). Part of rationale for including a younger population is that bariatric surgery at a younger age appears to lead to greater weight loss (Contreras, Santander, & Bravo, 2013) and that adults aged 18-35 years old are more at risk for problematic alcohol use (Brown et al., 2008). Thus, young adults may have an increased risk for substance use problems at post-surgery (Spadola et al., 2015).

The majority of the post-operative bariatric surgery study samples to date are middle-aged females. However, minority populations such as African Americans, Hispanics, and Native Americans/American Indians account for an increasing proportion of the obese population (Flegal, Carroll, Kit, & Ogden, 2012; Schiller, Lucas, Ward, & Peregoy, 2012), these populations represent an important demographic group to evaluate the post-surgical effects of bariatric surgeries (Pickett-Blakely, Huizinga, & Clark, 2012). Of the studies reviewed, the majority of the study patients are white. The report by Conason and colleagues (Conason et al., 2013) was the only one to include minority study participants.

Study design. The majority of studies evaluating alcohol and drug use in post-operative bariatric surgery patients rely on retrospective reporting on pre-surgical history of alcohol use (Spadola et al., 2015). An important improvement in study design would be to increase the number of longitudinal investigations using reliable and validated assessment tools as well as age- and gender-matched controls. Future studies should be more rigorous in acquiring accurate historical data on alcohol use in potential study participants. This may help identify patients at elevated risks for developing AUD.

Sample size. The majority of the studies have a small sample size, which limit the power of the analysis and generalizability of results. To move the field forward, it is imperative that future studies have larger sample sizes.

Assessment tools. The common assessment tool utilized is the AUDIT. Data are also collected by clinicians who are treating the patients. One important note is that there is a strong need to develop better diagnostic criterion to access use and dependence on alcohol. Further, to reduce reporting bias, researchers can consider re-structuring the questions so that more precise and thorough data can be collected. For example, to reduce patients' underreporting of alcohol abuse so that they can be eligible for surgery, the study criteria can be re-structured so that potential study candidates do not fear that the surgery will not be approved. This will prompt potential candidates to be honest about their alcohol misuse. Alternatively, more sensitive biological markers (from blood tests) of recent and distant alcohol use can be employed in research study designs to compare self-reported alcohol use with evidence from biological markers. Resultantly, nurse researchers can design measurement tools that can yield more accurate participant responses. Furthermore, nursing researchers can conduct prospective cohort studies to help identify risk factors and independent predictors of AUD in this population, with subsequent randomized control trials.

Discussion and Summary

The literature on bariatric surgery and alcohol use outcomes continues to expand. Studies have revealed that the prevalence of AUD among post-operative RYGB patients is higher than the general population (Substance Abuse and Mental Health Services Administration (SAMHSA), 2015). In addition, there are data suggesting that post-operative RYGB patients are overrepresented in substance abuse treatment centers (Spadola et al., 2015). However, post-operative RYGB patients are admitted to treatment centers about 5 years after surgery (Cuellar-Barboza et al., 2015) even though they meet the criteria for AUD as early as 2 years after surgery (King et al., 2012). As the prevalence of AUD among post-operative RYGB patients exceeds that of the general population, these data suggest that RYGB patients need long-term follow-up that is targeted at identifying potential triggers and warning signs of alcohol related problems. At pre- and post-bariatric surgery, medical health care professionals should educate patients about adaptive coping skills to manage this potential adverse outcome. With close

monitoring, vulnerable individuals can be promptly connected with the appropriate treatment and support services.

Several risk factors underlying the phenomenon of bariatric surgery-associated AUD (not specifically RYGB-associated AUD) have been identified. These include male gender, younger age, history of regular problematic alcohol use pre-surgery, history of maladaptive eating behaviors and social support (Spadola et al., 2015). There is much more that needs to be known in order to predict which post-operative RYGB patients may have a heightened risk for developing AUD.

It is intriguing that even though addiction transfer is an unsubstantiated hypothesis, post-operative bariatric surgery patients in substance abuse treatment program acknowledge that transfer addiction from food to substances, especially alcohol, is an underlying factor contributing to their substance use disorders (Ivezaj, Saules, & Wiedemann, 2012). Further, when these study patients were asked "if you knew what you know now, would you still have the surgery?" One participant said "I would rather be a fat social drinker than a thinner alcohol/addict" and elaborated "I don't regret getting the surgery, I regret becoming an alcoholic" (Ivezaj et al., 2012).

Future studies that are targeted to bridging the knowledge gaps about RYGB-associated AUD and alcohol problems will greatly contribute to nursing science and improved patient care. In particular, studies that are focused on identifying predictors of increased AUD risk and that involve longitudinal designs, large and diverse study participants and improved validated assessment tools will help to further elucidate the relationship between bariatric surgery and alcohol-related problems. Consequently, at-risk patients will be more easily identified and treated with another form of weight loss intervention. By conducting more thorough studies, a more targeted approach to patient care will become established, which in turn will help decrease healthcare cost. Furthermore, since there are multifactorial barriers to the implementation of programs that can prevent AUD following bariatric surgery, in its role as a patient advocate and a discipline that promotes population health, nursing can target its efforts to close the research gap in the phenomenon of study, and help to prevent AUD in this vulnerable patient population.

Chapter 3 – Conceptual/Theoretical Framework

Philosophical Underpinnings

Contemporary empiricism most accurately and directly influences how the research problem is viewed, as it incorporates the importance of both observation and experimentation as a way of getting closer to finding the most potentially reliable knowledge. The two tenets of empiricism are deductive reasoning, which includes objectivity and theoretical models, and theory substantiation which includes making hypotheses observable and operations to test theory (Weiss, 1995).

Deductive reasoning

Deductive reasoning relies on objectivity and knowledge that is acquired by repeatedly testing hypotheses in order to explain a phenomenon (Weiss, 1995). Karl Popper, a logical empiricist in the 1960s, and proponent of a theory-driven, hypothetico-deductive approach to attaining knowledge, claimed that a scientific theory can never be proven, only falsified (Weiss, 1995). He challenged the earlier logical positivists of the 1930s and their use of verification as a way of proving claims, based solely on observation of the physical world (Allmark, 2003). Instead of an inductive model, he introduced a deductive model, where a scientist starts out with a problem or clear hypothesis and objective, and then attempts to falsify it (Allmark, 2003; Horner & Westacott, 2000). Falsification allows for theories to be tested numerous times as a way of disproving them, instead of accepting a theoretical claim as verified, based on simple observation alone (Horner & Westacott, 2000; Weiss, 1995).

Objectivity. Objectivity, as a subset of deductive reasoning, is an essential component to deductive reasoning, in order to eliminate as much individual preconception as possible (Weiss, 1995). Consulting literature, and testing multiple other theories related to the phenomena being studied are two important steps in attempting to lessen the potential for personal bias (Weiss, 1995).

Theoretical models. Theoretical models are abstract ways to describe the link between sets of concepts that represent the nature of the phenomena of study (Weiss, 1995). Inferences and hypotheses are formed from these models and serve as a tool to predict and outcome of the study (Weiss, 1995). However, as with Popper's theory of deductive reasoning, these models will continually change due to an iterative

process of conjecture and negation (Godfrey-Smith, 2003). Equally, as they are modified, theoretical models must look to expand their ways of predicting results, without relying on prior refutation and assumptions (Godfrey-Smith, 2003).

Substantiation of theoretical claims

Theoretical claims, the second tenet of contemporary empiricism, are substantiated when tested extensively through falsification to illustrate their plausibility (Godfrey-Smith, 2003). Since theories are plausible, they must be challenged (Magee, 2001). When knowledge is derived from observation only, exclusive of testing, it cannot be considered verifiable (Weiss, 1995). Prior to testing, the theoretical claims must be organized into a set of operations, which take abstract concepts and make them observable in the physical world (Weiss, 1995). But even then, empiricists cannot prove theories; they can only disprove them through multiple intensive rounds of testing (Weiss, 1995).

Making hypotheses observable. Part of substantiating a theory is making hypotheses observable, translated to concrete feelings, thoughts, and behaviors, so that they can be measured or quantified. In contemporary empiricism, knowledge and acquiring new knowledge must be derived from an individual's sensory experiences and relationship with the environment (Weiss, 1995). John Locke introduced this with his theory of knowledge, and recognized that individuals create their own subjective experiences based on their personal interaction with their senses and the physical world (Locke & Pringle-Pattison, 1924; Magee, 2001). Individuals, then, develop the ability to reflect on and translate sensory input (Weiss, 1995). Hypotheses, when quantified through an observable lens, offer individuals the ability to utilize their distinctive perspective to test and measure theories.

Operations to test the theory. Repetition of experimentation through controlled conditions is the standard for testing hypotheses and theories of knowledge in contemporary empiricism (Weiss, 1995). Performing experiments and testing must involve hypotheses and include some way to measure thoughts, feelings, and actions (Weiss, 1995). Through falsification, Popper changed the way in which experiments are defined and understood (Weiss, 1995). Theories and hypotheses must be tested repeatedly to disprove claims, instead of verifying them (Godfrey-Smith, 2003; Weiss, 1995). Once a theory is disproven and

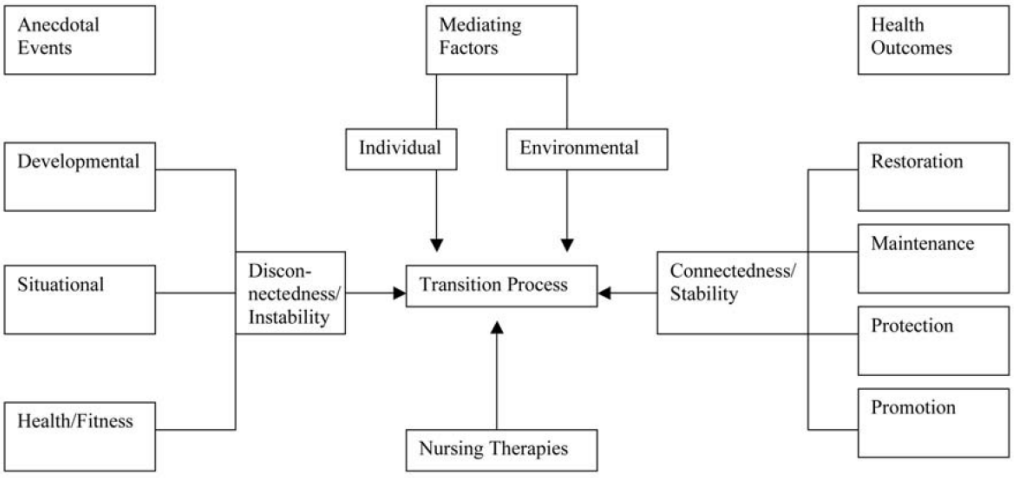
cannot hold up through additional testing, another theory must replace it (Magee, 2001; Weiss, 1995). However, according to Popper, it is not possible to absolutely confirm a theory through continual testing or by collection of observations (Godfrey-Smith, 2003).

Theoretical Framework

Meleis' Transition Theory

The phenomenon of study is RYGB-associated AUD, whereby a subset of post-operative RYGB patients experiences a hypothesized transition from unhealthy food consumption during the pre-bariatric surgery state to unhealthy consumption of alcohol during the post-bariatric surgery state. Given that this study is concerned with the nature of transitions, this phenomenon of study will use Afaf Meleis' Transition Theory (MTT) (Figure 3) (Schumacher & Meleis, 1994), a theory that describes shifting from one relatively stable state to another, following a change.

Meleis Transition Theory



Meleis, A.I. (2010) Transitions Theory: Middle Range and Situation Specific Theories in Research and Practice. New York, NY: Springer Publishing Company.

Figure 3: The Meleis' Transition Theory

The MTT is heavily utilized for its effectiveness in characterizing the nature of transitions between various situations, and has broad applicability in diverse health outcomes. The MTT will be used to examine the transitions that post-operative bariatric surgery patients face as they move from the somewhat stable existence of obesity (and accompanying co-morbidities) to a new reality, the altered self after losing a substantial amount of weight which can potentially create additional threats to health through harmful alcohol consumption. The MTT is applicable to RYGB-associated AUD because these post-operative bariatric surgery patients are believed to transition from food "addiction" to alcohol "addiction" after experiencing the triggering event of gastric bypass surgery.

Altered Dopamine Reward Pathway Theory

While the roots of addiction remain obscure in detail, one promising physiological explanation is a blunted response to dopamine at dopaminergic receptors in the brain. Dopaminergic neurotransmission in the central nervous system registers pleasure from activities with high reward salience, and motivates people to repeat rewarding actions in search of additional pleasure (Blum et al., 2011). Dopamine abnormality may underlie obesity, and obese adults' strong preference for sugary foods (Pepino et al., 2016). Pepino and colleagues found that, developmentally, the transition to adulthood correlates with a decline in preferences for sweet foods, and that younger age and fewer dopamine receptors are associated with a higher sweet preference (Pepino et al., 2016). However, in obese adults, an age-related decline in dopamine receptor was not associated with an age-related decline in sweetness preference. Thus, the extra body fat in obese adults may affect how their brains perceive rewards during meals, especially sweet meals (Pepino et al., 2016).

To elaborate further on the dopamine theory, Carpenter and colleagues (2013), have reported that the D2 receptor and addictive behavior and appetite control genes influence craving and overeating (Carpenter et al., 2013). The dopamine reward versus non-reward system is important in regulating food intake. The reward system is related to "wanting", rather than "liking" food (Berridge, 2009). When food becomes a reward, the mesolimbic dopamine neurons fire at a higher rate in response to food stimuli (Carpenter, 2013). With a dampened response to the dopamine reward system, the individual may compensate for the lack of response by overeating (Carpenter, 2013; Carpenter et al., 2013). Interestingly, Wang and colleagues have documented that severely obese individuals have reduced striatal dopamine activity (Wang et al., 2001). This level of reduced activity is comparable to what has been observed in patients who have problematic alcohol and drug use (Wang et al., 2001). In a subsequent paper, the authors proposed that low D2 receptor density may result in compulsive consumption of food or substances to experience the pleasurable effects (Wang et al., 2004). One concern is that by not engaging in their pre-surgery eating habits, these post-operative bariatric surgery patients may turn to other substances of abuse such as alcohol (Volkow & Wise, 2005; Wendling & Wudyka, 2011).

Another important concept in the dopamine theoretical framework is that the Taq 1A1 allele of the dopamine receptor D2 (DRD2) gene has been proposed to have an important role in obesity, and that it could potentially increase the risk for substance use disorders (Carpenter et al., 2013). Substance abuse may arise as a way to compensate for insufficient intrinsic dopaminergic activity (Carpenter et al., 2013). These data build on prior studies that suggest the DRD2 Taq1A1 allele may be closely linked with problematic alcohol and drug use (Blum et al., 2011). Moreover, post-operative bariatric surgery patients have accelerated alcohol absorption, higher maximum alcohol concentration, and longer alcohol elimination time (Hagedorn et al., 2007; Klockhoff et al., 2002; Woodard et al., 2011). One hypothesis to explain this effect is that by bypassing the stomach in post-operative bariatric surgery patients, alcohol dehydrogenase activity is limited. Thus, alcohol is rapidly absorbed (Lee et al., 2006). Furthermore, preliminary studies by two independent groups have shown that dopamine receptor patterns are altered in the ventral striatum and caudate nucleus of RYGB patients (Dunn et al., 2010; Steele et al., 2010).

Chapter 4 – Methods and Procedures

Overview

Since there are no established criteria for identifying bariatric surgery patients who are susceptible to AUD, and the mechanisms underlying RYGB-associated AUD is not fully understood, the goal of my study is to help bridge these knowledge gaps and reduce the number of bariatric surgery patients who experience AUD.

Research Questions

The main research question is to determine risk factors that predict AUD among post-operative bariatric surgery patients, and as a comparison between RYGB and sleeve gastrectomy patients. My research study is aimed at evaluating five potential AUD risk factors among post-operative bariatric surgery patients: addictive eating behavior, craving for sugary foods, drug abuse, low differentiation of self and lack of social support.

Research Approach

Questionnaire-based cross-sectional study of bariatric surgery patients in the UCLA database and the Kaighan database. Using Qualtrics, a survey containing established questionnaires for the five variables was emailed to post-operative bariatric surgery patients – 1,320 patients in the UCLA database and 4,662 patients in the Kaighan database. The questionnaires were the Food Craving Inventory, Power of Food Scale, Interpersonal Support Evaluation List-12, Drug Abuse Screening Test-20, Differentiation of Self Inventory-Revised and AUDIT. The variables collected from these questionnaires were used to determine if craving for sugary foods, addictive eating behavior, drug abuse, low differentiation of self and lack of social support are risk factors for AUD among post-operative bariatric surgery patients.

Variables of Study, Instruments and Measurements

The original dependent variable in the study is AUD status (positive or negative), and the revised dependent variable is AUP status (positive or negative). The independent variables in the study are craving for sugary foods score, addictive eating behavior score, drug abuse score, differentiation of self score, and social support score.

Alcohol Use Disorders Identification Test (AUDIT)

WHO's 10-item AUDIT self-report questionnaire that covers use of alcoholic beverages during the past year (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The AUDIT has three conceptual domains: alcohol consumption (items 1-3), alcohol dependence (items 4-6), and alcohol-related consequences (items 7-10) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). The AUDIT was developed as a uniform tool for identifying individuals with early alcohol problems; a tool that incorporated the best features of relevant self-report, laboratory and clinical procedures, and distinguished low-risk drinkers from high-risk drinkers. In the process of developing this tool, approximately 2000 patients were recruited – 64% current drinkers and 25% diagnosed alcohol dependent, and these patients' responses to the AUDIT questions were collected, as well interview and physical examination data. Ultimately, the 10 AUDIT items were selected because they correlated closely with the physical examination and interview, and because they effectively captured the data of interest. Further, clinical relevance, coverage of the conceptual domains, gender appropriateness, and cross-national generalizability were other factors that were used to select the 10 AUDIT items (Babor et al., 2001).

The responses to the 10 AUDIT questions are scored on a Leikert scale, for a total AUDIT score ranging from 0-40. For items 1 through 8, each of the five answer choices has a score ranging from 0 to 4, with 4 denoting highest severity (worse outcome). Items 9 and 10 have three answer choices, valued at 0, 2 and 4; a value of 4 represents the worse outcome. In general, a score of 1 or more on Item 2 or Item 3 indicates consumption at a hazardous level. Points scored above 0 on Items 4-6 (especially weekly or daily symptoms) imply the presence or incipience of alcohol dependence. Points scored on Items 7-10 indicate that alcohol-related harm is already being experienced. The total AUDIT score is calculated by adding the scores to each question (Babor et al., 2001).

The diagnosis criteria for AUD are outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). An individual who meets any two of the 11 criteria within the same 12-month period is diagnosed with AUD, and the severity of an AUD (mild, moderate or severe) is based on the number of criteria met. A total AUDIT score of 8 or more is recommended as an indicator of hazardous and harmful

alcohol use, and possible alcohol dependence. Generally, for AUDIT scores between 0-7, the recommended intervention is alcohol education. AUDIT scores between 8 and 15 are followed by simple advice to help the patient reduce hazardous drinking. For AUDIT scores between 16 and 19, the practioner may give the patient brief counseling and continued monitoring. AUDIT Scores of 20 and above generally warrant further diagnostic evaluation by a specialist for alcohol dependence and referral to treatment (Babor et al., 2001).

Validity: Among the studies that have established the validity of the AUDIT, Bohn and colleagues were one of the earliest groups - using the U.S. sample that was included in the AUDIT development project (Bohn, Babor, & Kranzler, 1995). This group used standard methods (Cronbach, 1969) to examine concurrent validity, construct validity, and discriminant validity of the AUDIT Core (the 10-item questionnaire) and Clinical Instruments (such as the Michigan Alcoholism Screening Test (MAST), MacAndrew Alcoholism Scale (MAC) and laboratory tests) in the study population. Concurrent validity was determined by comparing the AUDIT scores with scores on concurrent alcohol screening tests such as the MAST and MAC. Construct validity was evaluated by examining the correlation between AUDIT scores and measurements of i) development of heavy drinking and alcohol-related problems, ii) continuation of heavy drinking, and iii) problems developing from heavy drinking. The discriminant validity was assessed on the basis of how well it differentiated hazardous drinkers from non-hazardous drinkers, harmful drinkers from non-harmful drinkers and alcoholics from non-alcoholics (Bohn et al., 1995). The reported concurrent validity of the AUDIT Core score with the MAST score was 0.88 in men and 0.88 in women, and with the MAC, it was 0.47 and 0.46 in men and women, respectively (Bohn et al., 1995). Similarly, the reported concurrent validity of the AUDIT Clinical score with the MAST score was 0.66 in men and 0.54 in women, and with the MAC, it was 0.32 and 0.27 in men and women, respectively (Bohn et al., 1995). This demonstrated that there was a highly significant correlation between the score of AUDIT instruments (core and clinical) and scores on the MAC and MAST (Bohn et al., 1995). For construct validity, there was a significant correlation between the AUDIT Core and Instruments with risk factors for development and progression of alcohol problems. The AUDIT

instruments successfully discriminated harmful drinkers and nonharmful drinkers. The AUDIT Core was best (6.87 ± 4.45 vs 17.84 ± 6.44) followed by the MAST (4.31 ± 6.83 vs 11.00 ± 8.71). On the other hand, the AUDIT Clinical could not discriminate hazardous from non-hazardous drinkers.

Reliability: As reviewed in WHO's 2001 Manual on AUDIT (Babor et al., 2001), the AUDIT has high internal consistency, suggesting that it is reliably measuring a single construct. Among a sample consisting of non-hazardous drinkers, cocaine abusers, and alcoholics, a test-retest reliability study on AUDIT indicated high reliability (r=.86) (Sinclair, McRee, & Babor, 1992). In a study standardizing the AUDIT in a Greek population (Moussas et al., 2009), reliability of internal consistency was calculated using the Cronbach α index. The internal consistency was 0.73 for controls and 0.80 for patients. Generally, if the Cronbach α index is 0.6-0.7, the reliability is acceptable, and if it is 0.8 or higher, it is good reliability (Pradhan et al., 2012). The reliability of AUDIT to identify individuals who meet DSM-IV criteria for alcohol dependence/abuse and hazardous drinking was examined in another study (Pradhan et al., 2012). Using the Cronbach α index, the internal consistency of the AUDIT was 0.82, and the inter item correlations were ≥ 0.6 in all but one question (Pradhan et al., 2012).

Test-retest reliability and internal reliability of the instrument in the proposed study will be established by i) administering the AUDIT in the same format (self-report vs oral interview), ii) if oral, asking the questions in the same order for each study subject, iii) training each researcher to administer the AUDIT.

Sensitivity and Specificity: During development of the AUDIT, sensitivity (percentage of positive cases identified by the test) and specificity (percentage of negative cases identified by the test), were determined through the use of several reference standards (Saunders, Aasland, Amundsen, & Grant, 1993). One of the reference standards developed to identify a positive "case" was hazardous alcohol consumption. This was defined as an average daily alcohol intake that was excess of 60 g per day for men and excess of 40 g per day for women. The second reference standard was recurrent intoxication, defined as consumption of 60 g in a single session at least weekly. The third reference standard was abnormal drinking behavior, which was diagnosis with at least one criterion of the alcohol dependence syndrome on

the drinking behavior scale. The fourth reference standard was alcohol-related problems. To be classified as a positive "case", an individual has to exhibit one of the aforementioned reference standards (Saunders et al., 1993). The WHO's recommended cut-off score for the AUDIT is a score of 8, which is sensitive and specific for current ICD-10 AUDs and the risk of future harm (Allen, Litten, Fertig, & Babor, 1997; Cherpitel, 1995; Conigrave, Hall, & Saunders, 1995). Using data from the various countries included in the development study of the AUDIT, the sensitivity of AUDIT was between 95% to 100% for hazardous alcohol consumption, between 66% and 89% for recurrent intoxication, between 93% and 100% for abnormal drinking behavior, and between 91% to 100% for alcohol problems within the last year (Saunders et al., 1993). When all of the countries' values were combined, the AUDIT's index of hazardous and alcohol use was 92% (Saunders et al., 1993).

The sensitivity and specificity of the AUDIT to differentiate alcoholics from non-alcoholics was determined through ROC analyses (Murphy et al., 1987). At the threshold AUDIT Core score ≥ 10, the AUDIT detected harmful drinkers with a sensitivity of 60% and specificity of 87% (Bohn et al., 1995). At the threshold AUDIT Core score ≥ 10, the AUDIT detected hazardous drinkers with a sensitivity of 87% and specificity of 75% (Bohn et al., 1995). Further, the alcoholics scored ≥ 9 and a score of ≥ 10 corresponded to a sensitivity of 99% and a specificity of 74% in identifying alcoholics undergoing treatment (Bohn et al., 1995).

The AUDIT is generally the gold standard for assessing AUD, and several studies have used it to evaluate alcohol consumption and alcohol related problems among bariatric surgery patients (King et al., 2012; Kudsi et al., 2013; Mitchell et al., 2001; Mitchell et al., 2015; Suzuki et al., 2012).

Alcohol Use Disorders Identification Test - Consumption (AUDIT-C)

The AUDIT-C, which is the first three questions of the AUDIT, has a total score range of 0-12 (each AUDIT-C question is scored 0-4) (Delaney et al., 2014). The AUDIT-C measures alcohol consumption, and the risk of AUD and other drinking-related complications (Delaney et al., 2014). It has been used in previous studies to assess harmful or hazardous drinking among bariatric surgery patients (Ibrahim et al., 2019) and in the general population (Delaney et al., 2014). In a study of 1,319

participants, the AUDIT-C identified heavy drinkers more accurately than the full AUDIT, but the AUDIT was marginally better in identifying patients with active alcohol abuse or dependence (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The AUDIT-C performed better than other instruments (AUDIT, CAGE) in identifying alcohol misuse at cutoff of 4 for men and 3 for women (Bradley et al., 2007). With the AUDIT-C used to measure AUD post-bariatric surgery, higher income and higher educational level contributed to AUD development (Ibrahim et al., 2019). Another study concluded that clinicians should take into account both the AUDIT-C score and alcohol consumption reported by the patient, as up to 21% of patients had AUDIT-C results that were inconsistent with their drinking as reported on the same instrument (Delaney et al., 2014).

The Interpersonal Support Evaluation List-12 (ISEL-12)

The original ISEL is a self-report measure that is commonly used to assess the perceived availability of social support to the respondent (Hoberman, 1983). It contains 40 items and covers four separate functions of social support (subscales): i) perceived appraisal support (perceived availability of someone for to provide advice or guidance), ii) perceived self-esteem support (presence of someone who is viewed as favorable), iii) perceived belonging support (perceived presence of a group to provide empathy, acceptance, concern) and iv) perceived tangible support (perceived availability of help or assistance) (Bolton, 1988; Cohen & Wills, 1985; Merz et al., 2014). The ISEL has good internal consistency reliability, test-retest reliability and convergent validity (Merz et al., 2014). The ISEL was developed at least in part because of previous finding supporting an association between perceived support and health outcomes (Cohen, 2008; Cohen & Wills, 1985; Hoberman, 1983).

The ISEL-12, the short form of the ISEL, is also widely used to assess perceived social support (Merz et al., 2014). It contains 12 items that describe perceived social support in three subscales – appraisal, belonging and tangible (Cohen & Wills, 1985; Merz et al., 2014). The score for each question is on a 4-point scale. The responses for Items 3, 4, 6, 9 and 10 are scored as 0 (definitely false), 1 (probably false), 2 (probably true) and 3 (definitely true). The responses for Items, 1, 2, 7, 8, 11 are scored as 0 (definitely true), 1 (probably true), 2 (probably false) and 3 (definitely false). The total ISEL-12 score

ranges from 0 to 36. Higher scores indicate greater availability of support. In a study to validate ISEL-12 among 5,313 English and Spanish speaking Hispanics, the total ISEL-12 score was internally consistent for the full sample (Merz et al., 2014). On the other hand, the scores for the three ISEL-12 subscales were lower than the recommended cutoff of 0.70 for the full sample (Merz et al., 2014). In an earlier study, ISEL-12 data collected from 1,399 individuals showed an internal consistency of $\alpha = 0.80$ to 0.90 for the total scale (Cohen, 2008). The ISEL-12 has construct validity, as evidenced by similarly positive relationships observed as other measurements of social support, and inverse for relationships for dissimilar constructs (Cohen, 2008; Cohen & Wills, 1985).

The ISEL-12 was used to assess perceived social support among bariatric surgery patients (King et al., 2012; Mitchell et al., 2015). Among a study sample containing almost 70% of RYGB patients, lower interpersonal support (lower sense of belonging) prior to surgery was predictive of AUD post-surgery (King et al., 2012).

Food Craving Inventory (FCI)

The FCI is a 28-item validated test that measures the frequency of food cravings, where craving is defined as an "intense desire for a specific food that is difficult to resist" (Pepino, Bradley, et al., 2014; Weingarten & Elston, 1990, 1991; White & Grilo, 2005). The FCI measures overall food cravings and cravings for specific types of foods: high fats (items 1-8), sweets (items 9-16), carbohydrates/starches (items 17-24), fast-food (items 25-28) during the previous month (Pepino, Bradley, et al., 2014; Yeh et al., 2016). Responses are scored using the Likert scale, ranging from 1 (never), 2 (rarely), sometimes (3), often (4) to 5 (very often/always) (Pepino, Bradley, et al., 2014; White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002). For each subscale (high fats, sweets, carbohydrates/starches, fast food), the maximum score is 4 (Yeh et al., 2016). Higher subscale scores indicate higher craving for that particular group of food items (Martin, O'Neil, Tollefson, Greenway, & White, 2008). The overall FCI score is an average of score for the 28 items (Leahey et al., 2012). Higher overall FCI scores indicate higher frequency of food cravings.

In the development of the FCI, the internal consistency ranged from α = 0.76 to 0.91 (Martin, McClernon, Chellino, & Correa, 2011; White et al., 2002). The reliability and concurrent validity of the FCI was tested with a sample of 379 participants. For each of the four FCI subscales, the reliability indices were 0.86 for high fats, 0.84 for carbohydrates/starches, 0.86 for sweets, 0.76 for fast-food fats and 0.93 for the total score (White et al., 2002). The test-retest reliability scores for the FCI were 0.91 for high fats, 0.79 for carbohydrates/starches, 0.87 for sweets, 0.87 for fast-food fats and 0.86 for the total score (White et al., 2002). Concurrent validity of the FCI was established through comparison with the Conceptual Craving Scale (CCS) and the disinhibition and perceived hunger scales of the Three Factor Eating Questionnaire (TFEQ) (White et al., 2002). This comparison revealed that the FCI strongly correlated with the frequency scale of the CCS, where it was 0.84 for high fats, 0.87 for carbohydrates/starches, 0.78 for sweets, 0.76 for fast-food fats and 0.68 for the total score (White et al., 2002). On the other hand, the FCI correlated moderately with disinhibition, with 0.14 for high fats, 0.19 for carbohydrates/starches, 0.37 for sweets, 0.18 for fast-food fats and 0.27 for the total score (White et al., 2002). In a more recent study evaluating menstrual craving prevalence among 275 women, the internal consistency scores of the FCI were 0.76 for high fats, 0.80 for carbohydrates/starches, 0.37 for sweets, 0.806 for fast-food fats (Hormes & Niemiec, 2017).

The FCI was used to assess perceived social support among bariatric surgery patients (King et al., 2012; Mitchell et al., 2015). Among a study sample containing almost 70% of RYGB patients, lower interpersonal support (lower sense of belonging) prior to surgery was predictive of AUD post-surgery (King et al., 2012).

Power of Food Scale (PFS)

The PFS is a validated 15-item questionnaire that evaluates the psychological impact of living in food-abundant environments (Ullrich, Ernst, Wilms, Thurnheer, & Schultes, 2013), and measures what motivates individuals to consume highly palatable food, independent of homeostatic hunger (Appelhans et al., 2011; Cappelleri et al., 2009; Lowe et al., 2009). The PFS assesses an individual's behavior and cognition towards food when it is available but not present, present but not tasted, and tasted but not

consumed (Appelhans et al., 2011; Cappelleri et al., 2009). Responses are scored from 1 (don't agree), 2 (agree a little), 3 (agree somewhat), 4 (agree) and 5 (strongly agree). The total PFS score is calculated by summing the scores of each item, for a total PFS score range of 21 to 105. The higher score indicates higher responsiveness to the food cues and availability, which can be interpreted as food having "power" over the individual. The PFS score can be assessed according to three domain scores and one aggregate score – factor 1 (food available), factor 2 (food present), factor 3 (food taste) and aggregate (Cappelleri et al., 2009). The domain scores represent the mean of the items in the corresponding domain, and the aggregate score is calculated as the mean of the three domains (Lipsky et al., 2016). Experts have agreed on the content validity of the PFS, that is, the PFS had a strong representation of the construct that it aimed to measure (Cappelleri et al., 2009).

Assessment of food reward sensitivity using the PFS in 2,202 patients in the NEXT Generation Health Study revealed high internal consistency for all three PFS domains and aggregate; $\alpha = 0.85$ for food available, $\alpha = 0.87$ for food present, $\alpha = 0.84$ for food tasted and $\alpha = 0.94$ for aggregate (Lipsky et al., 2016). In an overweight/overeating study of 120 individuals, hedonically-driven eating was evaluated by the PFS. In this study, the internal consistency of the PFS was 0.97. The PFS was also used to assess eating behavior among 141 individuals who were at least 24 months post-RYGB (Reslan et al., 2014). The study demonstrated that significantly higher PFS scores were observed in the 14% of the post-operative RYGB patients with substance misuse compared to those who did not have substance misuse (Reslan et al., 2014). These results indicate that high PFS scores is a factor that elevates risk for substance misuse among post-operative RYGB patients.

Drug Abuse Screening Test (DAST-20)

The DAST is a 28-item self-report that quantitatively measures the severity of drug abuse, and is commonly used to detect drug use disorder (Skinner, 1982; Villalobos-Gallegos, Perez-Lopez, Mendoza-Hassey, Graue-Moreno, & Marin-Navarrete, 2015). The DAST covers an individual's involvement with drugs, excluding alcoholic beverages, during the past 12 months. It was developed and validated in a sample of patients seeking treatment for substance use problems (Skinner, 1982; Villalobos-Gallegos et

al., 2015). The DAST questionnaire has five factors – factor I is defined by 14 items and covers self-acknowledgement of a drug problem and history of substance abuse; factor II is defined by 10 items and measures last onset social consequences of drug use; factor III is defined by seven items and relates to help-seeking as a consequence of drug abuse; factor IV is defined by two items and covers illegal drug-related activities; factor V is defined by three items and covers inability to control drug use (Staley & el-Guebaly, 1990). The answer choices for the DAST are "Yes" and "No", which are scored as yes = 1 and no = 0 with the exception of three questions which are scored as no = 1 and yes = 0 (Skinner, 1982): "Can you get through the week without using drugs (other than those required for medical reasons", "Are you always able to stop using drugs when you want to", "Do you try to limit your drug use to certain situations?" The total score of the DAST is determined by adding all responses, thus producing a maximum of 28 (Skinner, 1982).

Using a clinical sample of 256 drug/alcohol abuse clients, the internal consistency reliability of DAST was 0.92 (coefficient alpha), which indicates high consistency for subjects' responses (Nunnally, 1978; Skinner, 1982). Concurrent validity tests revealed correlations of the DAST with frequency of drug use in the past year and psychopathology indications. The DAST has an overall accuracy of 89% in identifying DSM-III Substance Abuse patients (Staley & el-Guebaly, 1990). The DAST has high sensitivity and specificity at cutoff thresholds of 5/6 through 10/11 - the 5/6 cutoff threshold has maximum sensitivity and effectively detects substance abuse cases and the 10/11 cutoff threshold has maximum specificity and effectively screens out non-substance abusers (Staley & el-Guebaly, 1990).

The DAST-20 is a shortened version of the original DAST, and includes 20 questions. It has been evaluated in multiple samples, and has a moderate to good internal consistency ranging between .74 to 0.93 (Villalobos-Gallegos et al., 2015). Further, the DAST-20 has been shown to have a concurrent validity with DSM-IV diagnostic criteria for drug abuse and dependence (Villalobos-Gallegos et al., 2015). The DAST-20 score is calculated by summing the scores for the 20 items (minimum DAST-20 score is 0; maximum DAST-20 score is 20). The DAST-20 score reflects the individual's degree of drug abuse problems or consequences. With regards to scoring interpretation: DAST-20 scores of 0 are

categorized as no drug abuse (no evidence of drug-related problems reported), and no intervention is recommended. DAST-20 scores between 1-5 are categorized as low drug abuse, and brief intervention is recommended. DAST-20 scores between 6-10 are categorized as intermediate drug abuse (likely meets DSM criteria), and outpatient (intensive) intervention is recommended. DAST-20 scores between 11-15 are categorized as substantial drug abuse, and intensive intervention is recommended. DAST-20 scores between 16-20 are categorized as severe drug abuse, and intensive intervention is recommended.

Differentiation of Self Inventory-Revised (DSI-R)

The original DSI contains 43 items that measure how well adults differentiate themselves from others, by "distinguish[ing] between the emotional system and the intellectual system and to decide which of the two takes precedence in a given situation" (Skowron & Friedlander, 1998; Skowron & Schmitt, 2003). The DSI contains four subscales: Emotional Reactivity (ER), which contains 11 items and assesses emotional responses; "I" Position (IP), which has 11 items and measures how well the individual relies on their own thoughts and feelings; Emotional Cutoff (EC) has 13 items and measures intimacy; Fusion with Others (FO) contains 9 items and measures emotional involvement (Skowron & Schmitt, 2003). The internal consistency for the full DSI is 0.88, and for each subscale, it is 0.84 for ER, 0.85 for IP, 0.82 for EC and 0.74 for FO (Skowron & Schmitt, 2003). The items are rated on a 6-point Likert-type scale that ranges from "not at all true of me" (score of 1) to very true of me (score of 6). The total score is calculated by summing the responses for all questions and dividing by the number of items. The higher scores reflect greater differentiation of self, that is, less emotional reactivity, less difficulty in maintaining the I-position, less emotional cutoff and less fusion with others (Sheikh, Khodabakhshi Koolaee, & Rahmati Zadeh, 2013; Skowron & Schmitt, 2003).

The DSI-R is the revised version of the DSI, containing 46 questions. The FO subscale has 12 items (compared to 9 in the original DSI) and the EC subscale has 12 items (compared to 11 in the original DSI) (Skowron & Schmitt, 2003). The internal consistency for the full DSI-R is 0.92, and for each subscale, it is 0.89 for ER, 0.81 for IP, 0.84 for EC and 0.86 for FO (Skowron & Schmitt, 2003).

The DSI-R score is calculated by adding scores for the 46 items (and then dividing that total score by 46 (minimum DSI-R score is 1, maximum DSI-R score is 6). The scores for each of the 4 subscales is calculated by adding the scores for the items in the subscale then dividing by the number of items in the subscale (minimum subscale score is 1, maximum subscale score is 6). ER subscale has 11 items, IP subscale has 11 items, EC subscale has 12 items and FO subscale has 12 items. Higher DSI-R scores reflect greater differentiation of self. Higher subscale scores suggest lower emotional reactivity, emotional cutoff, lowered fusion with others, and an increased ability to take "I" positions (Skowron & Schmitt, 2003).

Specific Aims

Specific Aim 1: Determine if disordered eating behaviors, such as food craving and addictive eating behavior are predictors of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative

(defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Studies have shown that similar brain responses are triggered by food and alcohol (Volkow et al., 2011). Among RYGB patients, pre-operative food addiction was identified as a predictor of post-operative substance use (alcohol, drugs) (Reslan et al., 2014) In a study sample with almost 93% RYGB patients, individuals with pre-operative problems with High-Sugar/Low-Fat Foods and/or High Glycemic Index foods had higher risk for developing substance use disorder (alcohol, drugs) (Fowler et al., 2014).

Specific Aim 2: Determine if lack of social support is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are

AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Among a study sample containing almost 70% of RYGB patients, pre-surgery lower interpersonal support (lower sense of belonging) was predictive of AUD post-surgery (King et al., 2012).

Specific Aim 3: Determine if low differentiation of self is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping

Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping

Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: There are no published studies on the relationship between differentiation of self and AUD risk. However, an individual who is an alcoholic or addict is thought to have low differentiation of self, whereas someone who is an alcoholic/addict in recovery is believed to have high differentiation of self (Rubalcava, 2019).

Specific Aim 4: Determine if drug abuse is a predictor of AUD among post-operative bariatric surgery patients.

Hypothesis for Original Grouping:

Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis for Revised Grouping:

Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Rationale: Studies on drug abuse and AUD risk typically look at drug use under the umbrella of substance use, where substance use refers to alcohol use, drug use, smoking (Fogger & McGuinness, 2012; Ivezaj et al., 2014; Li & Wu, 2016; Mitchell et al., 2015; Saules et al., 2010; Tedesco et al., 2013; Wiedemann et al., 2013). The King et al study (2012) reported that preoperative recreational drug use may increase postoperative AUD risk. In another study of 54 bariatric surgery patients enrolled in a substance abuse treatment program for alcohol and/or drug, 35.8% had a history of heavy use of drugs and/or alcohol, 43.4% were new-onset heavy users, and 20.8% of the preoperative heavy users switched to a different drug and/or alcohol after surgery than what they used before surgery (Saules et al., 2010). Furthermore, adults with no history of using opiates, benzodiazepine were more likely to begin using those drugs after surgery, compared to alcohol and cigarettes (Saules et al., 2010).

Data Analysis Plan

The outcome, AUD status (AUD-negative and AUD-positive) and AUP status (AUP-negative and AUP-positive), were determined by the AUDIT questionnaire, and the AUDIT-C questionnaire and history of hospitalization and/or counseling due to alcohol use and/or substance use, respectively. Also completed was descriptive statistics on all demographic variables including gender, age, education level,

ethnicity, income and marital status for the whole sample as well as separately for the AUD-negative and AUD-positive groups, and for the AUP-negative and AUP-positive groups. Pre- and post-surgery BMI, height, weight, history of smoking and substance abuse were reported by group status and tested for group differences with parametric or non-parametric methods as appropriate. For continuous variables, means and standard deviations will be reported, and for categorical variables frequencies will be given. For hypothesis testing, two group comparisons using independent sample t tests were completed to compare groups on the variable of interest. A two-sided p-value of 0.05 in conjunction with 95% confidence intervals was used to determine statistical significance. Drug abuse, addictive eating behavior, food craving, differentiation of self and social support were treated as predictors in a logistic regression with AUP as the binary outcome.

Categories were combined during data analysis for five demographic questions. For race, Multiple Races include White or Caucasian, American Indian or Alaska Native; White or Caucasian, Asian; White or Caucasian, Black or African American; White or Caucasian, Black or African American, American Indian or Alaska Native; White or Caucasian, Other. The question about education was asked across five categories, which were then recategorized as No College Degree, which includes some college (at least one year), some high school, other post high school education, and College Degree and Above which includes college diploma (Bachelor's degree) and graduate or professional degree. The question about household income was asked across six categories; for analysis, less than $25,000, $25,000 to $49,999, $50,000-$74,999, and $75,000-$99,999 were combined into a single Less than $100,000 category. The question about marital status was asked across six categories, which were then recategorized into three categories: Married/Living as Married includes married and living as married; Separated/Widowed/Divorced includes separated or lived as married but no longer living as married; widowed; and separated. The question about tobacco use was asked across three categories, then yes, and no, but did a year or more ago were recategorized as Yes.

Scoring Details

AUDIT (Babor et al., 2001)

Scoring: The AUDIT score was calculated by adding the scores for the 10 items (minimum AUDIT score is 0, maximum AUDIT score is 40).

Cutoff: Since AUDIT scores of 8 or more are recommended as indicators of hazardous and harmful alcohol use, as well as possible alcohol dependence, AUDIT score of 8 or higher is AUD-positive and AUDIT score of 0 to 7 is AUD-negative.

AUDIT-C (Babor et al., 2001; Delaney et al., 2014)

Scoring: The AUDIT-C score was calculated by adding the scores for items 1-3 of the AUDIT.

Cutoff: The AUDIT-C score cutoff for unhealthy alcohol use was 4 for men and 3 for women.

ISEL-12 (Merz et al., 2014;)

Scoring: The ISEL-12 score was calculated by adding the scores for the 12 items (maximum ISEL-12 score is 36). The score for the belonging subscale was calculated by adding the scores for items 1, 5, 7 and 9; the appraisal subscale score was calculated by adding the scores for items 2, 4, 6 and 11; the tangible subscale score was calculated by adding the scores for items 3, 8, 10 and 12.

DAST-20 (Skinner, 1982; Villalobos-Gallegos et al., 2015)

Scoring: The DAST-20 score was calculated by summing the scores for the 20 items (minimum DAST-20 score is 0; maximum DAST-20 score is 20).

Scoring Interpretation: DAST-20 scores of 0 are categorized as no drug abuse (no evidence of drug-related problems reported). DAST-20 scores between 1-5 are categorized as low drug abuse. DAST-20 scores between 6-10 are categorized as intermediate drug abuse (likely meets DSM criteria). DAST-20 scores between 11-15 are categorized as substantial drug abuse. DAST-20 scores between 16-20 are categorized as severe drug abuse.

DSI-R (Skowron & Schmitt, 2003)

Scoring: The DSI-R score was calculated by adding scores for the 45 items (usually it is 46 items but one question was accidentally omitted) and then dividing that total score by 45 (minimum DSI-R score is 1, maximum DSI-R score is 6). The scores for each of the 4 subscales was calculated by adding the scores for the items in the subscale then dividing by the number of items in the subscale (minimum subscale

score is 1, maximum subscale score is 6). ER subscale has 11 items, IP subscale has 11 items, EC subscale has 12 items and FO subscale has 11 items (usually FO has 12 items).

Scoring Interpretation: Higher DSI-R scores reflect greater sense of self. Higher subscale scores suggest lower emotional reactivity, lower emotional cutoff, lower fusion with others, and an increased ability to take "I" positions.

FCI (Martin et al., 2008)

Scoring: The FCI score was calculated by adding the scores for the 28 items and then dividing by 28. The scores for each of the 4 subscales was calculated by taking the mean of the items on that scale (minimum subscale score is 1, maximum subscale score is 5). The high fats subscale is usually covered by items 1-8 but one item was accidentally omitted; items 9-16 for the sweets subscale; items 17-24 for the carbohydrates/starches subscale; and items 25-28 for the fast-food subscale.

Scoring Interpretation: Higher FCI scores reflect more frequent cravings, and higher FCI subscale scores indicate more frequent cravings for that particular food category.

PFS (Cappelleri et al., 2009)

Scoring: The PFS score was calculated by adding the scores of the 21 items (maximum PFS score is 105).

Scoring Interpretation: Higher PFS scores indicate higher greater responsiveness to the food environment.

Chapter 5 – Results

Findings are presented in this chapter in two parts. The first part consists of sample and variable characteristics. These data are presented by AUD status, where AUD-positive status is defined as AUDIT score of >= 8 for harmful or hazardous drinking, and AUD-negative status is defined as AUDIT score of < 8. This first section corresponds to the original aims and hypotheses. However, during the course of research, we also identified alcohol use problems, so the second part presents findings grouped by Alcohol Use Problems (AUP) status. AUP-positive status is defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use. AUP-negative status is defined as a combination of AUDIT-C score of >= 2 for women and >= 4=3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use. Specifically, there were 13 AUD-positive participants, and 46 AUP-positive participants. Since the motivation of this research project is to identify people who are at risk of alcohol use problems, we added revised hypotheses to assess this group.

Study Participants

The Qualtrics survey with the six questionnaires was emailed to 5,982 participants who were part of the UCLA Health database and the Kaighan database. Of these 5,982 individuals, 229 (45.8%) consented and 218 (43.6%) met the eligibility requirements of the study - they were at least 25 years old and had bariatric surgery. Among the individuals who consented and were eligible to participate in the study, 212 completed the AUDIT questionnaire. The flow of study participants is shown in Figure 4.

Methodology

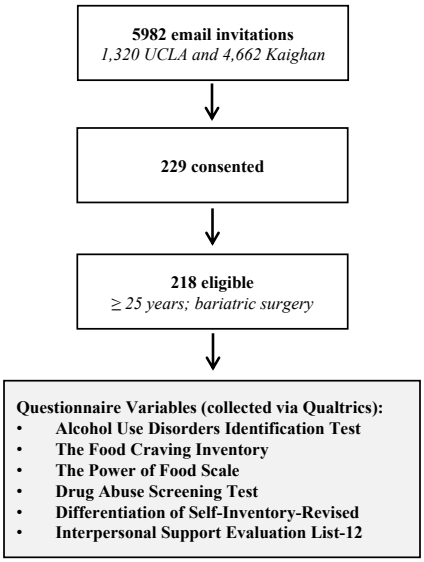


Figure 4. *Flow of study participants. All 212 who completed AUDIT also completed demographics, but a subset were incomplete on some of the other questionnaires.*

Grouping of Study Participants for Hypothesis Testing

As shown in Figure 5, the 212 study participants were grouped together in two separate ways: by AUD status under the original hypotheses, and by AUP status under revised hypotheses. The group split by AUD status consists of 13 positive participants and 199 negative participants. The group split by AUP status consists of 46 positive participants and 166 negative participants.

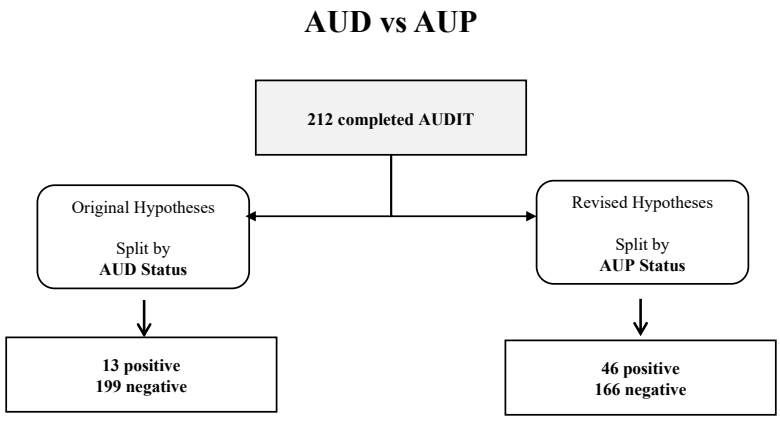


Figure 5. *Grouping of study participants for hypothesis testing*

Expanding AUD-Positive to AUP-Positive after Bariatric Surgery

The intention of the current study was to assess AUD-positive individuals to identify people with alcohol use problems. However, given that the AUDIT questionnaire is a point-in-time measure (ie. AUDIT status at time of survey), and measures alcohol use in the past year only, the number of AUD-positive participants as measured by the AUDIT questionnaire may be an underrepresentation of participants who have experienced alcohol use problems. As such, participants were assessed on history of post-surgery counseling and/or hospitalization due to alcohol use-related problems, as these types of treatment would have happened over time. The idea is that history of post-surgery counseling and/or hospitalization due to alcohol use-related problems is a broader way to identify anyone who has had alcohol use problems, as it will include those who are AUD-positive at the time of survey completion, as well as those who are AUD-negative at time of survey completion and have experienced post-surgery counseling and/or hospitalization due to alcohol use-related problems. Therefore, for this categorization of people with alcohol use problems, AUP-positive status is defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use. The sample characteristics and hypothesis testing from previous sections were repeated with alcohol use problems groups.

Original Grouping – Descriptive Statistics and Hypotheses Tests

The first set of results addresses original hypotheses for the study sample split by AUD status.

Hypothesis 1: Post-operative bariatric surgery patients with AUD have more history of drug abuse.

Hypothesis 1. Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis 2: Post-operative bariatric surgery patients with AUD have lower differentiation of self.

Hypothesis 2. Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis 3: Post-operative bariatric surgery patients with AUD have higher craving for sweets.

Hypothesis 3. Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis 4: Post-operative bariatric surgery patients with AUD have lower social support.

Hypothesis 4. Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Hypothesis 5: AUD is positively associated with addictive eating behavior.

Hypothesis 5. Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (defined by AUDIT score of < 8).

Sample Characteristics by AUD Status

Characteristics of Total Study Population

Table 5.1 and Table 5.2 present the sample characteristics for the total study population, AUD-positive participants and AUD-negative participants. There was 6.1% post-operative AUD among the study participants. The majority of study participants were female (72.1%), non-Hispanic (84.4%) and non-smokers (82.1%). With regards to race, 69.3% identified as White or Caucasian, 10.8% identified as Black or African American, 8.5% identified as Other, 2.8% identified as Asian, and 0.9% identified as American Indian or Alaska Native. Those who selected more than one race were categorized as multiple races (7.5%). Multiple race selections were White or Caucasian, American Indian or Alaska Native; White or Caucasian, Asian; White or Caucasian, Black or African American; White or Caucasian, Black or African American, American Indian or Alaska Native; and White or Caucasian, Other.

The majority of participants (67.5%) had a college degree or higher (a college diploma or Bachelor's degree, or a graduate or professional degree). Thirty-two percent had no some college degree. For annual household income, 51.4% had income of $100, 000 or less, 29.2% had income between $100,000 and $199, 000, and 19.3% had income of $200,000 or more. For marital status, 52.8% were married or living as married. Among the others, 30.2% were never married and lived as never married, and 17.0% were divorced, widowed or separated or lived as married but no longer living as married.

In terms of substance use, 17.9% of the study participants were current smokers or who used to smoke a year or ago. Alcohol consumption at least two times per week was reported by 34.9% of study participants, and 6.1% met the criteria for AUD.

Among the participants, 70.3% had sleeve gastrectomy, 27.8% had RYGB, and 1.9% had adjustable gastric band. The current mean weight was 97.6 kg (49.9-208.7, SD 25.2) and before surgery, the mean weight was 133.1 kg (83.9-258.5, SD 30.7). The mean lowest weight after surgery was 90.7 kg (47.6-208.7, SD 22.8). The current mean BMI was 34.0 kg/m^2 (19.8-70.9, SD 7.9) and the mean BMI before surgery was 46.3 kg/m^2 (19.8-86.9, SD 9.2). The mean lowest BMI after surgery was 31.6 kg/m^2 (19.8-70.9, SD 7.3). The mean current age was 52.4 (25.1-80.3, SD 12.0), the mean age at the time of surgery was 47.9 (23.6-68.9, SD 10.9), and the mean time since surgery was 4.5 years (0.1-28.8, SD 5.3).

Characteristics of AUD-Negative Participants

Characteristics of the 199 AUD-negative participants are shown in Table 5.1 and Table 5.2. The majority were female (72.9%), White or Caucasian (68.8%), non-Hispanic (84.4%), non-smokers (85.5%), experienced marriage (69.8%), completed a college degree (67.3%) and had an annual household income of $100,000 or less (52.2%). The majority underwent RYGB (72.4%). The mean age was 52.6 years (25.1-80.3, SD 11.9), the mean age at the time of surgery was 47.9 years (23.6-68.9, SD 10.8), and the mean time since surgery was 4.4 months (0.0-28.8, SD 5.3). The mean weight before surgery was 132.5 kg (0.0-258.6, SD 30.3), the mean lowest weight was 90.9 kg (47.6-208.7, SD 22.8), and the mean current weight was 97.5 kg (49.9-208.7, SD 25.0). The mean BMI before surgery was 46.3 kg/m^2 (0.0-86.9, SD 9.2), the mean lowest BMI is 31.8 kg/m^2 (19.8-70.9, SD 7.4) and the mean current BMI was 34.1 kg/m^2 (19.8-70.9, SD 7.9).

Characteristics of AUD-Positive Participants

Characteristics of the 13 AUD-positive participants are shown in Table 5.1 and Table 5.2. The majority were female (61.2%), White or Caucasian (76.9%), non-Hispanic (84.6%), smokers (69.3%), experienced marriage (53.9%), completed a college degree (69.2%) and had an annual household income of $100,000 or higher (61.6%). The majority underwent Roux-en-Y gastric bypass (61.5%). The mean age was 48.6 years (37.1-74.9, SD 12.1), the mean age at the time of surgery was 41.7 years (27.5-67.5, SD 11.4), and the mean time since surgery was 6.8 years (S1.9-12.2, SD 3.8). The mean weight before surgery

was 141.4 kg (85.7-220, SD 35.9), the mean lowest weight was 87.8 kg (57.6-127.0, SD 23.9), and the mean current weight was 98.2 kg (60.8-144.2, SD 29.9). The mean BMI before surgery was 46.8 kg/m^2 (27.1-65.8, SD 9.1), the mean lowest BMI is 29.0 kg/m^2 (21.8-38.0, SD 5.9) and the mean current BMI was 32.3 kg/m^2 (23.0-44.3, SD 7.8).

Table 5.1: Sample Characteristics - Classifications (N=212)

Distributions of sample over categorical variables. Abbreviations: N, number; [a] This is a combination of current smokers, and non-smokers who smoked a year ago. P value for Chi-square comparison between AUD-negative and AUD-positive. $p \leq 0.05$ is statistically significant*

	All		AUD-Negative		AUD-Positive		Comparison
	N (of 212)	%	N (of 199)	%	N (of 13)	%	*P* value
Gender							0.38
Male	59	27.8	54	27.1	5	38.5	
Female	153	72.1	145	72.9	8	61.5	
Race							0.71
White or Caucasian	147	69.3	137	68.8	10	76.9	
Black or African American	23	10.8	23	11.6	0	0.0	
Asian	6	2.8	6	3.0	0	0.0	
American Indian or Alaska Native	2	0.9	2	1.0	0	0.0	
Multiple races	16	7.5	15	7.5	1	7.7	
Other	18	8.5	16	8.0	2	15.4	
Hispanic Ethnicity	33	15.6	31	15.6	2	15.4	1.00
Marital Status							0.42
Married/Living as married	112	52.8	107	53.8	5	38.5	
Never Married	64	30.2	58	29.1	6	46.2	
Separated/Widowed/Divorced	36	17.0	34	17.1	2	15.4	
Education							0.89
No college degree	69	32.5	65	32.7	4	30.8	
≥College degree	143	67.5	134	67.3	9	69.2	
Household Income							0.50
<$100,000	109	51.4	104	52.2	5	38.5	
$100,000-$199,999	62	29.2	58	29.1	4	30.8	
≥$200,000	41	19.3	37	18.6	4	30.8	
Substance Use							< 0.05*
[a] Tobacco Use	38	17.9	29	14.5	9	69.3	
Surgical Procedure							< 0.05*
Sleeve gastrectomy	149	70.3	144	72.4	5	38.5	
Roux-en-Y gastric bypass	59	27.8	51	25.6	8	61.5	
Adjustable gastric band	4	1.9	4	2.0	0	0.0	

Table 5.2: Sample Characteristics – Continuous variables (N=212)

*Distributions of sample over continuous variables. Sample size varied across measures. Abbreviations: BMI, body mass index; Std, standard deviation; [a]Calculated as weight in kilograms divided by height in meters squared. Scores: Mean ± Standard Deviation [minimum–maximum]; P value for t-test comparison between AUD-negative and AUD-positive. * $p \leq 0.05$ is statistically significant*

	All		AUD-Negative		AUD-Positive		Comparison
Variable	**N (of 212)**	**Mean ± Std [range]**	**N (of 199)**	**Mean ± Std [range]**	**N (of 13)**	**Mean ± Std [range]**	***P* value**
AUDIT Score	212	2.3 ± 4.1 [0.0–28.0]	199	1.4 ± 1.6 [0.0-7.0]	13	15.5 ± 6.8 [8.0-28.0]	< 0.05*
Age							
Current age (yrs)	212	52.4 ± 12.0 [25.1-80.3]	199	52.6 ± 11.9 [25.1-80.3]	13	48.6 ± 12.1 [37.1-74.9]	0.26
Age at time of surgery (yrs)	202	47.9 ± 10.9 [23.6-68.9]	189	48.3 ± 10.8 [23.6-68.9]	13	41.7 ± 11.4 [27.5-67.5]	0.07
Time from surgery (yrs)	202	4.5 ± 5.3 [0.1-28.8]	199	4.4 ± 5.3 [0.0-28.8]	13	6.8 ± 3.8 [1.9-12.2]	0.05*
Weight							
Before surgery (kg)	212	133.1 ± 30.7 [83.9-258.5]	199	132.5 ± 30.3 [0.0-258.6]	13	141.4 ± 35.9 [85.7-220.0]	0.40
Lowest (kg)	212	90.7 ± 22.8 [47.6-208.7]	199	90.9 ± 22.8 [47.6-208.7]	13	87.8 ± 23.9 [57.6-127.0]	0.66
Current (kg)	212	97.6 ± 25.2 [49.9-208.7]	199	97.5 ± 25.0 [49.9-208.7]	13	98.2 ± 29.9 [60.8-144.2]	0.18
BMI[a]							
Before surgery (kg/m2)	212	46.3 ± 9.2 [19.8-86.9]	199	46.3 ± 9.2 [0.0-86.9]	13	46.8 ± 9.1 [27.1-65.8]	0.85
Lowest (kg/m2)	212	31.6 ± 7.3 [19.8-70.9]	199	31.8 ± 7.4 [19.8-70.9]	13	29.0 ± 5.9 [21.8-38.0]	0.12
Current (kg/m2)	212	34.0 ± 7.9 [19.8-70.9]	199	34.1 ± 7.9 [19.8-70.9]	13	32.3 ± 7.8 [23.0-44.3]	0.45

Variable Scores by AUD Status

Scores were calculated for alcohol use disorder, drug abuse, differentiation of self, food craving, social support and addictive eating behavior. A total of 212 participants completed the study, but sample size varied across measures (AUDIT for alcohol use disorder, n=212; DAST-20 for drug abuse, n=212; DSI-R, for differentiation of self, n=151; FCI for food craving, n=204; ISEL-12 for social support, n=205; PFS for addictive eating behavior, n=202). Table 5.3 presents the descriptive statistics for the variable scores.

Alcohol Use Disorder

Table 5.3 presents the AUDIT scores for the total study population, AUD-negative participants and AUD-positive participants. AUD-positive status is defined as AUDIT score of >= 8 for harmful or hazardous drinking, and AUD-negative status is defined as AUDIT score of <8. Overall, the mean AUDIT score was 2.3 (0.0 – 28.1, SD 4.1). The mean AUDIT score was higher for the AUD-positive participants compared to the AUD-negative participants. For the 199 AUD-negative participants, the mean AUDIT score was 1.4 (0.0-7.0, SD 1.6). For the 13 AUD-positive participants, the mean AUDIT score was 15.5 (8.0-28.0, SD 6.8).

Drug Abuse

Table 5.3 presents the DAST-20 scores for the total study population, AUD-negative participants and AUD-positive participants. Overall, the mean DAST-20 score was 4.2 (0.0-18.0, SD 2.3). The mean DAST-20 score was higher for the AUD-positive participants compared to the AUD-negative participants. For AUD-negative participants, the mean DAST-20 score was 4.0 (0.0-16.0, SD 1.7). For AUD-positive participants, the mean DAST-20 score was 7.3 (0.0-18.0, SD 5.4).

Differentiation of Self

Table 5.3 presents the DSI-R scores for the total study population, AUD-negative participants and AUD-positive participants. Overall, the mean DSI-R score was 4.3 (2.2-6.0, SD 0.8), with a mean ER subscale score of 4.0 (1.0-6.0, SD 1.2), mean I subscale score of 4.2 (1.5-6.0, SD 0.9), mean EC subscale score of 4.9 (2.5-6.0, SD 0.9) and mean FO subscale score of 4.1 (2.0-6.0, SD 1.0). The mean DSI-R score of the AUD-positive participants was lower than that of the AUD-negative participants. Similarly, the mean subscale scores (ER, I, EC and FO) were lower among the AUD-positive participants compared to the AUD-negative participants. For the AUD-negative participants, the mean DSI-R score was 4.4 (2.2-6.0, SD 0.8), with a mean ER subscale score of 4.0 (1.0-6.0, SD 1.2), mean I subscale score of 4.3 (1.5-6.0, SD 0.9), mean EC subscale score of 4.9 (2.5-6.0, SD 0.9) and mean FO subscale score of 4.1 (2.0-6.0, SD 0.9). For the AUD-positive participants, the mean DSI-R score was 3.4 (2.8-4.3, SD 0.6), with a mean ER subscale

score of 2.7 (1.6-4.0, SD 0.8), mean I subscale score of 3.8 (2.0-4.9, SD 1.1), mean EC subscale score of 4.0 (2.9-5.0, SD 0.7) and mean FO subscale score of 3.2 (2.6-4.6, SD 0.6).

Food Craving

Table 5.3 presents the FCI scores for the total study population, AUD-negative participants and AUD-positive participants. Overall, the mean FCI score was 2.1 (1.0-5.0, SD 0.6), with a mean high fats subscale score of 1.8 (1.0-5.0, SD 0.1), mean sweets subscale score of 2.3 (1.0-4.4, SD 0.8), mean carbohydrates subscale score of 2.0 (1.0-3.9, SD 0.7) and mean fast foods subscale score of 2.5 (1.0-5.0, SD 0.8). The mean FCI score and the mean subscale scores (high fats, sweets, carbohydrates, fast foods) were all higher for the AUD-positive participants compared to the AUD-negative participants. For the AUD-negative participants, the mean FCI score was 2.1 (1.0-3.5, SD 0.5), with a mean high fats subscale score of 1.8 (1.0-3.1, SD 0.6), mean sweets subscale score of 2.3 (1.0-4.4, SD 0.8), mean carbohydrates subscale score of 2.0 (1.0-3.9, SD 0.7) and mean fast foods subscale score of 2.5 (1.0-4.5, SD 0.7). For the AUD-positive participants, the mean FCI score was 2.5 (1.2-5.0, SD 1.0), with a mean high fats subscale score of 2.4 (1.0-5.0, SD 1.0), mean sweets subscale score of 2.5 (1.0-5.0, SD 1.1), mean carbohydrates subscale score of 2.3 (1.0-5.0, SD 1.1) and mean fast foods subscale score of 3.0 (1.5-5.0, SD 1.0).

Social Support

Table 5.3 presents the ISEL-12 scores for the total study population, AUD-negative participants and AUD-positive participants. Overall, the mean ISEL-12 score was 28.8 (3.0-36.0, SD 7.0), mean appraisal subscale score of 10.3 (1.0-12.0, SD 2.4), mean belonging subscale score of 9.1 (0.0-12.0, SD 3.8) and mean tangible subscale score of 9.4 (0.0-12.0, SD 2.7). The mean ISEL-12 score and the mean subscale scores (appraisal, belonging, tangible) were all lower for the AUD-positive participants compared to the AUD-negative participants. For the AUD-negative participants, the mean ISEL-12 score was 29.1 (3.0-36.0, SD 6.9), mean appraisal subscale score of 10.4 (1.0-12.0, SD 2.3), mean belonging subscale score of 9.2 (0.0-12.0, SD 2.9) and mean tangible subscale score of 9.5 (0.0-12.0, SD 2.7). For the AUD-positive participants, the mean ISEL-12 score was 23.8 (14.0-36.0, SD 6.4), mean appraisal subscale score of 8.8

(2.0-12.0, SD 3.1), mean belonging subscale score of 7.0 (1.0-12.0, SD 3.5) and mean tangible subscale score of 8.0 (4.0-12.0, SD 2.5).

Addictive Eating Behavior

Table 5.3 presents the PFS scores for the total study population, AUD-negative participants and AUD-positive participants. Overall, the mean PFS score was 48.1 (21.0-105.0, SD 21.0). The mean PFS score was higher for the AUD-positive participants compared to the AUD-negative participants. For the AUD-negative participants, the mean PFS score was 47.1 (21.0-105.0, SD 20.3). For the AUD-positive participants, the mean PFS score was 63.5 (27.0-105.0, SD 24.6).

Table 5.3: *Descriptive statistics for variable scores*

*Distributions of sample over variable scores. Sample size varied across measures. Abbreviations: N, number; Std, standard deviation; Scores: Mean ± Standard Deviation [minimum–maximum]; P value for t-test comparison between AUD-negative and AUD-positive. * $p \leq 0.05$ is statistically significant*

	All		AUD-Negative		AUD-Positive		Comparison
Variable	**N (of 212)**	**Mean ± Std [range]**	**N (of 199)**	**Mean ± Std [range]**	**N (of 13)**	**Mean ± Std [range]**	***P* value**
AUDIT Score	212	2.3 ± 4.1 [0.0–28.0]	199	1.4 ± 1.6 [0.0-7.0]	13	15.5 ± 6.8 [8-28]	<0.05*
DAST-20	212	4.2 ± 2.3 [0.0–18.0]	199	4.0 ± 1.7 [0.0-16.0]	13	7.3 ± 5.4 [0-18]	0.05*
DSI-R	151	4.3 ± 0.8 [2.2–6.0]	143	4.4 ± 0.8 [2.2-6.0]	8	3.4 ± 0.6 [2.8-4.3]	<0.05*
ER	151	4.0 ± 1.2 [1.0–6.0]	143	4.0 ± 1.2 [1.0-6.0]	8	2.7 ± 0.8 [1.6-4.0]	<0.05*
I	151	4.2 ± 0.9 [1.5–6.0]	143	4.3 ± 0.9 [1.5-6.0]	8	3.8 ± 1.1 [2.0-4.9]	0.23
EC	151	4.9 ± 0.9 [2.5–6.0]	143	4.9 ± 0.9 [2.5-6.0]	8	4.0 ± 0.7 2.9-5.0]	<0.05*
FO	151	4.1 ± 1.0 [2.0–6.0]	143	4.1 ± 0.9 [2.0-6.0]	8	3.2 ± 0.6 [2.6-4.6]	<0.05*
FCI	204	2.1 ± 0.6 [1.0–5.0]	191	2.1 ± 0.5 [1.0-3.5]	13	2.5 ± 1.0 [1.2-5.0]	0.18
High fats	204	1.8 ± 0.1 [1.0–5.0]	191	1.8 ± 0.6 [1.0-3.1]	13	2.4 ± 1.0 [1.0-5.0]	<0.05*
Sweets	204	2.3 ± 0.8 [1.0–5.0]	191	2.3 ± 0.8 [1.0-4.4]	13	2.5 ± 1.1 [1.0-5.0]	0.53
Carbohydrates	204	2.0 ± 0.7 [1.0–5.0]	191	2.0 ± 0.7 [1.0-3.9]	13	2.3 ± 1.1 [1.0-5.0]	0.36
Fast foods	204	2.5 ± 0.8 [1.0–5.0]	191	2.5 ± 0.7 [1.0-4.5]	13	3.0 ± 1.0 [1.5-5.0]	0.07
ISEL-12	205	28.8 ± 7.0 [3.0–36.0]	192	29.1 ± 6.9 [3.0-36.0]	13	23.8 ± 6.4 [14.0-36.0]	<0.05*
Appraisal	205	10.3 ± 2.4 [1.0–12.0]	192	10.4 ± 2.3 [1.0-12.0]	13	8.8 ± 3.1 [2.0-12.0]	0.08
Belonging	205	9.1 ± 3.8 [0.0–12.0]	192	9.2 ± 2.9 [0.0-12.0]	13	7.0 ± 3.5 [1.0-12.0]	<0.05*

Tangible	205	9.4 ± 2.7 [0.0–12.0]	192	9.5 ± 2.7 [0.0-12.0]	13	8.0 ± 2.5 [4.0-12.0]	0.05
PFS	202	48.1 ± 21.0 [21.0–105.0]	189	47.1 ± 20.3 [21.0-105.0]	13	63.5 ± 24.6 [27.0-105.0]	<0.05*

Hypothesis Testing in Relationship to Original Specific Aims

Hypothesis 1: Post-operative bariatric patients with AUD have more history of drug abuse.

Hypothesis 1. Independent Samples Test analysis was used to test the hypothesis that drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (AUDIT score of < 8). Results revealed a significant correlation between drug abuse and AUD status. Hypothesis 1 was accepted based on these findings.

Hypothesis 2: Post-operative bariatric patients with AUD have lower differentiation of self.

Hypothesis 2. Independent Samples Test analysis was used to test the hypothesis that differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (AUDIT score of < 8). Results revealed a significant correlation between differentiation of self and AUD status. Hypothesis 2 was accepted based on these findings.

Hypothesis 3: Post-operative bariatric patients with AUD have higher craving for sweets.

Hypothesis 3. Independent Samples Test analysis was used to test the hypothesis that sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (AUDIT score of < 8). Results revealed a non-significant correlation between sugary food craving and AUD status. Hypothesis 3 was rejected based on these findings.

Hypothesis 4: Post-operative bariatric patients with AUD have lower social support.

Hypothesis 4. Independent Samples Test analysis was used to test the hypothesis that social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (AUDIT score of < 8). Results revealed a significant correlation between social support and AUD status. Hypothesis 4 was accepted based on these findings.

Hypothesis 5: Post-operative bariatric patients with AUD have higher addictive eating behavior.

Hypothesis 5. Independent Samples Test analysis was used to test the hypothesis that addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUD-positive (defined by AUDIT score of >= 8 for harmful or hazardous drinking) as compared to post-operative bariatric patients who are AUD-negative (AUDIT score of < 8). Results revealed a significant correlation between addictive eating behavior and AUD status. Hypothesis 5 was accepted based on these findings.

Revised Grouping – Descriptive Statistics and Hypotheses Tests

The second set of results addresses revised hypotheses for the study sample split by AUP status.

Hypothesis 1: Post-operative bariatric patients with AUP have more history of drug abuse.

Hypothesis 1. Drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of >= 2 for women and >= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Hypothesis 2: Post-operative bariatric patients with AUP have lower differentiation of self.

Hypothesis 2. Differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of >= 2 for women and >= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Hypothesis 3: Post-operative bariatric patients with AUP have higher with craving for sweets.

Hypothesis 3. Sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of >= 2 for women and >= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Hypothesis 4: Post-operative bariatric patients with AUP have less social support.

Hypothesis 4. Social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of >= 2 for women and >= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Hypothesis 5: Post-operative bariatric patients with AUP have higher addictive eating behavior.

Hypothesis 5. Addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of

AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of >= 2 for women and >= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use).

Sample Characteristics by AUP-Status

Characteristics of AUP-Negative Participants

Sample characteristics for the 166 AUP-negative participants are presented in Table 5.4 and Table 5.5. The majority were female (72.1%), White or Caucasian (67.9%), non-Hispanic (84.2%), smokers (55.3%), experienced marriage (71.1%), and completed a college degree (69.9%). The majority of participants underwent Sleeve gastrectomy (75.2%). The mean current age was 52.4 years (25.1-73.6, SD 12.2), the mean age at the time of surgery was 48.2 years (23.6-68.9, SD 11.1), and the mean time since surgery was 4.3 years (0.0-28.8, SD 5.4) years. The mean weight before surgery was 131.5 kg (0.0-251.7, SD 30.5), the mean lowest weight was 90.3 kg (47.6-140.6, SD 20.0), and the mean current weight was 95.8 kg (49.9-167.8, SD 22.1). The mean BMI before surgery was 46.2 (0.0-86.9, SD 9.2) kg/m^2, the mean lowest BMI is 31.8 (19.8-70.9, SD 7.4) kg/m^2 and the mean current BMI was 33.7 (19.8-70.9, SD 7.8) kg/m^2.

Characteristics of AUP-Positive Participants

Sample characteristics for the 46 AUP-positive participants are presented in Table 5.4 and Table 5.5. The majority were female (72.3%), White or Caucasian (74.5%), non-Hispanic (85.1%), non-smokers (55.3%), experienced marriage (60.8%), and completed a college degree (58.7%). The majority of the participants with alcohol use problems underwent sleeve gastrectomy (53.2%). The mean age was 52.2 (32.9-80.3, SD 11.2) years, the mean age at the time of surgery was 46.7 (27.5-67.5, SD 10.2) years, and the mean time since surgery was 5.3 (0.0-23.9, SD 4.76 years. The mean weight before surgery was 138.9 (83.9-258.5, SD 37.5) kg, the mean lowest weight was 92.3 (57.6-208.7, SD 31.0) kg, and the mean current weight was 103.9 (60.8-208.7, SD 33.7) kg. The mean BMI before surgery was 47.0 (29.9-72.1, SD 9.0)

kg/m^2, the mean lowest BMI is 31.1 (21.8-57.5, SD 7.4) kg/m^2 and the mean current BMI was 35.0 (22.9-57.5, SD 8.5 kg/m^2.

Table 5.4: *Sample Characteristics – Categorical variables (N=212). Distributions of sample over categorical variables. P value for Chi-square comparison between AUP-negative and AUP-positive.* [a] *This is a combination of current smokers, and non-smokers who smoked a year ago. * $p \leq 0.05$ is statistically significant*

	All		No Alcohol Use Problems (AUP-negative)		Alcohol Use Problems (AUP-positive)		Comparison
	N (of 212)	%	N (of 166)	%	N (of 46)	%	*P* value
Gender							0.98
Male	59	27.8	46	27.9	13	27.7	
Female	153	72.2	119	72.1	34	72.3	
Race							0.07
White or Caucasian	147	69.3	112	67.9	35	74.5	
Black or African American	23	10.8	20	12.1	3	6.4	
Asian	6	2.8	6	3.6	0	0.0	
American Indian/Alaska Native	2	0.9	0	0.0	2	4.3	
Multiple races	16	7.5	13	7.8	3	6.5	
Other	18	8.5	14	8.5	4	8.5	
Hispanic Ethnicity	33	15.6	26	15.8	7	14.9	0.89
Marital Status							0.71
Married/Living as married	112	52.8	90	54.2	22	47.8	
Never Married	64	30.2	48	28.9	16	34.8	
Separated/Widowed/Divorced	36	17.0	28	16.9	6	13.0	
Education							0.15
No college degree	69	32.5	50	30.1	19	41.3	
≥College degree	143	67.5	116	69.9	27	58.7	
Household Income							0.37
<$100,000	109	51.4	86	51.8	23	50.0	
$100,000-$199,999	62	29.2	51	30.7	11	23.9	
≥$200,000	41	19.3	29	17.5	12	26.1	
Substance Use							
[a] Tobacco Use	38	17.9	21	55.3	17	44.7	<0.00
Surgical Procedure							< 0.05*
Sleeve gastrectomy	149	70.3	124	75.2	25	53.2	
Roux-en-Y gastric bypass	59	27.8	39	23.6	20	42.6	
Adjustable gastric band	4	1.9	2	1.2	2	4.3	

Table 5.5: *Sample Characteristics – Continuous variables (N=212). P value for independent samples t-test comparison between AUP-negative and AUP-positive. Sample size varied across measures because some values were not completed. Abbreviations: BMI, body mass index; Std, standard deviation;* [a]*Calculated as*

weight in kilograms divided by height in meters squared. Scores: Mean ± Standard Deviation [minimum–maximum].

	All		No Alcohol Use Problems (AUP-negative)		Alcohol Use Problems (AUP-positive)		Comparison
Variable	**N (of 212)**	**Mean ± Std [range]**	**N (of 168)**	**Mean ± Std [range]**	**N (of 46)**	**Mean ± Std [range]**	***P* value**
Age							
Current age (yrs)	212	52.3 ± 12.0 [25.1-80.3]	166	52.4 ± 12.2 [25.1-73.6]	46	52.2 ± 11.2 [32.9-80.3]	0.91
Age at time of surgery (yrs)	202	47.9 ± 10.9 [23.6-68.9]	157	48.2 ± 11.1 [23.6-68.9]	45	46.7 ± 10.2 [27.5-67.5]	0.37
Time from surgery (yrs)	212	4.5 ± 5.3 [0.0-28.8]	166	4.3 ± 5.4 [0.0-28.8]	46	5.3 ± 4.6 0.0-23.9]	0.20
Weight							
Before surgery (kg)	212	133.1 ± 30.7 [0.0-258.5]	166	131.5 ± 28.5 [0.0-251.7]	46	138.9 ± 37.5 [83.9-258.5]	0.22
Lowest (kg)	212	90.7 ± 22.8 [47.6-208.7]	166	90.3 ± 20.0 [47.6-140.6]	46	92.3 ± 31.0 [57.6-208.7]	0.67
Current (kg)	212	97.6 ± 25.2 [49.9-208.7]	166	95.8 ± 22.1 [49.9-167.8]	46	103.9 ± 33.7 [60.8-208.7]	0.13
BMI[a]							
Before surgery (kg/m2)	212	46.3 ± 9.2 [0.0-86.9]	166	46.2 ± 9.2 [0.0-86.9]	46	47.0 ± 9.0 [29.9-72.1]	0.00
Lowest (kg/m2)	212	31.6 ± 7.3 [19.8-70.9]	166	31.8 ± 7.3 [19.8-70.9]	46	31.1 ± 7.4 [21.8-57.5]	0.56
Current (kg/m2)	212	34.0 ± 7.9 [19.8-70.9]	166	33.7 ± 7.8 [19.8-70.9]	46	35.0 ± 8.5 [22.9-57.5]	0.36

Variables Scores by AUP Status

Table 5.6 and Figures 6A-6E present the descriptive statistics for the variable scores for the total study population, AUP-negative participants and AUP-positive participants. Scores were calculated for alcohol use disorder, drug abuse, differentiation of self, food craving, social support and addictive eating behavior. A total of 212 participants completed the study, but sample size varied across measures (AUDIT for alcohol use disorder, n=212; DAST-20 for drug abuse, n=212; DSI-R, for differentiation of self, n=151; FCI for food craving, n=204; ISEL-12 for social support, n=205; PFS for addictive eating behavior, n=202).

Drug Abuse

Table 5.6 presents the DAST-20 scores for the total study population, AUP-negative participants, and AUP-positive participants. Figure 6A presents the mean DAST-20 scores for the AUP-negative participants, and AUP-positive participants. Overall, the mean DAST-20 score was 4.2 (SD 2.3). The mean DAST-20 score was higher for the AUP-positive participants compared to AUP-negative participants. For

AUP-negative participants, the mean DAST-20 score was 3.7 (SD 1.2). For AUP-positive participants, the mean DAST-20 score was 5.9 (SD 3.9).

Differentiation of Self

Table 5.6 presents the DSI-R scores for the total study population, AUP-negative participants, and AUP-positive participants. Figure 6B presents the mean DSI-R scores for the AUP-negative participants, and AUP-positive participants. Overall, the mean DSI-R score was 4.3 (SD 0.8), with a mean ER subscale score of 4.0 (SD 1.2), mean I subscale score of 4.2 (SD 0.9), mean EC subscale score of 4.9 (SD 0.9) and mean FO subscale score of 4.1 (SD 1.0). The mean DSI-R score of the AUP-positive participants was lower than that of the AUP-negative participants. Similarly, the mean subscale scores (ER, I, EC and FO) were lower among the AUP-positive participants compared to the AUP-negative participants. For the AUP-negative participants, the mean DSI-R score was 4.4 (SD 0.8), with a mean ER subscale score of 4.1 (SD 1.2), mean I subscale score of 4.3 (SD 0.9), mean EC subscale score of 4.9 (SD 0.9) and mean FO subscale score of 4.1 (SD 0.9). For the AUP-positive participants, the mean DSI-R score was 4.1 (SD 0.8), with a mean ER subscale score of 3.7 (SD 1.1), mean I subscale score of 4.2 (SD 1.0), mean EC subscale score of 4.7 (SD 1.0) and mean FO subscale score of 3.9 (SD 1.0).

Food Craving

Table 5.6 presents the FCI scores for the total study population, AUP-negative participants and AUP-positive participants. Figure 6C presents the mean FCI scores for the AUP-negative participants, and AUP-positive participants. Overall, the mean FCI score was 2.1 (SD 0.6), with a mean high fats subscale score of 1.8 (SD 0.1), mean sweets subscale score of 2.3 (SD 0.8), mean carbohydrates subscale score of 2.0 (SD 0.7) and mean fast foods subscale score of 2.5 (SD 0.8). The mean FCI score and the mean subscale scores (high fats, sweets, carbohydrates, fast foods) were all higher for the AUP-positive participants compared to the AUP-negative participants. For the AUP-negative participants, the mean FCI score was 2.1 (SD 0.5), with a mean high fats subscale score of 1.8 (SD 0.5), mean sweets subscale score of 2.3 (SD 0.8), mean carbohydrates subscale score of 1.9 (SD 0.7) and mean fast foods subscale score of 2.4 (SD 0.7). For the AUP-positive participants, the mean FCI score was 2.3 (SD 0.7), with a mean high fats subscale

score of 2.0 (SD 0.7), mean sweets subscale score of 2.3 (SD 0.8), mean carbohydrates subscale score of 2.2 (SD 0.8) and mean fast foods subscale score of 2.7 (SD 0.8).

Social Support

Table 5.6 presents the ISEL-12 scores for the total study population, AUP-negative participants and AUP-positive participants. Figure 6D presents the mean ISEL-12 scores for the AUP-negative participants, and AUP-positive participants. Overall, the mean ISEL-12 score was 28.8 (SD 7.0), mean appraisal subscale score of 10.3 (SD 2.4), mean belonging subscale score of 9.1 (SD 3.8) and mean tangible subscale score of 9.4 (SD 2.7). The mean ISEL-12 score and the mean subscale scores (appraisal, belonging, tangible) were all very similar for the AUP-positive participants and the AUP-negative participants. For the AUP-negative participants, the mean ISEL-12 score was 29.0 (SD 7.1), mean appraisal subscale score of 10.3 (SD 2.3), mean belonging subscale score of 9.1 (SD 2.9) and mean tangible subscale score of 9.4 (SD 2.8). For the AUP-positive participants, the mean ISEL-12 score was 29.0 (SD 7.0), mean appraisal subscale score of 10.4 (SD 2.4), mean belonging subscale score of 9.1 (SD 3.2) and mean tangible subscale score of 9.4 (SD 2.6).

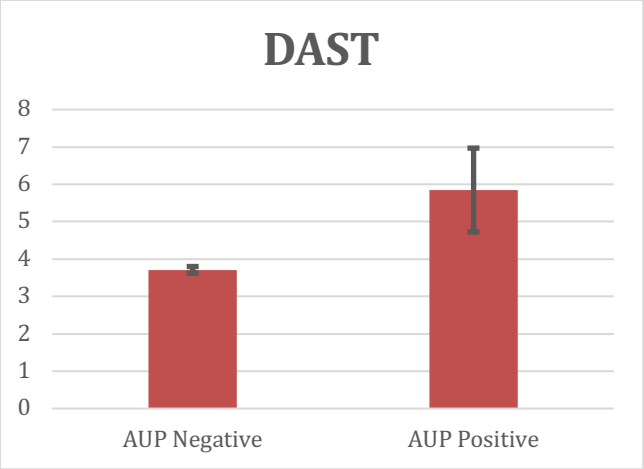
Addictive Eating Behavior

Table 5.6 presents the PFS scores for the total study population, AUP-negative participants and AUP-positive participants. Figure 6E presents the mean PFS scores for the AUP-negative participants, and AUP-positive participants. Overall, the mean PFS score was 48.1 (SD 21.0). The mean PFS score was higher for the AUP-positive participants compared to the AUP-negative participants. For the AUP-negative participants, the mean PFS score was 45.3 (SD 19.7). For the AUP-positive participants, the mean PFS score was 57.7 (SD 22.5).

Table 5.6: Descriptive statistics for variable scores

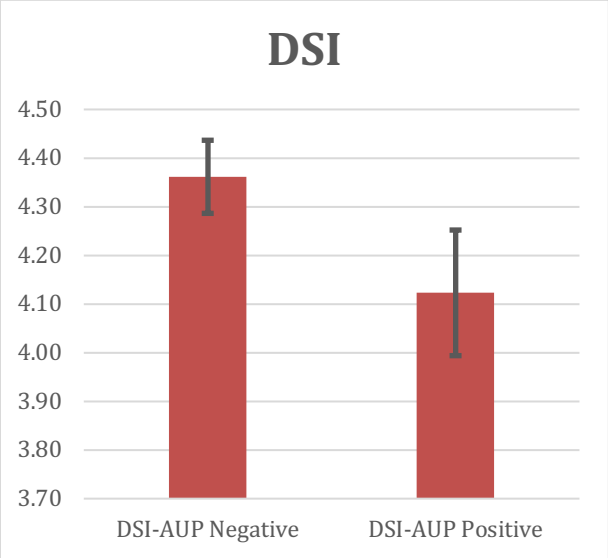
*Descriptive statistics for variable scores (N=212). Sample size varied across measures because some values were not completed. Abbreviations: N, number; Std, standard deviation. P value for independent samples t-test comparison between AUP-negative and AUP-positive. Scores: Mean ± Standard Deviation [minimum–maximum]. * $p \leq 0.05$ is statistically significant*

	All		No Alcohol Use Problems (AUP-negative)		Alcohol Use problems (AUP-positive)		Comparison
Variable	**N (of 212)**	**Mean ± Std [range]**	**N (of 166)**	**Mean ± Std [range]**	**N (of 46)**	**Mean ± Std [range]**	***P* value**
DAST-20	212	4.2 ± 2.2 [0–18]	166	3.7 ± 1.2 [0–5]	46	5.8 ± 3.9 [0–18]	< 0.05*
DSI-R	151	4.3 ± 0.8 [2.2–6.0]	113	4.4 ± 0.8 [2.2–6.0]	38	4.1 ± 0.8 [2.7–5.8]	0.12
ER	151	4.0 ± 1.2 [1–6]	113	4.1 ± 1.2 [1.0–6.0]	38	3.7 ± 1.1 [1.6–6.0]	0.09
I	151	4.2 ± 0.9 [1.5–6.0]	113	4.3 ± 0.9 [1.5–6.0]	38	4.2 ± 1.0 [2.0–5.8]	0.56
EC	151	4.9 ± 0.9 [2.5–6.0]	113	4.9 ± 0.9 [2.7–6.0]	38	4.7 ± 1.0 [2.5–6.0]	0.16
FO	151	4.1 ± 1.0 [2.0–6.0]	113	4.1 ± 0.9 [2.0–6.0]	38	3.9 ± 1.0 [2.3–6.0]	0.20
FCI	204	2.1 ± 0.6 [1.0–5.0]	158	2.1 ± 0.5 [1.0–3.5]	46	2.3 ± 0.7 [1.2–5.0]	0.06
High fats	204	1.8 ± 0.1 [1.0–5.0]	158	1.8 ± 0.5 [1.0–3.1]	46	2.0 ± 0.7 [1.0–5.0]	< 0.05*
Sweets	204	2.3 ± 0.8 [1.0–5.0]	158	2.3 ± 0.8 [1.0–4.4]	46	2.3 ± 0.8 [1.0–5.0]	0.68
Carbohydrates	204	2.0 ± 0.7 [1.0–5.0]	158	1.9 ± 0.7 [1.0–3.9]	46	2.2 ± 0.8 [1.0–5.0]	0.07
Fast foods	204	2.5 ± 0.8 [1.0–5.0]	158	2.4 ± 0.7 [1.0–4.5]	46	2.7 ± 0.8 [1.5–5.0]	< 0.05*
ISEL-12	205	28.8 ± 7.0 [3.0–36.0]	159	29.0 ± 7.1 [3.0–36]	46	29.0 ± 7.0 [14.0–36.0]	0.99
Appraisal	205	10.3 ± 2.4 [1.0–12.0]	159	10.3 ± 2.3 [1.0–12]	46	10.4 ± 2.4 [2.0–12.0]	0.80
Belonging	205	9.1 ± 3.8 [0.0–12.0]	159	9.1 ± 2.9 [0.0–12]	46	9.1 ± 3.2 [0.0–12.0]	0.96
Tangible	205	9.4 ± 2.7 [0.0–12.0]	159	9.4 ± 2.8 [0.0–12]	46	9.4 ± 2.6 [2.0–12.0]	0.89
PFS	202	48.1 ± 21.0 [21.0–105.0]	156	45.3 ± 19.7 [21.0–105.0]	46	57.7 ± 22.5 [21.0–105.0]	< 0.05*



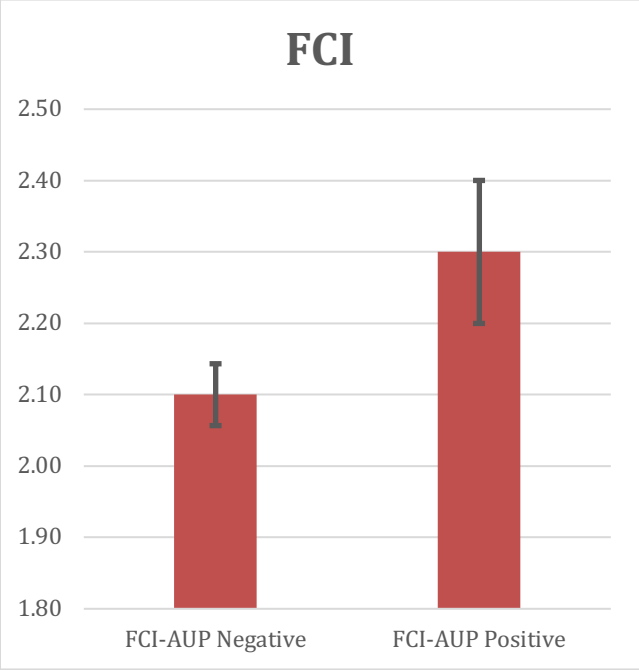
	DAST-20 AUP-Negative	DAST-20 AUP-Positive
Mean	3.7	5.9
Standard Error	0.1	1.1

Figure 6A. *Mean DAST-20 scores for AUP-negative and AUP-positive participants*



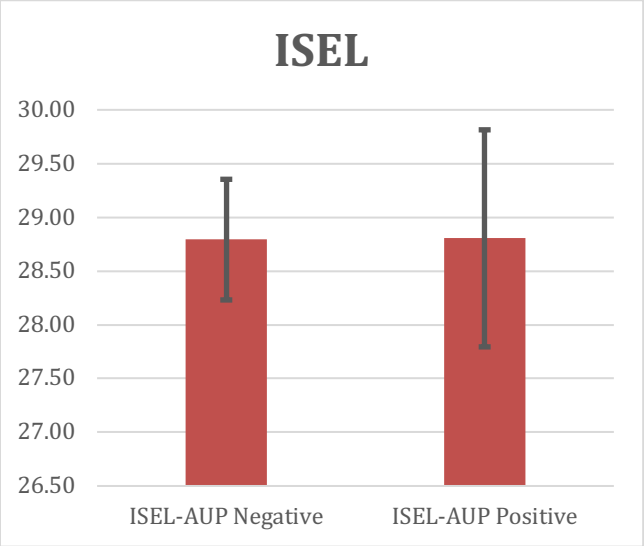
	DSI-R AUP-Negative	DSI-R AUP-Positive
Mean	4.4	4.1
Standard Error	0.1	0.1

Figure 6B. *Mean DSI-R scores for AUP-negative and AUP-positive participants*



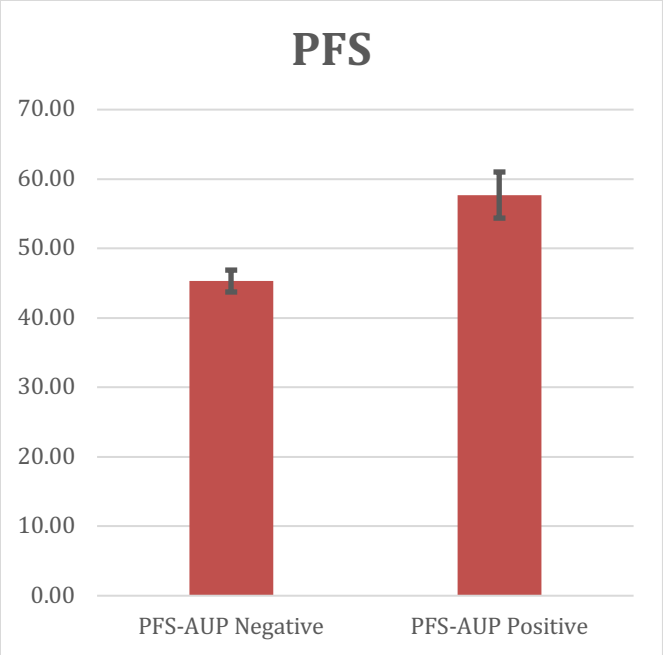
	FCI AUP-Negative	FCI AUP-Positive
Mean	2.1	2.3
Standard Error	0.0	0.1

Figure 6C. *Mean FCI scores for AUP-negative and AUP-positive participants*



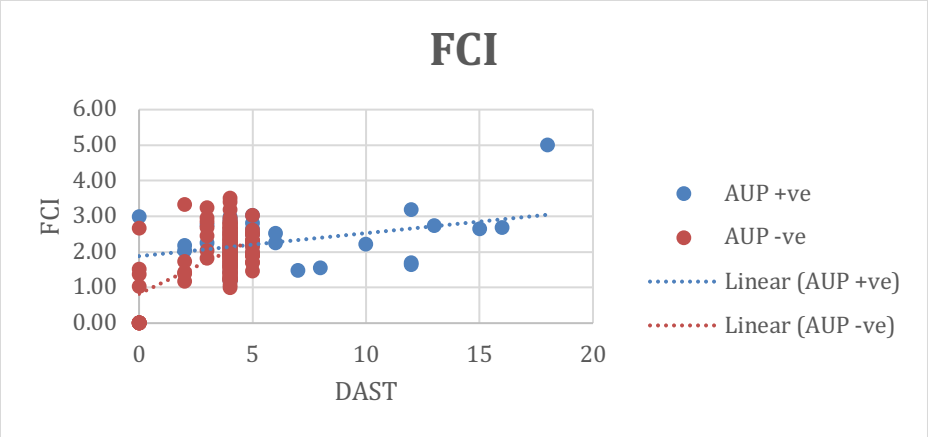
	ISEL-12 AUP-Negative	ISEL-12 AUP-Positive
Mean	28.8	28.8
Standard Error	0.6	1.0

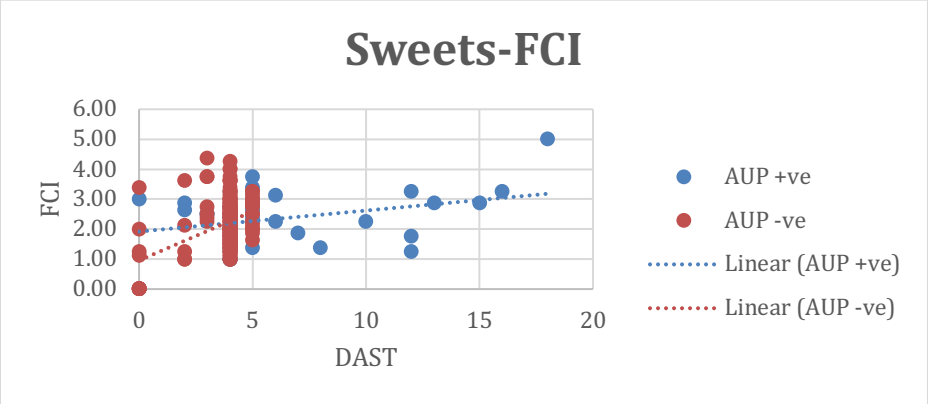
Figure 6D. *Mean ISEL-12 scores for AUP-negative and AUP-positive participants*

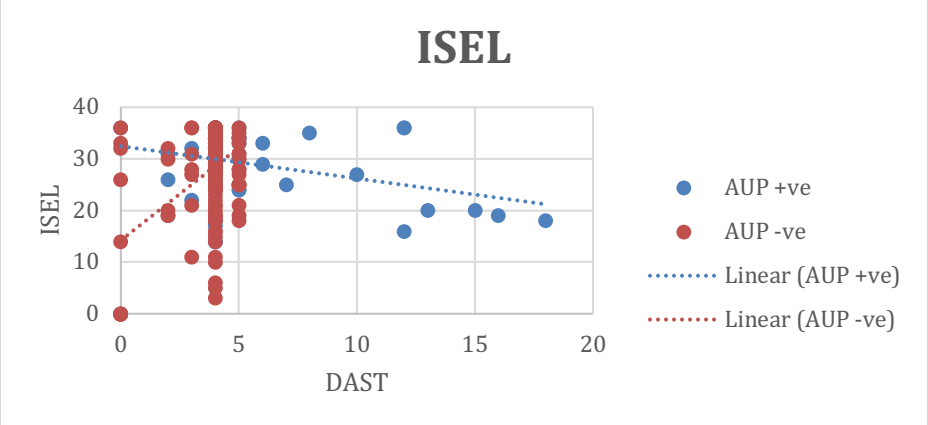


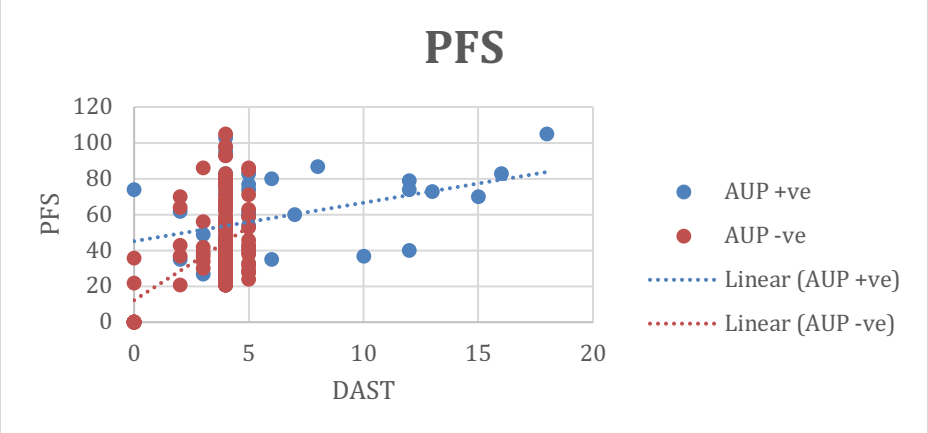
	PFS AUP-Negative	PFS AUP-Positive
Mean	45.3	57.7
Standard Error	1.6	3.3

Figure 6E. *Mean PFS scores for AUP-negative and AUP-positive participants*


FCI
6.00
5.00
4.00
3.00
2.00
1.00
0.00
FCI
0
5
10
15
20
DAST
AUP +ve
AUP -ve
Linear (AUP +ve)
Linear (AUP -ve)


Sweets-FCI
6.00
5.00
4.00
3.00
2.00
1.00
0.00
FCI
0
5
10
15
20
DAST
AUP +ve
AUP -ve
Linear (AUP +ve)
Linear (AUP -ve)


ISEL
40
30
20
10
0
ISEL
0
5
10
15
20
DAST
AUP +ve
AUP -ve
Linear (AUP +ve)
Linear (AUP -ve)


PFS
120
100
80
60
40
20
0
PFS
0
5
10
15
20
DAST
AUP +ve
AUP -ve
Linear (AUP +ve)
Linear (AUP -ve)

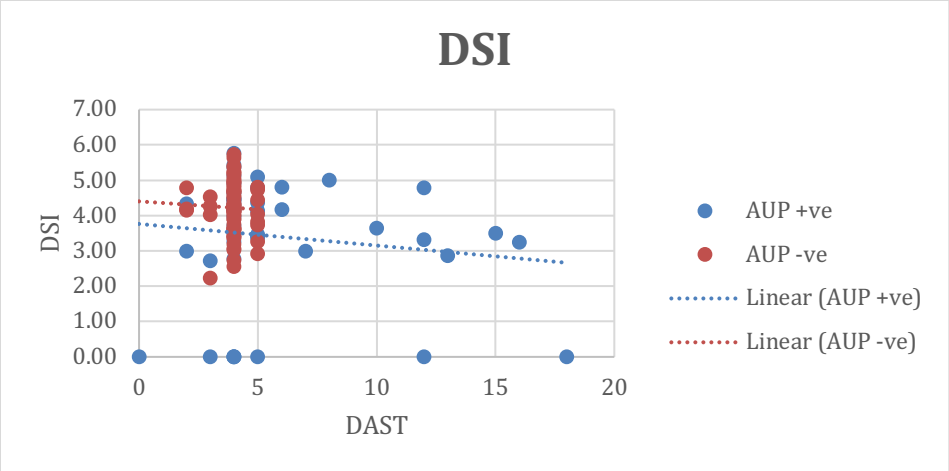


Figure 7. *DAST-20, PFS, DSI-R and FCI-Sweets scores for AUP-negative and AUP-positive participants*

Relationship of variables with DAST

Figure 7 presents regression lines for the DAST-20 scores and each of the other variables (ISEL-12 scores, DSI-R scores, PFS scores and FCI scores) for the AUP-negative and AUP-positive participants. For ISEL-12, there is a positive correlation for AUP-negative and a negative correlation for AUP-positive. For FCI, there is a positive correlation for both AUP-negative and AUP-positive. For FCI-sweets, there is a positive correlation for both AUP-negative and AUP-positive. For PFS, there is a positive correlation for both AUP-negative and AUP-positive. For DSI-R, there is a negative correlation for both AUP-negative and AUP-positive. A logistic regression model with all variables showed that when accounting for all variables, only the DAST showed a significant effect in distinguishing AUP-positive and AUP-negative. The model results are shown in Table 5.7.

Table 5.7: Logistic regression model results.

Model	Dependent:		AUP			
	Independent:	DAST	DSI	FCI	ISEL	PFS
Predictors	Intercept: No wrt Yes					
Betas	4.721	-0.714	0.204	0.337	-0.038	-0.019
Std Err	2.186	0.266	0.330	0.477	0.039	0.013
P values	0.031	*0.007	0.537	0.479	0.326	0.138

Hypothesis Testing in Relationship to Revised Specific Aims

Hypothesis 1: Post-operative bariatric patients with AUP has more history of drug abuse.

Hypothesis 1. Independent Samples Test analysis was used to test the hypothesis that drug abuse, as measured by the Drug Use Screening Test-20 questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use). Results revealed a significant correlation between drug abuse and AUD status. Hypothesis 1 was accepted based on these findings.

Hypothesis 2: Post-operative bariatric patients with AUP have lower differentiation of self.

Hypothesis 2. Independent Samples Test analysis was used to test the hypothesis that differentiation of self, as measured by the Differentiation of Self Inventory-Revised questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use). Results revealed a non-significant correlation between differentiation of self and AUD status. Hypothesis 2 was rejected based on these findings.

Hypothesis 3: Post-operative bariatric patients with AUP have higher craving for sweets.

Hypothesis 3. Independent Samples Test analysis was used to test the hypothesis that sugary food craving, as measured by the Food Craving Inventory questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use)

as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use). Results revealed a non-significant correlation between sugary food craving and AUD status. Hypothesis 3 was rejected based on these findings.

Hypothesis 4: Post-operative bariatric patients with AUP have lower social support.

Hypothesis 4. Independent Samples Test analysis was used to test the hypothesis that social support, as measured by the Interpersonal Support Evaluation-12 questionnaire, will be lower among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use). Results revealed a non-significant correlation between social support and AUD status. Hypothesis 4 was rejected based on these findings.

Hypothesis 5: Post-operative bariatric patients with AUP have higher addictive eating behavior.

Hypothesis 5. Independent Samples Test analysis was used to test the hypothesis that addictive eating behavior, as measured by the Power of Food Scale questionnaire, will be higher among post-operative bariatric surgery patients who are AUP-positive (defined as a combination of AUDIT-C score of >= 3 for women and >= 4 for men, and history of hospitalization and/or counseling due to alcohol use and/or substance use) as compared to post-operative bariatric surgery patients who are AUP-negative (defined as a combination of AUDIT-C score of <= 2 for women and <= 3 for men, and no history of hospitalization and/or counseling due to alcohol use and/or substance use). Results revealed a significant correlation between addictive eating behavior and AUD status. Hypothesis 5 was accepted based on these findings.

Hypothesis Testing in Relationship to Original and Revised Specific Aims

Table 5.8 presents a summary of the hypothesis testing for both the original and the revised specific aims. With regards to the original specific aims, the hypotheses for drug abuse, differentiation of self and social support were accepted. By comparison, with regards to the revised specific aims, the hypotheses for drug abuse and addictive eating behavior were accepted.

Table 5.8: Hypothesis testing in relationship to original and revised specific aims

*P value for independent samples t-test comparison between AUD-negative and AUD-positive, and between AUP-negative and AUP-positive * $p \leq 0.05$ is statistically significant*

	Hypothesis		*P* value
Original grouping (AUD-negative vs AUD-positive)	Post-operative bariatric surgery patients with AUD have more history of drug abuse	Accepted	0.05*
	Post-operative bariatric surgery patients with AUD have lower differentiation of self	Accepted	< 0.05*
	Post-operative bariatric surgery patients with AUD have higher craving for sweets	Rejected	0.53
	Post-operative bariatric surgery patients with AUD have lower with social support	Accepted	< 0.05*
	Post-operative bariatric surgery patients with AUD have higher addictive eating behavior	Accepted	< 0.05*
Revised grouping (AUP-negative vs AUP-positive)	Post-operative bariatric surgery patients with AUP have more history of drug abuse	Accepted	< 0.05*
	Post-operative bariatric surgery patients with AUP have lower differentiation of self	Rejected	0.12
	Post-operative bariatric surgery patients with AUP have higher with craving for sweets	Rejected	0.68
	Post-operative bariatric surgery patients with AUP have lower with social support	Rejected	0.99
	Post-operative bariatric surgery patients with AUP have higher addictive eating behavior	Accepted	< 0.05*

Alcohol Use Behaviors

This online survey used in the current study contains several questions that are focused on alcohol use behaviors. Specifically, there are ten AUDIT questions and four questions about hospitalization and counseling due to alcohol use. A detailed look at the answers to these 14 questions would provide a comprehensive analysis of the study participants' alcohol use behaviors. This analysis would add to AUD

status as indicated by the AUDIT score, and determine if reported drinking on the AUDIT questions corresponds to the revised grouping categories of AUP status.

Hazardous Alcohol Use

As shown in Table 5.9, the first three questions of the AUDIT, AUDIT-Consumption (AUDIT-C), measure hazardous drinking with questions that cover the frequency of drinking, typical quantity of drinks and frequency of heavy drinking (Babor et al., 2001). AUDIT-C is used to screen patients with drinking levels indicative of active AUD (Ibrahim et al., 2019). Ibrahim and colleagues (2019) used the AUDIT-C to determine the presence of AUD among bariatric surgery patients. The score of each of three AUDIT-C questions, which ranged from 0 to 4 points, were summed for a total AUDIT-C score of 0 to 12 points. A positive screen for unhealthy alcohol use was represented by a score of 3 or higher in women, and 4 or higher in men. There were 37 AUDIT-C-positive participants, which corresponded to 29 females and 8 males. None of the166 of the AUP-negative participants were positive for the AUDIT-C screen, and 37 of the AUP-positive participants were positive for the AUDIT-C screen. The AUP-positive participants had a higher frequency of drinking compared to AUP-negative participants: 58.7% of AUP-positive participants had alcoholic drinks two or more times per week, compared to 2.4% of the AUP-negative participants. With regards to typical daily drinking, 89.2% of AUP-positive participants drank one to four drinks on a typical day compared to 100.0% of AUP-negative participants. Heavy drinking (six or more drinks on one occasion) on a monthly or less than monthly basis was higher among AUP-positive participants – 39.1% of AUP-positive participants vs 0.6% of the AUD-negative participants.

Alcohol Dependence Symptoms

As shown in Table 5.9, alcohol dependence symptoms are captured through questions 4 – 6 on the AUDIT, and covers impaired control over drinking, increased salience of drinking and morning drinking (Babor et al., 2001). Impaired control over drinking was reported by 5.6% of the AUP-negative participants and 23.9% of the AUP-positive participants; 0.6% of AUP-negative participants and 21.7% of the AUP-positive participants reported increased salience of drinking; and 0.0% of the AUP-negative participants and 4.3% of the AUP-positive participants reported morning drinking.

Harmful Alcohol Use

Harmful alcohol use is covered with questions 7-10 on the AUDIT and ask about guilt after drinking, blackouts, alcohol-related injuries, and others being concerned about drinking (Babor et al., 2001). As shown in Table 5.9, 2.4% of the AUP-negative participants and 32.6% of the AUP-positive reported guilt after drinking; 0.6% of the AUP-negative participants and 30.4% of the AUP-positive participants reported blackouts; 0.6% of the AUP-negative participants and 20.0% of the AUP-positive participants reported alcohol-related injuries; and 2.4% of the AUP-negative participants and 28.3% of the AUP-positive participants reported that others were concerned about their drinking.

Table 5.9: Alcohol use behaviors

Descriptive statistics for AUDIT scores (N=212). Abbreviations: N, number

	All		No Alcohol Use Problems (AUP-negative)		Alcohol Use Problems (AUP-positive)	
	N (of 212)	%	N (of 166)	%	N (of 46)	%
AUDIT-C/Hazardous alcohol use						
Frequency of drinking						
Never	71	33.5	63	38.0	8	17.4
Monthly or less	54	25.5	51	30.7	3	6.5
2-4 times a month	45	21.2	37	22.3	8	17.4
2-3 times a week	22	10.4	4	2.4	18	39.1
4 or more times a week	9	4.2	0	0.0	9	19.6
Typical daily quantity of drinks						
1 or 2	199	93.9	163	98.3	36	78.3
3 or 4	8	3.8	3	1.8	5	10.9
5 or 6	2	0.9	0	0.0	2	4.3
7 to 9	3	1.4	0	0.0	3	6.5
10 or more	0	0.0	0	0.0	0	0.0
Frequency of heavy drinking (6+ drinks on one occasion)						
Never	190	89.6	165	99.4	25	54.3
Less than monthly	15	7.1	1	0.6	14	30.4
Monthly	4	1.9	0	0.0	4	8.7
Daily	1	0.5	0	0.0	1	2.2
Almost daily	2	0.9	0	0.0	2	4.3
Alcohol dependence symptoms						
Impaired control over drinking						
Never	200	94.3	165	99.4	35	76.1
Less than monthly	6	2.8	1	0.6	5	10.9
Monthly	3	1.4	0	0.0	3	6.5
Daily	2	0.9	0	0.0	2	4.3
Almost daily	1	0.5	0	0.0	1	2.2
Increased salience of drinking						
Never	201	94.8	165	99.4	36	78.3

Less than monthly	9	4.2	1	0.6	8	17.4
Monthly	1	0.5	0	0.0	1	2.2
Daily	1	0.5	0	0.0	1	2.2
Almost daily	0	0.0	0	0.0	0	0.0
Morning drinking						
Never	210	99.1	166	100.0	44	95.7
Less than monthly	0	0.0	0	0.0	0	0.0
Monthly	1	0.5	0	0.0	1	2.2
Daily	1	0.5	0	0.0	1	2.2
Almost daily	0	0.0	0	0.0	0	0.0
Harmful alcohol use						
Guilt after drinking						
Never	193	91.0	162	97.6	31	67.4
Less than monthly	13	6.1	1	2.4	9	19.6
Monthly	2	0.9	0	0.0	2	4.3
Daily	2	0.9	0	0.0	2	4.3
Almost daily	2	0.9	0	0.0	2	4.3
Blackouts						
Never	197	92.9	165	99.4	32	69.6
Less than monthly	9	4.2	1	0.6	8	17.4
Monthly	3	1.4	0	0.0	3	6.5
Daily	1	0.5	0	0.0	1	2.2
Almost daily	2	0.9	0	0.0	2	4.3
Alcohol-related injuries						
No	201	95.3	165	99.4	36	80.0
Yes, but not in the last year	9	4.2	0	0.0	9	19.6
Yes, during the last year	2	0.9	1	0.6	1	2.2
Others concerned about drinking						
No	195	92.0	162	97.6	33	71.7
Yes, but not in the last year	8	3.8	2	1.2	6	13.0
Yes, during the last year	9	4.2	2	1.2	7	15.2

Chapter 6 – Discussion

This online questionnaire-based study was primarily aimed at identifying individuals who are at risk of developing alcohol use problems, including AUD, following bariatric surgery. Five predictors of AUD - addictive eating behavior, consumption of sugary foods, drug abuse, differentiation of self and social support were accessed in 212 post-bariatric surgery patients in the UCLA Health database and the Kaighan database. Previously identified risk factors underlying bariatric surgery-associated AUD are male gender, younger age, smoking, history of regular problematic alcohol use pre-surgery, former AUD, recreational drug use, history of maladaptive eating behaviors and lower sense of belonging (social support), and undergoing a RYGB (King et al., 2017; Spadola et al., 2015). However, since the risk factors for AUD and alcohol-related problems post-bariatric surgery are not fully understood, this current study was aimed at further examining potential predictors of AUD among this vulnerable population by focusing on previously published predictor variables (drug abuse, social support, maladaptive eating behavior including addictive eating and consumption of sugary foods) and a factor that has not been previously tested, differentiation of self.

While this study was originally designed to examine postoperative AUD by using AUD status as the dependent variable, the study was expanded to AUP status to capture individuals who are AUD-positive at the time of survey completion, as well as those who are AUD-negative at time of survey completion and have experienced post-surgery counseling and/or hospitalization due to alcohol use-related problems. Therefore, the findings are presented with group comparisons based on AUD status (using the AUDIT questionnaire, an established measure for identifying AUD among post-bariatric surgery patients, and with group comparisons based on AUP-status (using a combination of AUDIT-C, another common measure for identifying AUD among post-bariatric surgery patients, and a history of hospitalization and/or counseling due to alcohol use and/or substance use).

Major Findings

Findings from independent samples test analyses supported a significant association between AUD-positive status and three predictor variables - addictive eating behavior, low differentiation of self and low social support, as well as a significant association between AUP-positive status and two predictor variables - drug abuse and addictive eating behavior. Findings from logistic regression analysis supported that history of drug abuse, food craving and addictive eating behavior are predictors of AUP-positive status. Together, these findings support previous reports and suggest that individuals with history of drug abuse, addictive eating behavior, low differentiation of self, low social support may be at an increased risk for alcohol use problems, including AUD, following bariatric surgery.

Alcohol Use Disorder and Alcohol Use Problems

Our study supports previous reports of an association between AUD and bariatric surgery, and more specifically the association between AUD and RYGB compared to AUD and sleeve gastrectomy. In our study, there was a 6.1% prevalence of post-operative AUD, with patients meeting criteria for AUD between 1.9 years to 12.2 years post-surgery. Thus, in our study, AUD was evident as early as year 2 post-surgery. By comparison, a previous study documented a 7.8% prevalence of post-operative AUD, with patients meeting criteria for AUD at 1-2 years post-surgery ((King et al., 2012). By surgery type, the AUD prevalence for RYGB in the current study was 13.6%, with patients meeting criteria for AUD between 3.3 to 12.2 years, and 3.1% for sleeve gastrectomy, with patients meeting criteria for AUD between 1.9 to 7.3 years. None of the patients who underwent Lap band in the current study met the criteria for AUD, which is unlike the 5.1%-5.7% AUD among Lap band patients that was previously reported by King et al (2012). Looking specifically at the AUD-positive participants in the current study, 61.5% underwent RYGB and the remaining 38.5% underwent sleeve gastrectomy. Together, these data support published reports that AUD symptoms are present as early as year 2 post-surgery and as late as year 13 post-surgery. Moreover, RYGB patients have a higher rate of post-operative AUD compared to sleeve gastrectomy patients, which supports previous findings (Conason et al., 2013; King et al., 2012; Suzuki et al., 2012). Further, our earliest AUD documentation at year 2 post-surgery supports previous

reports that post-operative RYGB patients meet the criteria for AUD between 2 to 5 years post-surgery ((Cuellar-Barboza et al., 2015; King et al., 2012; Mayo Clinic, 2015; Mitchell et al., 2015; Suzuki et al., 2012). Overall, this provides evidence that bariatric surgery is a risk factor for AUD.

When assessing the AUP group comparisons, there was a 21.7% prevalence of alcohol use problems, which is more than three times higher than the AUD prevalence in our study. By surgery type, the AUP prevalence for RYGB was 33.9%, 16.8% for sleeve gastrectomy, and 50% for Lap band; AUD prevalence was much lower than AUP prevalence for all three surgery types. Looking specifically at the AUP-positive participants in the current study, 42.6% underwent RYGB, which is 30% less than AUD-positive participants; 53.2% underwent sleeve gastrectomy, which is 28% more than AUD-positive participants; and the remaining 4.3% underwent Lap band, which is 100% more than AUD-positive participants. Overall, these AUP data support an association between alcohol use problems and bariatric surgery, with the patients who underwent sleeve gastrectomy having the highest risk. This increased risk for post-operative alcohol use problems among patients who underwent sleeve gastrectomy is alarming given that sleeve gastrectomy has become the most popular type of bariatric surgery, overtaking RYGB (Buchwald & Oien, 2013; Rosenthal, Szomstein, & Lo Menzo, 2020). Unlike RYGB, previous studies did not document alteration in alcohol metabolism for sleeve gastrectomy (Azam et al., 2018; Changchien et al., 2012; Gallo et al., 2014), and the mechanisms underlying susceptibility of sleeve gastrectomy patients to alcohol use problems remains largely unknown.

Sample Demographics

For the demographic questions, there was no statistically significant difference between the status groups for current age, age at surgery, gender, race, Hispanic ethnicity, marital status, education, income, current weight, weight before surgery, lowest weight, current BMI, BMI before surgery and lowest BMI. Thus, these are not confounding factors. However, time since surgery and smoking were significantly different between the AUD-negative and AUD-positive groups. Surgery type was significantly different between the AUD-negative and AUD-positive groups, as well as between the AUP-negative and AUP-

positive groups. Therefore, time since surgery, smoking, and surgery type may be indicators of increased risk for AUD and/or alcohol use problems.

The study participants have diverse racial backgrounds, with White or Caucasian being the most predominant race (69.3%). By comparison, the residents of Los Angeles, the study location, are similarly of diverse racial backgrounds, with White accounting for the majority (52.4%) (United States Census Bureau, 2019). On the other hand, while Los Angeles has 48.6% residents with Hispanic/Latino ethnicity (United States Census Bureau, 2019), this group was underrepresented in the current study population (15.6%). The high representation of White study participants could be accounted for by the fact that the majority of bariatric surgery patients are White. In fact, in published reports on alcohol use problems among bariatric surgery patients, the study participants were predominantly White (Cuellar-Barboza et al., 2015; Ertelt et al., 2008; Ivezaj et al., 2014; King et al., 2012; Lent et al., 2013). Racial/ethnic minorities are underrepresented in the sample in the current study and in the published literature. Even though racial/ethnic minorities have disproportionally high rates of obesity compared to Whites, and are thus highly eligible to undergo bariatric surgery (Spadola et al., 2018), less than one third of the participants in the current study were non-White. Possible reasons for the underrepresentation of minorities in these studies are that minorities are less likely to seek and undergo bariatric surgery compared to White individuals. Contributing factors may include socioeconomic status which includes health insurance coverage, or other barriers such as fears and concerns about treatment effects, and lack of physician referral for bariatric surgery (Lynch, Chang, Ford, & Ibrahim, 2007; Mainous, Johnson, Saxena, & Wright; Martin, Beekley, Kjorstad, & Sebesta, 2010; Wee, Huskey, et al., 2014).

The gender distribution in the current study is more inclusive of males than previous studies: in the current study, there was 28% male, compared to 25% male (Ostlund et al., 2013), 21% male (King et al., 2012), 17% male (Mitchell et al., 2001), 16% male (Ivezaj et al., 2014), 15% male (Odom et al., 2010) (Odom et al., 2010), 14% male (Ertelt et al., 2008; Suzuki et al., 2012) and 4% male (Fogger & McGuinness, 2012). With a higher number of male participants in the current study, additional analysis may reveal gender-specific effects of bariatric surgery-associated alcohol use problems.

Since the study by King and colleagues (2012) is often regarded as the landmark report on AUD and bariatric surgery, the data from the current study was categorized and evaluated in a similar manner when possible. In instances when there were low numbers in categories, the data was combined and presented in broader categories in the tables. The current study sample has similar demographics to that of the King et al (2012) report: 72.1% female vs 78.8% female; median age of 53 vs median age of 47; 52.8% married/living as married vs 64% married/living as married. With regards to surgery type, in our study, sleeve gastrectomy was the most common surgery (70.3%) compared to RYGB as the common surgery in the King et al., 2012 study (69.9%). The change in the most common bariatric surgery type from RYGB to sleeve gastrectomy reflects recent reports that sleeve gastrectomy has become the leading type of bariatric surgery, overtaking RYGB (American Society for Metabolic and Bariatric Surgery (ASMBS), 2016). However, regardless of surgery type in our study, bariatric surgery successfully reduced the participants' BMI, with the mean BMI decreasing from 46.3 kg/m^2 before surgery to 34.0 kg/m^2 after surgery. Smoking was higher in the current study compared to the King et al., 2012 study (7.1% vs 2.2%, respectively), and since smoking was significantly different between the AUD-negative and AUD-positive groups, further analysis on the smoker population in the current study may shed insight between smoking and alcohol use.

Drug Abuse

In the current study, drug abuse (defined as the use of prescribed or "over-the-counter" drugs in excess of the directions, and any non-medical use of drugs in the past year) was observed to be significantly higher among the AUD-positive participants compared to the AUD-negative participants, and significantly higher among the AUP-positive participants compared to the AUP-negative participants. Drug abuse was also observed to be a predictor of AUP-positive status. Since drug is an addictive substance like alcohol, and since recreational drug use was previously identified as a risk factor for AUD (King et al., 2012), it is not surprising that data from the current study supports our hypothesis that the subset of post-bariatric surgery patients who experience AUD have a history of misusing drugs. Our study adds to the literature that drug abuse may be an indicator of increased AUD risk.

Differentiation of Self

The study examined differentiation of self as a predictor of AUD among post-bariatric surgery patients. We observed a significantly lower differentiation of self or lower sense of self-identity among the AUD-positive participants compared to the AUD-negative participants. Specifically, the statistically significant difference was observed for the DSI-R score, as well as for three of the four subscales: emotional reactivity, emotional cutoff and fusion with others. However, while there was lower differentiation of self among the AUP-positive participants compared to the AUP-negative participants, the difference was not statistically significant. Similarly, differentiation of self was not observed to be a predictor of AUP-positive status. This supports our hypothesis that the subset of post-bariatric surgery patients who experience AUD have low self-identity and may not be mentally or emotionally able to independently stop misusing alcohol. Our study adds to the literature that lower differentiation of self in terms of emotional reactivity, emotional cutoff and fusion with others may be all be indicators of increased AUD risk.

Food Craving

The study examined food cravings for high fats, sweets, carbohydrates and fast foods as a predictor of AUD among post-bariatric surgery patients. AUD-positive participants had greater food cravings for high fats, sweets, carbohydrates and fast foods, compared to AUD-negative participants. However, the difference was only statistically significant for high fats. The notable craving for high fats could be because drinking stimulates consumption of high fat food. With regards to AUP status, there was statistically significant differences for food cravings for high fats and fast foods between AUP-positive participants and the AUP-negative participants. Food craving was also observed to be a predictor of AUP-positive status. Overall, these findings do not support our hypothesis that the subset of post-bariatric surgery patients who experience AUD have increased food craving for sweets. Increased craving for sweets among AUD-positive individuals compared to AUD-negative individuals was anticipated because alcohol and sweets both activate the dopamine reward pathway, and alcoholic drinks tend have high sugar content. Among the AUD-positive individuals, the absence of increased craving for sugar is probably due to the fact that the alcohol is satisfying the sugar craving. It was previously reported that individuals with pre-operative

problems with High-Sugar/Low-Fat Foods and/or High Glycemic Index foods had higher risk for developing substance use disorder (alcohol, drugs) (Fowler et al., 2014). However, in the current study, pre-operative food cravings was not measured. Our study adds to the literature that craving for sweets may not be an indicator of increased AUD risk, and that cravings for high fats and fast food may be both indicators of increased AUD risk.

Social Support

The study examined social support (appraisal, belonging, tangible) as a predictor of AUD among post-bariatric surgery patients. The ISEL-12 score and score on the belonging subscale were significantly lower among the AUD-positive participants compared to the AUD-negative participants. However, there was no difference in social support between AUP-positive participants and the AUP-negative participants. Social support was also not observed to be a predictor of AUP-positive status. This supports our hypothesis that the subset of post-bariatric surgery patients who experience AUD lack social support – that is, in the absence of supportive friends and family, these individuals may be unaware of the magnitude of their harmful behaviors or they may be purposely consuming alcohol to substitute for the good feeling that they used to derive from food. To date, there is one previous study that found that pre-surgery lower sense of belonging was predictive of AUD post-surgery (King et al., 2012). However, in the current study, pre-operative social support was not measured. Our study adds to the literature that post-operative lower sense of belonging may be an indicator of AUD risk.

Addictive Eating Behavior

The study examined addictive eating behavior as a predictor of AUD among post-bariatric surgery patients. Addictive eating behavior was significantly higher among the AUD-positive participants compared to the AUD-negative participants, and significantly higher among the AUP-positive participants compared to the AUP-negative participants. Addictive eating behavior was also observed to be a predictor of AUP-positive status. This supports our hypothesis that addictive eating behavior may be a predictor of AUD among post-bariatric surgery patients. We expected an increase in addictive eating behavior in the AUD- or AUP-positive group compared to the AUD- or AUP-negative group because eating disorders and

alcohol abuse both have the root of addiction, and are possibly used as a coping mechanism for seeking relief from underlying stress, anxiety or other emotions. Often, individuals with an eating disorder are also abusing alcohol and/or drugs, and individuals in treatment for eating disorders are likely to also meet the criteria for substance abuse problems (Grilo, Sinha, & O'Malley). Pre-operative food addiction was identified as a predictor of post-operative substance use (alcohol, drugs) among RYGB patients (Reslan, Saules, Greenwald, & Schuh, 2013). However, in the current study, pre-operative addictive eating behavior was not measured. Our study adds to the literature that addictive eating behavior may be an indicator of increased AUD risk.

Limitations

While post-bariatric surgical patients represent a vulnerable population that may be at high risk for AUD, the prevalence of AUD in this current study (6%) does not exceed the 6.2% prevalence of AUD that occurs in the general population (Substance Abuse and Mental Health Services Administration (SAMHSA), 2015).

The sample size is small, with less than 4% of the individuals contacted being included in the study. Further, among the 212 study participants, there were only 13 AUD-positive individuals and 46 AUP-positive individuals. With regards to the low number of AUD-positive individuals, this may be due to the fact that AUD is periodic. Even if individuals had AUD within surgery sampling at the single timepoint, it is likely that this is an underrepresentation as some people could have been missed. Thus, confounded AUD-negative individuals may include people we would want in the AUD-positive group, and the overall AUD status results are muddied. On the other hand, the differences that are detected in the study population are likely to be present in the general population. A better study design would be a longitudinal study, though there are several factors that make the feasibility of such as study uncertain. The proposed longitudinal study should ask about not just present moment when filling out survey, but also capture years of experience so as to reduce mean differences/effect size.

There were a few minor issues that may have negatively influenced the results, but likely not major influence. There were some technical errors in the survey: i) Question #25 was accidentally omitted for the DSI-R (differentiation of self) questionnaire and ii) question #4 was accidentally omitted for the FCI (food craving inventory) questionnaire.

Implications for Clinical Practice and Future Directions

The outcome of post-surgery alcohol use problems can be reduced, potentially through improved clinical practices for managing bariatric surgery patients from pre-surgery to post-surgery. Recommendations for patient management include a more comprehensive overview for surgical preparedness – patients should be well-informed about what to expect in terms of changes and challenges, and about the potential for alcohol use-related problems, and enrolled in support groups. There should be longer post-surgery follow-up with patients, possibly annual appointments up to 10 year post-surgery to ensure that the patients have all of the support that they need. Since bariatric surgery impacts multiple aspects of the patient's life – body image, relationship with food, eating behavior, sexuality, socialization and psychological health (Reaves, Dickson, Halford, Christiansen, & Hardman, 2019) – it is possible that changes in any of these aspects or combination may drive alcohol misuse post-surgery. Thus, follow-up appointments with post-bariatric surgery patients can be targeted to revealing changes in the patient's life, perhaps especially social events and negative life events, as these can be drinking motivators. Other motivators to track during the follow-up appointments include i) self-image – how the patient feels about their body, if they have a positive or negative body image, and if they have accepted the surgical results; ii) eating behavior – how they managed the impact of the surgical-imposed restriction, and if they sought alcohol to derive the pleasurable affects that used to achieved from eating their preferred food; iii) sources of support – whether it is a partner, family members, friends, peers, medical staff to provide sufficient and consistent emotional and other types of support (Reaves et al., 2019).

Patients should also receive continued education about the danger of consuming alcohol before and after bariatric surgery – i) tolerance for alcohol may be altered, ii) alcohol enters the bloodstream quicker and takes longer to leave the body, thus symptoms for intoxications may last longer and it is more

difficult to become sober. The healthcare team should include a nutritionist to help patients alter their drinking habits to decrease the risk for AUD. Patient care should also include seamless referral to substance abuse treatment that is hopefully covered by health insurance.

Recommendations for future research include an examination of post-surgery alcohol use problems by demographic variables to identify underserved groups, and a longitudinal study that accesses predictor variables both pre- and post-surgery so as to document present point-in-time of completing the survey after surgery and historical experience. Also, a research study can be done to examine the extent to which at-risk patients, such as the bariatric surgery patient candidates who have known/suspected substance misuse/dependence, follow the advice to eliminate alcohol consumption after surgery. There may also be value in examining why alcohol misuse tends to manifest in year 2 post-surgery and persists onwards – perhaps patients abstain/enjoy alcohol responsibly in year 1 post-surgery, and then there is a change in year 2 post-surgery or later.

Conclusions

Our study highlights that history of drug abuse, food craving and addictive eating behavior are predictors of AUD-positive status. Moreover, history of drug abuse, lower differentiation of self in terms of emotional reactivity, emotional cutoff and fusion with others, cravings for high fats and fast food, post-operative lower sense of belonging, and addictive eating behavior may be important indicators of increased AUD risk among post-bariatric surgery patients. These contributors of alcohol-related outcomes post-surgery help us to better understand the psychological motivators of alcohol misuse, especially when surgery-induced restriction disrupts usual eating patterns (Reaves et al., 2019). In post-surgery patients, coping may be a motivator for consuming foods that have high fat, sugary or calorie-dense, which may serve to make the individual feel better in negative states or circumstances (Reaves et al., 2019). Similarly, drinking to cope can be the route used after a stressor, in cases when the individual has fewer adaptive coping strategies (Reaves et al., 2019) – such as when the individual has a low sense of self, or when they have low social support. Additional incentives to drink post-surgery may stem from changes in self-esteem and socialization.

Our study also highlights that using AUP status as the basis for identifying individuals who are have increased risk for post-surgery AUD proved to be more inclusive means of capturing history of alcohol use problems as it is based on AUDIT-C score and history of hospitalization and/or counseling due to alcohol use and/or substance use. Now that sleeve gastrectomy is the leading type of bariatric surgery, and given that the association between sleeve gastrectomy and AUD is not as well studied as the association between RYGB and AUD, AUP status may serve as a useful basis for identifying at-risk individuals in further studies.

Appendix

Qualtrics Survey Outreach #1

UCLA Research Study

Start of Block: Informed Consent

Informed Consent **Researcher:** D. Krogh, PhD(c), MSN, RN
Dissertation Co-Chairs: Dr. Paul Macey and Dr. Catherine Carpenter
The University of California Los Angeles

Welcome! My name is D. Krogh, and I am a doctoral student at University of California Los Angeles. I am conducting a research study with the purpose of helping researchers understand how Bariatric surgery patients are affected by reward seeking behavior and weight loss success. I am asking you to participate in my study which may help you and other individuals who undergo Bariatric surgery to support them in staying on a path of long-term weight loss success and healthy reward seeking behavior. Please take your time to read the information below and feel free to ask any questions before Consenting to this document.

If you are interested in participating, please consider the following questions:
· Are you age **25 or older**?
· Did you undergo **bariatric surgery**?
If you answered 'yes' to each of the above questions, then you are invited to participate in this study.

What do I have to do? You will be asked to complete four online self-report questionnaires. The first questionnaire determines your eligibility to participate (informed consent), the second asks basic demographic information, the third concerns your reward seeking behavior and the last one concerns your thoughts and feelings about yourself and relationships with others. Please complete these questionnaires privately.

How long will this study take? Participation is expected to take approximately 20 minutes.

Are there any risks if I agree to participate? Study participation is not intended nor anticipated to cause risk. The risks involved in this study are minimal. Participants may experience discomfort due to remembering negative personal experiences about past behaviors and relationships; however, this psychological discomfort is not considered to be greater than what would be expected in daily life.

Although there is minimal psychological risk in this study, participants may click on the link located at the end of the surgery to be directed to resources: a hotline to speak with someone and

another resource to text with an individual who can direct you to mental health resources in your area. These sources can help you find a list of local and national mental health agencies will be available for each participant in the event that any participant experiences symptoms of psychological distress as a result of responding to questions contained in these questionnaires. To minimize the potential for emotional discomfort/distress, you may decline to participate at any time and/or withdraw your participation at any time.

Will I be compensated for my time? No, however all participants will have a free a new health app called "Healthy Changes" with "Top 10 Exercises" for strengthening saggy skin/flat stomach. Participation is voluntary, you may withdraw from the study at any time. **Benefits to Participants:** You will not directly benefit from this study. However, we hope the information learned from this study can benefit Bariatric surgery patients to create long-term weight loss success. Furthermore, we hope to support bariatric surgery professionals (nurses, surgeons, psychologists, dietitians, social workers) to increase understanding of the association between emotional maturity and long-term weight loss success and healthy reward seeking behavior in Bariatric surgery patients.

Will my information be kept confidential? During this study, information will be collected about you for the purpose of this research. This includes demographic (age, gender, weight history, height) as well as questions on your thoughts and feelings about yourself and relationships with others. Confidentiality will be maintained at all times and information reported will only be used for research purposes. No names will be required on the survey or consent form. IP addresses will not be collected, and the data will be kept secure on a password-protected computer. Furthermore, Qualtrics has safeguards in place to protect the information collected. There are firewalls in place to protect the servers, as well as regularly performed security scans and the use of encryption for the transfer of information. No one will have access to research data except for the researcher. Lastly, all data will be reported in group format with no identifying information disclosed. All research materials will be kept for a minimum of five years after publication as per APA guidelines. Your research records may be reviewed by federal agencies whose responsibility is to protect human subjects participating in research, including the Office of Human Research Protections (OHRP) and by representatives from UCLA Institutional Review Board, a committee that oversees research.

Alternatives to Participation: Participation in this study is voluntary. You may withdraw from study participation at any time without any penalty.

Who can I contact if I have questions, comments or concerns? If you have questions related to the procedures described in this document, please contact D. Krogh, PhD(c), MSN, RN at donjildes@ucla.edu or Dr. Paul Macey at pmacey@ucla.edu. If you have questions concerning your rights in this research study you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research project. You may reach the IRB office Monday-Friday by calling 310-825-7122 or writing: Institutional Review Board, University of California Los Angeles, 10889 Wilshire Blvd, Suite 830, Los Angeles, CA 90095-1406

I have read the above information and have received satisfactory answers to my questions. I understand the research project and the procedures involved have been explained to me. I agree that by clicking yes to the first question I am providing consent to participate in this study. I

understand my participation is voluntary and I do not need to consent to participate if I do not want to be part of this research project.

- ○ Yes I Consent (1)
- ○ No I do not Consent (0)

Skip To: End of Survey If Researcher: D. Krogh, PhD(c), MSN, RN Dissertation Co-Chairs: Dr. Paul Macey and Dr. Catherine C... = No I do not Consent

End of Block: Informed Consent

Start of Block: SCREENER - 2 Questions

X→

Screener BarSurg Did you have Bariatric (weight loss) surgery?

- ○ Yes (1)
- ○ No (0)

Skip To: End of Survey If Did you have Bariatric (weight loss) surgery? = No

X→

Screener 25 or Older Are you age 25 or older?

- ○ Yes (1)
- ○ No (0)

Skip To: End of Survey If age_25_older = No

End of Block: SCREENER - 2 Questions

Start of Block: DEMOGRAPHIC-13 Questions

Race What is your race? *(check all that apply)*

- ☐ White or Caucasian (1)
- ☐ Black or African American (2)
- ☐ American Indian or Alaska Native (3)
- ☐ Asian (4)
- ☐ Native Hawaiian or Pacific Islander (5)
- ☐ Other (6) _____

MonthYear Surgery Please select the month and year of your surgery

Month (1)
Year (2)

▼ Month (1) ... December ~ 2018 (482)

Display This Question:

If Did you have Bariatric (weight loss) surgery? = Yes

MonthYear SurgeryYes Please enter the month and year of your surgery

- ○ Month (1) _____
- ○ Year (2) _____

Ethnicity What is your ethnicity?

- ○ Hispanic (1)
- ○ Non-Hispanic (2)

X→

Gender What is your gender?

- ○ Male (1)
- ○ Female (2)

Education What is the highest level of school you have completed or the highest degree you have received?

- ○ Less than seventh grad (1)
- ○ At least seventh grade - but less than ninth grade (2)
- ○ Some high school (3)
- ○ Some college (at least one year) (4)
- ○ Other post high school education (5)
- ○ College diploma (Bachelors degree) (6)
- ○ Graduate or professional degree (7)

Income Which of the categories below represents your Annual Household Income?

- ○ Less than $25,000 (1)
- ○ $25,000 to $49,999 (2)
- ○ $50,000 to $74,999 (3)
- ○ $75,000 to $99,999 (4)
- ○ $100,000 to $199,999 (5)
- ○ $200,000 or more (6)

Marital What is your current marital status?

- ○ Never married and never lived as married (1)
- ○ Married (2)
- ○ Living as married (3)
- ○ Separated or lived as married but no longer living as married (4)
- ○ Divorced (5)
- ○ Widowed (6)

Type Surgery What type of bariatric surgery did you have? If more than one, please select your most effective weight loss surgery?

- ○ Roux-en-Y Gastric Bypass (RYGB) (1)
- ○ Sleeve Gastrectomy (Sleeve) (2)
- ○ Adjustable Gastric Band (Lap Band) (3)
- ○ Biliopancreatic Diversion with Duodenal Switch (BPD/DS) (4)

*

WeightBefore Surgery What was your weight **BEFORE** bariatric surgery date (in pounds)?

_____

*

Current Weight What is your **CURRENT** weight (in pounds)?

_____

Height What is your height?

- ○ Feet (11) _____
- ○ Inches (12) _____

*

Weight Lowest What was your **LOWEST** weight after bariatric surgery (in pounds)?

_____

JS

DOB
What is your Date of Birth

Month (1)	▼ January (1) ... (150)
Year (2)	▼ January (1) ... (150)

MonthYearBirth Please enter the month and year of your birthdate

- Month (1) _____
- Year (2) _____

X→

Tobacco Do you use tobacco? (Cigarettes, vaping, other)

- Yes (1)
- No (0)
- No - but did a year or more ago? (2)

End of Block: DEMOGRAPHIC-13 Questions

Start of Block: Interpersonal Support Evaluation List-12 Questions

X→

ISEL12_R3,4,5,6,9,10 **Instructions**: Read each of the 12 statements and select the answer that describes you. Choose "definitely true" if you are certain that it is true about you, "probably true"

if you think it is true but are not absolutely certain, "definitely false" if you are certain that it is false about you and "probably false" if you think it is false but you are not absolutely certain.

	Definitely false (0)	Probably false (1)	Probably true (2)	Definitely true (3)
If I wanted to go on a trip for a day (for example to the beach, the country or mountains). I would have a hard time finding someone to go with me. (ISEL12_1)	○	○	○	○
I feel that there is no one I can share my most private worries and fears with. (ISEL12_2)	○	○	○	○
If I were sick, I could easily find someone to help me with my daily chores. (ISEL12_3R)	○	○	○	○
There is someone I can turn to for advice about handling problems with my family. (ISEL12_4R)	○	○	○	○
If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me. (ISEL12_5R)	○	○	○	○
When I need suggestions on how to deal with a personal problem, I know someone I can turn to. (ISEL12_6R)	○	○	○	○

I don't often get invited to do things with others. (ISEL12_7)	○	○	○	○
If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc). (ISEL12_8)	○	○	○	○
If I wanted to have lunch with someone, I could easily find someone to join me. (ISEL12_9R)	○	○	○	○
If I was stranded 10 miles from home, there is someone I could call who could come and get me. (ISEL12_10R)	○	○	○	○
If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it. (ISEL12_11)	○	○	○	○
If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me. (ISEL12_12)	○	○	○	○

End of Block: Interpersonal Support Evaluation List-12 Questions

Start of Block: FOOD CRAVING INVENTORY-27 Food Choices

FCI27 **Instructions:** Over the **PAST MONTH,** select how often you have experienced a *craving* for the food.

	Never (1)	**Rarely** (2)	**Sometimes** (3)	**Often** (4)	**Always/almost every day** (5)
Fried Chicken (1)	○	○	○	○	○
Sausage (2)	○	○	○	○	○
Gravy (3)	○	○	○	○	○
Bacon (4)	○	○	○	○	○
Cornbread (5)	○	○	○	○	○
Hot dog (6)	○	○	○	○	○
Steak (7)	○	○	○	○	○
Brownies (8)	○	○	○	○	○
Cookies (9)	○	○	○	○	○
Candy (10)	○	○	○	○	○
Chocolate (11)	○	○	○	○	○
Donuts (12)	○	○	○	○	○
Cake (13)	○	○	○	○	○
Cinnamon rolls (14)	○	○	○	○	○

Ice cream (15)	○	○	○	○	○
Rolls (16)	○	○	○	○	○
Pancakes or Waffles (17)	○	○	○	○	○
Biscuits (18)	○	○	○	○	○
Sandwich Bread (19)	○	○	○	○	○
Rice (20)	○	○	○	○	○
Baked potato (21)	○	○	○	○	○
Pasta (22)	○	○	○	○	○
Cereal (23)	○	○	○	○	○
Hamburger (24)	○	○	○	○	○
French fries (25)	○	○	○	○	○
Chips (26)	○	○	○	○	○
Pizza (27)	○	○	○	○	○

End of Block: FOOD CRAVING INVENTORY-27 Food Choices

Start of Block: POWER OF FOOD SCALE-21 Questions

PFS21 **Instructions:** Please indicate the extent to which you agree that the following items describe you.

	Do not agree at all (1)	Agree a little (2)	Agree somewhat (3)	Agree quite a bit (4)	Strongly agree (5)
I find myself thinking about food even when I'm not physically hungry. (PFS21_1)	○	○	○	○	○
When I'm in a situation where delicious foods are present but I have to wait to eat them, it is very difficult for me to wait. (PFS21_2)	○	○	○	○	○
I get more pleasure from eating than I do from almost anything else. (PFS21_3)	○	○	○	○	○
I feel that food is to me like liquor is to an alcoholic. (PFS21_4)	○	○	○	○	○
If I see or smell a food I like, I get a powerful urge to have some. (PFS21_5)	○	○	○	○	○
When I'm around a fattening food I love, it's hard to stop myself from at least tasting it. (PFS21_6)	○	○	○	○	○

I often think about what foods I might eat later in the day. (PFS21_7)	○	○	○	○	○
It's scary to think of the power that food has over me. (PFS21_8)	○	○	○	○	○
When I taste a favorite food, I feel intense pleasure. (PFS21_9)	○	○	○	○	○
When I know a delicious food is available, I can't help myself from thinking about having some (PFS21_10)	○	○	○	○	○
I love the taste of certain foods so much that I can't avoid eating them even if they're bad for me. (PFS21_11)	○	○	○	○	○
When I see delicious foods in advertisements or commercials, it makes me want to eat. (PFS21_12)	○	○	○	○	○

I feel like food controls me rather then the other way around. (PFS21_13)	○	○	○	○	○
Just before I taste a favorite food, I feel intense anticipation. (PFS21_14)	○	○	○	○	○
When I eat delicious food I focus a lot on how good it tastes. (PFS21_15)	○	○	○	○	○
Sometimes, when I'm doing everyday activities, I get an urge to eat out of the blue (for no apparent reason). (PFS21_16)	○	○	○	○	○
I think I enjoy eating, a lot more than most other people. (PFS21_17)	○	○	○	○	○
Hearing someone describe a great meal makes me really want to have something to eat. (PFS21_18)	○	○	○	○	○

It seems like I have food on my mind a lot. (PFS21_19)	○	○	○	○	○
It's very important to me that the foods I eat are as delicious as possible. (PFS21_20)	○	○	○	○	○
Before I eat a favorite food my mouth tends to flood with saliva. (PFS21_21)	○	○	○	○	○

End of Block: POWER OF FOOD SCALE-21 Questions

Start of Block: BEFORE and AFTER SURGERY-8 Questions

X→

CounAlcBefore Did you have counseling for psychiatric or emotional problems due to Alcohol Use ***BEFORE*** Bariatric surgery

- ○ Yes (1)
- ○ No (0)

X→

HospAlcBefore Did you have hospital admissions for psychiatric or emotional problems due to Alcohol Use ***BEFORE*** Bariatric surgery

- ○ Yes (1)
- ○ No (0)

CounSubBefore Did you have counseling for psychiatric or emotional problems due to Substance Use ***BEFORE*** Bariatric surgery

- Yes (1)
- No (0)

HospSubBefore Did you have hospital admissions for psychiatric or emotional problems due to Substance Use ***BEFORE*** Bariatric surgery

- Yes (1)
- No (0)

CounsAlcAfter Did you have counseling for psychiatric or emotional problems due to Alcohol Use ***AFTER*** Bariatric surgery

- Yes (1)
- No (0)

HospAlcAfter Did you have hospital admissions for psychiatric or emotional problems due to Alcohol Use ***AFTER*** Bariatric surgery

- Yes (1)
- No (0)

CounSubAfter Did you have counseling for psychiatric or emotional problems due to Substance Use ***AFTER*** Bariatric surgery

- ○ Yes (1)
- ○ No (0)

HospSubAfter Did you have hospital admissions for psychiatric or emotional problems due to Substance Use ***AFTER*** Bariatric surgery

- ○ Yes (1)
- ○ No (0)

End of Block: BEFORE and AFTER SURGERY-8 Questions

Start of Block: ALCOHOL USE DISORDER IDENTIFICATION TEST-10 Questions

AUDIT 1-10 **Instructions:** Check one that best describes your answer to each question. If #2 does not apply to you please leave blank.

How often do you have a drink containing alcohol? (AUDIT_1)	○ Never (0)	○ Montly or less (1)	○ 2-4 times a month (2)	○ 2-3 times a week (3)	○ 4 or more times a week (4)
How many drinks containing alcohol do you have on a typical day when you are drinking? (If n/a leave blank) (AUDIT_2)	○ 1 to 2 (0)	○ 3 to 4 (1)	○ 5 to 6 (2)	○ 7 to 9 (3)	○ 10 or more (4)
How often do you have six or more drinks on one occasion? (AUDIT_3)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)

How often during the last year have you found that you were not able to stop drinking once you had started? (AUDIT_4)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)
How often during the last year have you failed to do what was normally expected from you because of drinking? (AUDIT_5)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)

How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session? (AUDIT_6)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)
How often during the last year have you had a feeling of guilt or remorse after drinking? (AUDIT_7)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)

How often during the last year have you been unable to remember what happened the night before because of your drinking? (AUDIT_8)	○ Never (0)	○ Less than monthly (1)	○ Monthly (2)	○ Weekly (3)	○ Daily or almost daily (4)
Have you or someone else been injured as a result of your drinking? (AUDIT_9)	○ No (0)	○ . (1)	○ Yes, but not in the last year (2)	○ . (3)	○ Yes, during the last year (4)

Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down? (AUDIT_10)	○ No (0)	○ . (1)	○ Yes, but not in the last year (2)	○ . (3)	○ Yes, during the last year (4)

End of Block: ALCOHOL USE DISORDER IDENTIFICATION TEST-10 Questions

Start of Block: SUBSTANCE USE - 20 Questions

DAST20_R4,5 Because substance use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of substances. Your answers will remain confidential so please be honest.

	Yes (1)	No (2)
Have you used drugs other than those required for medical reasons? (DAST_1)	○	○
Have you abused prescription drugs? (DAST_2)	○	○
Do you abuse more than one drug at a time? (DAST_3)	○	○
Can you get through the week without using drugs? (DAST_4R)	○	○
Are you always able to stop using drugs when you want to? (DAST_5R)	○	○
Have you had "blackouts" or flashbacks" as a result of drug use? (DAST_6)	○	○
Do you ever feel bad or guilty about your drug use? (DAST_7)	○	○
Does your spouse (or parents) ever complain about your involvement with drugs? (DAST_8)	○	○
Has drug abuse created problems between you and your spouse or your parents? (DAST_9)	○	○
Have you lost friends because of your use of drugs? (DAST_10)	○	○
Have you neglected your family because of your use of drugs? (DAST_11)	○	○
Have you been in trouble art work because of your use of drugs? (DAST_12)	○	○
Have you lost a job because of drug abuse? (DAST_13)	○	○

Have you gotten into fights when under the influence of drugs? (DAST_14)	○	○
Have you engaged in illegal activities in order to obtain drugs? (DAST_15)	○	○
Have you been arrested for possession of illegal drugs? (DAST_16)	○	○
Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs? (DAST_17)	○	○
Have you had medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, heeding, etc.)? (DAST_18)	○	○
Have you gone to anyone for help for a drug problem? (DAST_19)	○	○
Have you been involved in a treatment program especially related to drug use? (DAST_20)	○	○

End of Block: SUBSTANCE USE - 20 Questions

Start of Block: DIFFERENTIATION OF SELF INVENTORY REVISED - 45 Questions

Consent Thank you for your participation in determining if you are eligible for the UCLA Survey. Instructions: Before advancing to the 2 screener questions you will need to select "Yes, I consent" to answering the 2 eligibility criteria questions. Once you have consented you will advance to the next page. The 2 screener questions and the consent question have to be answered "YES" in order to be eligible to continue on with the survey. If you are not eligible you will be exited out of the program and the survey will end.

○ Yes I Consent (1)

○ No I do not consent (2)

DSI45 This is the last page of the Survey

Instructions: These are questions concerning your thoughts and feelings about yourself and relationships with others. Please read each statement carefully and decide how much the statement is generally true of you on a 1 (not at all) to 6 (very) scale. If you believe that an item does not pertain to you (e.g. you are not currently married or in a committed relationship, or one or both of your parents are deceased), please answer the item according to your best guess about

what your thoughts and feelings would be in that situation. Be sure to answer every item and try to be as honest and accurate as possible in your responses.

	Not at all (1)	. (2)	. (3)	. (4)	. (5)	Very (6)
People have remarked that I am overly emotional (DSI_1R)	○	○	○	○	○	○
I have difficulty expressing my feelings to people I care for (DSI_2R)	○	○	○	○	○	○
I often feel inhibited around my family (DSI_3R)	○	○	○	○	○	○
I tend to remain pretty calm even under stress (DSI_4)	○	○	○	○	○	○
I usually need a lot of encouragement from others when starting a big job or task (DSI_5R)	○	○	○	○	○	○
When someone close to me disappoints me, I withdraw from him / her for a time (DSI_6R)	○	○	○	○	○	○
No matter what happens in my life, I know that I'll never lose my sense of who I am (DSI_7)	○	○	○	○	○	○

I tend to distance myself when people get to close to me (DSI_8R)	○	○	○	○	○	○
I want to live up to my parents' expectations of me (DSI_9R)	○	○	○	○	○	○
I wish that I weren't so emotional (DSI_10R)	○	○	○	○	○	○
I usually do not change my behavior simply to please another person (DSI_11)	○	○	○	○	○	○
My spouse / partner could not tolerate it if I were to express to him / her my true feelings about some things (DSI_12R)	○	○	○	○	○	○
When my spouse / partner criticizes me, it bothers me for days (DSI_13R)	○	○	○	○	○	○
At times my feelings get the best of me and I have trouble thinking clearly (DSI_14R)	○	○	○	○	○	○

When I am having an argument with someone, I can separate my thoughts about the issue from my feelings about the person (DSI_15)	○	○	○	○	○	○
I'm often uncomfortable when people get too close to me (DSI_16R)	○	○	○	○	○	○
I feel a need for approval from virtually everyone in my life (DSI_17R)	○	○	○	○	○	○
At times I feel as if I'm riding an emotional rollercoaster (DSI_18R)	○	○	○	○	○	○
There's no point in getting upset about things I cannot change (DSI_19)	○	○	○	○	○	○
I'm concerned about losing my independence in intimate relationships (DSI_20R)	○	○	○	○	○	○
I'm overly sensitive to criticism (DSI_21R)	○	○	○	○	○	○

I try to live up to my parents' expectations (DSI_22R)	○	○	○	○	○	○
I'm fairly self-accepting (DSI_23)	○	○	○	○	○	○
I often feel that my spouse / partner wants too much from me (DSI_24R)	○	○	○	○	○	○
If I have had an argument with my spouse / partner, I tend to think about it all day (DSI_26R)	○	○	○	○	○	○
I am able to say "no" to others even when I feel pressured by them (DSI_27)	○	○	○	○	○	○
When one of my relationships becomes very intense, I feel the urge to run away from it (DSI_28R)	○	○	○	○	○	○
Arguments with my parent(s) or sibling(s) can still make me feel awful (DSI_29R)	○	○	○	○	○	○
If someone is upset with me, I can't seem to let it go easily (DSI_30R)	○	○	○	○	○	○

I'm less concerned that others approve of me than I am in doing what I think is right (DSI_31)	○	○	○	○	○	○
I would never consider turning to any of my family members for emotional support (DSI_32R)	○	○	○	○	○	○
I often feel unsure when others are not around to help me make a decision (DSI_33R)	○	○	○	○	○	○
I'm very sensitive to being hurt. by others (DSI_34R)	○	○	○	○	○	○
My self-esteem really depends on how others think of me (DSI_35R)	○	○	○	○	○	○
When I'm with my spouse / partner, I often feel smothered (DSI_36R)	○	○	○	○	○	○
When making decisions, I seldom worry about what others will think (DSI_37)	○	○	○	○	○	○

I often wonder about the kind of impression I create (DSI_38R)	○	○	○	○	○	○
When things go wrong, talking about them usually makes it wors (DSI_39R)	○	○	○	○	○	○
I feel things more intensely than others do (DSI_40)	○	○	○	○	○	○
I usually do what I believe is right regardless of what others say (DSI_41R)	○	○	○	○	○	○
Our relationship might be better if my spouse / partner would give me the space I need (DSI_42R)	○	○	○	○	○	○
I tend to feel pretty stable under stress (DSI_43)	○	○	○	○	○	○
Sometimes I feel sick after arguing with my spouse / partner (DSI_44R)	○	○	○	○	○	○

I feel it's important to hear my parent's opinions before making decisions (DSI_45R)	○	○	○	○	○	○
I worry about people close to me getting sick, hurt, or upset (DSI_46R)	○	○	○	○	○	○

End of Block: DIFFERENTIATION OF SELF INVENTORY REVISED - 45 Questions

Qualtrics Survey Outreach #2

UCLA Research Study Round 2

Start of Block: Informed Consent

Informed Consent **INFORMED CONSENT** Researcher: D. Krogh, PhD(c), MSN, RN
Dissertation Co-Chairs: Dr. Paul Macey and Dr. Catherine Carpenter
The University of California Los Angeles Welcome! My name is D. Krogh, and I am a doctoral student at University of California Los Angeles. I am conducting a research study with the purpose of helping researchers understand how Bariatric surgery patients are affected by reward seeking behavior and weight loss success. I am asking you to participate in my study which may help you and other individuals who undergo Bariatric surgery to support them in staying on a path of long-term weight loss success and healthy reward seeking behavior. Please take your time to read the information below and feel free to ask any questions before Consenting to this document. If you are interested in participating, please consider the following questions:
· *Are you age 25 or older?*
· *Did you undergo bariatric surgery?*
If you answered 'yes' to each of the above questions, then you are invited to participate in this study.
What do I have to do? You will be asked to complete four online self-report questionnaires. The first questionnaire determines your eligibility to participate (informed consent), the second asks basic demographic information, the third concerns your reward seeking behavior and the last one concerns your thoughts and feelings about yourself and relationships with others. Please complete these questionnaires privately.
How long will this study take? Participation is expected to take approximately 20 minutes.
Are there any risks if I agree to participate? Study participation is not intended nor anticipated to cause risk. The risks involved in this study are minimal. Participants may experience discomfort due to remembering negative personal experiences about past behaviors and relationships; however, this psychological discomfort is not considered to be greater than what would be expected in daily life.
Although there is minimal psychological risk in this study, participants may click on the link located at the end of the surgery to be directed to resources. To minimize the potential for emotional discomfort/distress, you may decline to participate at any time and/or withdraw your participation at any time. **Will I be compensated for my time?** No, however all participants will have a free new health app called "Healthy Changes" with "Top 10 Exercises" for strengthening saggy skin/flat stomach. Participation is voluntary, you may withdraw from the study at any time. **Benefits to Participants:** You will not directly benefit from this study. However, we hope the information learned from this study can benefit Bariatric surgery patients to create long-term weight loss success. Furthermore, we hope to support bariatric surgery professionals (nurses, surgeons, psychologists, diaticians, social workers) to increase understanding of the association between emotional maturity, long-term weight loss success and

healthy reward seeking behavior in Bariatric surgery patients. **Will my information be kept confidential?** During this study, information will be collected about you for the purpose of this research. This includes demographic (age, gender, weight history, height) as well as questions on your thoughts and feelings about yourself and relationships with others. Confidentiality will be maintained at all times and information reported will only be used for research purposes. No names will be required on the survey or consent form. IP addresses will not be collected, and the data will be kept secure on a password-protected computer. Furthermore, Qualtrics has safeguards in place to protect the information collected. There are firewalls in place to protect the servers, as well as regularly performed security scans and the use of encryption for the transfer of information. No one will have access to research data except for the researcher. Lastly, all data will be reported in group format with no identifying information disclosed. All research materials will be kept for a minimum of five years after publication as per APA guidelines. Your research records may be reviewed by federal agencies whose responsibility is to protect human subjects participating in research, including the Office of Human Research Protections (OHRP) and by representatives from UCLA Institutional Review Board, a committee that oversees research.
Alternatives to Participation: Participation in this study is voluntary. You may withdraw from study participation at any time without any penalty.
Who can I contact if I have questions, comments or concerns? If you have questions related to the procedures described in this document, please contact D. Krogh at donjildes@ucla.edu or Dr. Paul Macey at pmacey@ucla.edu. If you have questions concerning your rights in this research study you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research projects. You may reach the IRB office Monday-Friday by calling 310-825-7122 or writing: Institutional Review Board, University of California Los Angeles, 10889 Wilshire Blvd, Suite 830, Los Angeles, CA 90095-1406 **I have read the above information and have received satisfactory answers to my questions. I understand the research project and the procedures involved have been explained to me. I agree that by clicking yes to the first question I am providing consent to participate in this study.**

- ○ Yes I Consent (1)
- ○ No I do not Consent (0)

Skip To: End of Survey If consent = No I do not Consent

End of Block: Informed Consent

Start of Block: SCREENER - 2 Questions

X→

Screener BarSurg Did you have Bariatric (weight loss) surgery?

- ○ Yes (1)
- ○ No (0)

Skip To: End of Survey If Did you have Bariatric (weight loss) surgery? = No

Screener 25 or Older Are you age 25 or older?

- ○ Yes (1)
- ○ No (0)

Skip To: End of Survey If Are you age 25 or older? = No

End of Block: SCREENER - 2 Questions

Start of Block: DEMOGRAPHIC-13 Questions

MonthYearSurgery Please select your Date of Surgery.
Month (1)
Year (2)

▼ Month (1) ... December ~ 2018 (482)

Race What is your race? *(check all that apply)*

- ☐ White or Caucasian (1)
- ☐ Black or African American (2)
- ☐ American Indian or Alaska Native (3)
- ☐ Asian (4)
- ☐ Native Hawaiian or Pacific Islander (5)
- ☐ Other (6) _____

Ethnicity What is your ethnicity?

- ○ Hispanic (1)
- ○ Non-Hispanic (2)

Gender What is your gender?

- ○ Male (1)
- ○ Female (2)

Education What is the highest level of school you have completed or the highest degree you have received?

- Less than seventh grad (1)
- At least seventh grade - but less than ninth grade (2)
- Some high school (3)
- Some college (at least one year) (4)
- Other post high school education (5)
- College diploma (Bachelors degree) (6)
- Graduate or professional degree (7)

Income Which of the categories below represents your Annual Household Income?

- Less than $25,000 (1)
- $25,000 to $49,999 (2)
- $50,000 to $74,999 (3)
- $75,000 to $99,999 (4)
- $100,000 to $199,999 (5)
- $200,000 or more (6)

Marital What is your current marital status?

- ○ Never married and never lived as married (1)
- ○ Married (2)
- ○ Living as married (3)
- ○ Separated or lived as married but no longer living as married (4)
- ○ Divorced (5)
- ○ Widowed (6)

Type Surgery What type of bariatric surgery did you have? If more than one, please select your most effective weight loss surgery?

- ○ Roux-en-Y Gastric Bypass (RYGB) (1)
- ○ Sleeve Gastrectomy (Sleeve) (2)
- ○ Adjustable Gastric Band (Lap Band) (3)
- ○ Biliopancreatic Diversion with Duodenal Switch (BPD/DS) (4)

*

Weigh Before Surgery What was your weight **BEFORE** bariatric surgery date (in pounds)?

_____

*

Current Weight What is your **CURRENT** weight (in pounds)?

_____

Height What is your height?

- Feet (11) _____
- Inches (12) _____

Weigh Lowest What was your **LOWEST** weight after bariatric surgery (in pounds)?

_____

DOB
Please select your Date of Birth.

Month (1)	▼ January (1) ... (150)
Year (2)	▼ January (1) ... (150)

Tobacco Do you use tobacco? (Cigarettes, vaping, other)

- Yes (1)
- No (0)
- No - but did a year or more ago? (2)

End of Block: DEMOGRAPHIC-13 Questions

Start of Block: Interpersonal Support Evaluation List-12 Questions

ISEL12_1,2,7,8,11,12

Instructions: Read each of the 6 statements and select the answer that describes you. Choose "definitely true" if you are certain that it is true about you, "probably true" if you think it is true

but are not absolutely certain, "definitely false" if you are certain that it is false about you and "probably false" if you think it is false but you are not absolutely certain.

	Definitely false (3)	Probably false (2)	Probably true (1)	Definitely true (0)
1. If I wanted to go on a trip for a day (for example to the beach, the country or mountains). I would have a hard time finding someone to go with me. (ISEL_1)	○	○	○	○
2. I feel that there is no one I can share my most private worries and fears with. (ISEL_2)	○	○	○	○
7. I don't often get invited to do things with others. (ISEL_7)	○	○	○	○
8. If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc). (ISEL_8)	○	○	○	○
11. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it. (ISEL_11)	○	○	○	○

12. If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me. (ISEL_12)	○	○	○	○

ISEL12_R3,4,5,6,9,10
Instructions: Read each of the 6 statements and select the answer that describes you. Choose "definitely true" if you are certain that it is true about you, "probably true" if you think it is true but are not absolutely certain, "definitely false" if you are certain that it is false about you and

"probably false" if you think it is false but you are not absolutely certain.

	Definitely false (0)	Probably false (1)	Probably true (2)	Definitely true (3)
3. If I were sick, I could easily find someone to help me with my daily chores. (ISEL_3R)	○	○	○	○
4. There is someone I can turn to for advice about handling problems with my family. (ISEL_4R)	○	○	○	○
5. If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me. (ISEL_5R)	○	○	○	○
6. When I need suggestions on how to deal with a personal problem, I know someone I can turn to. (ISEL_6R)	○	○	○	○
9. If I wanted to have lunch with someone, I could easily find someone to join me. (ISEL_9R)	○	○	○	○
10. If I was stranded 10 miles from home, there is someone I could call who could come and get me. (ISEL_10R)	○	○	○	○

End of Block: Interpersonal Support Evaluation List-12 Questions

Start of Block: FOOD CRAVING INVENTORY-28 Food Choices

FCI28

Instructions: Over the **PAST MONTH,** select how often you have experienced a craving for the food.

	Never (1)	**Rarely** (2)	**Sometimes** (3)	**Often** (4)	**Always/almost every day** (5)
Fried Chicken (FCI_Fats_1)	○	○	○	○	○
Sausage (FCI_Fats_2)	○	○	○	○	○
Gravy (FCI_Fats_3)	○	○	○	○	○
Fried fish (FCI_Fats_4)	○	○	○	○	○
Bacon (FCI_Fats_5)	○	○	○	○	○
Cornbread (FCI_Fats_6)	○	○	○	○	○
Hot dog (FCI_Fats_7)	○	○	○	○	○
Steak (FCI_Fats_8)	○	○	○	○	○
Brownies (FCI_Sweets_9)	○	○	○	○	○
Cookies (FCI_Sweets_10)	○	○	○	○	○
Candy (FCI_Sweets_11)	○	○	○	○	○
Chocolate (FCI_Sweets_12)	○	○	○	○	○
Donuts (FCI_Sweets_13)	○	○	○	○	○
Cake (FCI_Sweets_14)	○	○	○	○	○

Cinnamon rolls (FCI_Sweets_15)	○	○	○	○	○
Ice cream (FCI_Carbs_16)	○	○	○	○	○
Rolls (FCI_Carbs_17)	○	○	○	○	○
Pancakes or Waffles (FCI_Carbs_18)	○	○	○	○	○
Biscuits (FCI_Carbs_19)	○	○	○	○	○
Sandwich Bread (FCI_Carbs_20)	○	○	○	○	○
Rice (FCI_Carbs_21)	○	○	○	○	○
Baked potato (FCI_Carbs_22)	○	○	○	○	○
Pasta (FCI_Carbs_23)	○	○	○	○	○
Cereal (FCI_Carbs_24)	○	○	○	○	○
Hamburger (FCI_FF_25)	○	○	○	○	○
French fries (FCI_FF_26)	○	○	○	○	○
Chips (FCI_FF_27)	○	○	○	○	○
Pizza (FCI_FF_28)	○	○	○	○	○

End of Block: FOOD CRAVING INVENTORY-28 Food Choices

Start of Block: POWER OF FOOD SCALE-21 Questions

PFS21

Instructions: Please indicate the extent to which you agree that the following items describe you.

	Do not agree at all (1)	Agree a little (2)	Agree somewhat (3)	Agree quite a bit (4)	Strongly agree (5)
I find myself thinking about food even when I'm not physically hungry. (PFS_1)	○	○	○	○	○
When I'm in a situation where delicious foods are present but I have to wait to eat them, it is very difficult for me to wait. (PFS_2)	○	○	○	○	○
I get more pleasure from eating than I do from almost anything else. (PFS_3)	○	○	○	○	○
I feel that food is to me like liquor is to an alcoholic. (PFS_4)	○	○	○	○	○
If I see or smell a food I like, I get a powerful urge to have some. (PFS_5)	○	○	○	○	○
When I'm around a fattening food I love, it's hard to stop myself from at least tasting it. (PFS_6)	○	○	○	○	○

I often think about what foods I might eat later in the day. (PFS_7)	○	○	○	○	○
It's scary to think of the power that food has over me. (PFS_8)	○	○	○	○	○
When I taste a favorite food, I feel intense pleasure. (PFS_9)	○	○	○	○	○
When I know a delicious food is available, I can't help myself from thinking about having some (PFS_10)	○	○	○	○	○
I love the taste of certain foods so much that I can't avoid eating them even if they're bad for me. (PFS_11)	○	○	○	○	○
When I see delicious foods in advertisements or commercials, it makes me want to eat. (PFS_12)	○	○	○	○	○
I feel like food controls me rather then the other way around. (PFS_13)	○	○	○	○	○

Just before I taste a favorite food, I feel intense anticipation. (PFS_14)	○	○	○	○	○
When I eat delicious food I focus a lot on how good it tastes. (PFS_15)	○	○	○	○	○
Sometimes, when I'm doing everyday activities, I get an urge to eat out of the blue (for no apparent reason). (PFS_16)	○	○	○	○	○
I think I enjoy eating, a lot more than most other people. (PFS_17)	○	○	○	○	○
Hearing someone describe a great meal makes me really want to have something to eat. (PFS_18)	○	○	○	○	○
It seems like I have food on my mind a lot. (PFS_19)	○	○	○	○	○

It's very important to me that the foods I eat are as delicious as possible. (PFS_20)	○	○	○	○	○
Before I eat a favorite food my mouth tends to flood with saliva. (PFS_21)	○	○	○	○	○

End of Block: POWER OF FOOD SCALE-21 Questions

Start of Block: BEFORE and AFTER SURGERY-8 Questions

CounAlcBefore Did you have **counseling** for psychiatric or emotional problems due to **Alcohol Use** *BEFORE* Bariatric surgery

- ○ Yes (1)
- ○ No (0)

HospAlcBefore Did you have **hospital admissions** for psychiatric or emotional problems due to **Alcohol Use** *BEFORE* Bariatric surgery

- ○ Yes (1)
- ○ No (0)

CounSubBefore Did you have **counseling** for psychiatric or emotional problems due to **Substance Use** *BEFORE* Bariatric surgery

- Yes (1)
- No (0)

HospSubBefore Did you have **hospital admissions** for psychiatric or emotional problems due to **Substance Use** *BEFORE* Bariatric surgery

- Yes (1)
- No (0)

CounAlcAfter Did you have **counseling** for psychiatric or emotional problems due to **Alcohol Use** *AFTER* Bariatric surgery

- Yes (1)
- No (0)

HospAlcAfter Did you have **hospital admissions** for psychiatric or emotional problems due to **Alcohol Use** *AFTER* Bariatric surgery

- Yes (1)
- No (0)

CounSubAfter Did you have **counseling** for psychiatric or emotional problems due to **Substance Use** *AFTER* Bariatric surgery

- ○ Yes (1)
- ○ No (0)

HospSubAfter Did you have **hospital admissions** for psychiatric or emotional problems due to **Substance Use** *AFTER* Bariatric surgery

- ○ Yes (1)
- ○ No (0)

End of Block: BEFORE and AFTER SURGERY-8 Questions

Start of Block: ALCOHOL USE DISORDER IDENTIFICATION TEST-10 Questions

AUDIT-1
Instructions: Check one that best describes your answer to each question.

	Never (0)	Monthly or less (1)	2-4 times a month (2)	2-3 times a week (3)	4 or more times a week (4)
How often do you have a drink containing alcohol? (AUDIT_1)	○	○	○	○	○

Skip To: AUDIT-9,10 If Instructions: Check one that best describes your answer to each question. = Never

AUDIT-2

Instructions: Check one that best describes your answer to each question.

	1 to 2 (0)	3 to 4 (1)	5 to 6 (2)	7 to 9 (3)	10 or more (4)
How many drinks containing alcohol do you have on a typical day when you are drinking? (AUDIT_2)	○	○	○	○	○

AUDIT-3,4,5,6,7,8
Instructions: Check one that best describes your answer to each question.

	Never (0)	Less than monthly (1)	Monthly (2)	Weekly (3)	Daily or almost daily (4)
How often do you have six or more drinks on one occasion? (AUDIT_3)	○	○	○	○	○
How often during the last year have you found that you were not able to stop drinking once you had started? (AUDIT_4)	○	○	○	○	○
How often during the last year have you failed to do what was normally expected from you because of drinking? (AUDIT_5)	○	○	○	○	○
How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session? (AUDIT_6)	○	○	○	○	○

How often during the last year have you had a feeling of guilt or remorse after drinking? (AUDIT_7)	○	○	○	○	○
How often during the last year have you been unable to remember what happened the night before because of your drinking? (AUDIT_8)	○	○	○	○	○

AUDIT-9,10
Instructions: Check one that best describes your answer to each question.

	No (0)	Yes, but not in the last year (2)	Yes, during the last year (4)
Have you or someone else been injured as a result of your drinking? (AUDIT_9)	○	○	○
Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down? (AUDIT_10)	○	○	○

End of Block: ALCOHOL USE DISORDER IDENTIFICATION TEST-10 Questions

Start of Block: SUBSTANCE USE - 20 Questions

DAST-20 The following questions concern information about your potential involvement with drugs not including alcoholic beverages **during the past 12 months**.
In the statements "drug abuse" refers to (1) the use of prescribed or over the counter drugs in

excess of the directions and (2) any non-medical use of drugs. The various classes of drugs may include: cannabis (e.g. marijuana, hash), solvents, tranquilizers (e.g. Valium), barbiturates, cocaine, stimulants (e.g. speed), hallucinogens (e.g. LSD) or narcotics (e.g. heroin). Remember that the questions do not include alcoholic beverages.

	Yes (1)	No (0)
Have you used drugs other than those required for medical reasons? (DAST_1)	○	○
Have you abused prescription drugs? (DAST_2)	○	○
Do you abuse more than one drug at a time? (DAST_3)	○	○
Have you had "blackouts" or flashbacks" as a result of drug use? (DAST_6)	○	○
Do you ever feel bad or guilty about your drug use? (DAST_7)	○	○
Does your spouse (or parents) ever complain about your involvement with drugs? (DAST_8)	○	○
Has drug abuse created problems between you and your spouse or your parents? (DAST_9)	○	○
Have you lost friends because of your use of drugs? (DAST_10)	○	○
Have you neglected your family because of your use of drugs? (DAST_11)	○	○
Have you been in trouble at work because of drug abuse? (DAST_12)	○	○
Have you lost a job because of drug abuse? (DAST_13)	○	○
Have you gotten into fights when under the influence of drugs? (DAST_14)	○	○
Have you engaged in illegal activities in order to obtain drugs? (DAST_15)	○	○

Have you been arrested for possession of illegal drugs? (DAST_16)	○	○
Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs? (DAST_17)	○	○
Have you had medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, bleeding, etc.)? (DAST_18)	○	○
Have you gone to anyone for help for a drug problem? (DAST_19)	○	○
Have you been involved in a treatment program specifically related to drug use? (DAST_20)	○	○

Skip To: DAST20_Reversed 4,5 If The following questions concern information about your potential involvement with drugs not inclu... = Yes

DAST20_Reversed 4,5

The following questions concern information about your potential involvement with drugs not including alcoholic beverages during the past 12 months.
In the statements "drug abuse" refers to (1) the use of prescribed or over the counter drugs in excess of the directions and (2) any non-medical use of drugs. The various classes of drugs may include: cannabis (e.g. marijuana, hash), solvents, tranquilizers (e.g. Valium), barbiturates, cocaine, stimulants (e.g. speed), hallucinogens (e.g. LSD) or narcotics (e.g. heroin). Remember that the questions do not include alcoholic beverages.

	Yes (0)	No (1)
Can you get through the week without using drugs? (DAST_4R)	○	○
Are you always able to stop using drugs when you want to? (DAST_5R)	○	○

End of Block: SUBSTANCE USE - 20 Questions

Start of Block: DIFFERENTIATION OF SELF INVENTORY REVISED - 46 Questions

DSI_35Q Reversed

Instructions: These are questions concerning your thoughts and feelings about yourself and relationships with others. Please read each statement carefully and decide how much the statement is generally **true of you on a 1 (not at all) to 6 (very) scale**. If you believe that an item does not pertain to you (e.g. you are not currently married or in a committed relationship, or

one or both of your parents are deceased), please answer the item according to your best guess about what your thoughts and feelings would be in that situation.

	1 Not at all true of me (6)	2 (5)	3 (4)	4 (3)	5 (2)	6 Very true of me (1)
People have remarked that I am overly emotional (DSI_1R-ER)	○	○	○	○	○	○
I have difficulty expressing my feelings to people I care for (DSI_2R-EC)	○	○	○	○	○	○
I often feel inhibited around my family (DSI_3R-EC)	○	○	○	○	○	○
I usually need a lot of encouragement from others when starting a big job or task (DSI_5R-FO)	○	○	○	○	○	○
When someone close to me disappoints me, I withdraw from him / her for a time (DSI_6R-ER)	○	○	○	○	○	○
I tend to distance myself when people get to close to me (DSI_8R-EC)	○	○	○	○	○	○

I want to live up to my parents' expectations of me (DSI_9R-FO)	○	○	○	○	○	○
I wish that I weren't so emotional (DSI_10R-ER)	○	○	○	○	○	○
My spouse / partner could not tolerate it if I were to express to him / her my true feelings about some things (DSI_12R-EC)	○	○	○	○	○	○
When my spouse / partner criticizes me, it bothers me for days (DSI_13R-FO)	○	○	○	○	○	○
At times my feelings get the best of me and I have trouble thinking clearly (DSI_14R-ER)	○	○	○	○	○	○
I'm often uncomfortable when people get too close to me (DSI_16R-EC)	○	○	○	○	○	○
I feel a need for approval from virtually everyone in my life (DSI_17R-FO)	○	○	○	○	○	○

At times I feel as if I'm riding an emotional rollercoaster (DSI_18R-ER)	○	○	○	○	○	○
I'm concerned about losing my independence in intimate relationships (DSI_20R-EC)	○	○	○	○	○	○
I'm overly sensitive to criticism (DSI_21R-ER)	○	○	○	○	○	○
I try to live up to my parents' expectations (DSI_22R-FO)	○	○	○	○	○	○
I often feel that my spouse / partner wants too much from me (DSI-24R-EC)	○	○	○	○	○	○
I often agree with others just appease them (DSI_25R-FO)	○	○	○	○	○	○
If I have had an argument with my spouse / partner, I tend to think about it all day (DSI_26R-ER)	○	○	○	○	○	○

When one of my relationships becomes very intense, I feel the urge to run away from it (DSI_28R-EC)	○	○	○	○	○	○
Arguments with my parent(s) or sibling(s) can still make me feel awful (DSI_29R-FO)	○	○	○	○	○	○
If someone is upset with me, I can't seem to let it go easily (DSI_30R-ER)	○	○	○	○	○	○
I would never consider turning to any of my family members for emotional support (DSI_32R-EC)	○	○	○	○	○	○
I often feel unsure when others are not around to help me make a decision (DSI_33R-FO)	○	○	○	○	○	○
I'm very sensitive to being hurt by others (DSI_34R-ER)	○	○	○	○	○	○
My self-esteem really depends on how others think of me (DSI_35R-IP)	○	○	○	○	○	○

When I'm with my spouse / partner, I often feel smothered (DSI_36R-EC)	○	○	○	○	○	○
I often wonder about the kind of impression I create (DSI_38R-ER)	○	○	○	○	○	○
When things go wrong, talking about them usually makes it worse (DSI_39R-EC)	○	○	○	○	○	○
I feel things more intensely than others do (DSI_40R-ER)	○	○	○	○	○	○
Our relationship might be better if my spouse / partner would give me the space I need (DSI_42R-EC)	○	○	○	○	○	○
Sometimes I feel sick after arguing with my spouse / partner (DSI_44R-FO)	○	○	○	○	○	○
I feel it's important to hear my parent's opinions before making decisions (DSI_45R-FO)	○	○	○	○	○	○

I worry about people close to me getting sick, hurt, or upset (DSI_46R-FO)	○	○	○	○	○	○

DSI_11Q Not Reversed

Instructions: These are questions concerning your thoughts and feelings about yourself and relationships with others. Please read each statement carefully and decide how much the statement is generally true of you on a 1 (not at all) to 6 (very) scale. If you believe that an item does not pertain to you (e.g. you are not currently married or in a committed relationship, or one or both of your parents are deceased), please answer the item according to your best guess about what your thoughts and feelings would be in that situation.

	1 Not at all true of me (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 Very true of me (6)
I tend to remain pretty calm even under stress (DSI_4-IP)	○	○	○	○	○	○
No matter what happens in my life, I know that I'll never lose my sense of who I am (DSI_7-IP)	○	○	○	○	○	○
I usually do not change my behavior simply to please another person (DSI_11-IP)	○	○	○	○	○	○
When I am having an argument with someone, I can separate my thoughts about the issue from my feelings about the person (DSI_15-IP)	○	○	○	○	○	○

There's no point in getting upset about things I cannot change (DSI_19-IP)	○	○	○	○	○	○
I'm fairly self-accepting (DSI_23-IP)	○	○	○	○	○	○
I am able to say "no" to others even when I feel pressured by them (DSI_27-IP)	○	○	○	○	○	○
I'm less concerned that others approve of me than I am in doing what I think is right (DSI_31-IP)	○	○	○	○	○	○
When making decisions, I seldom worry about what others will think (DSI_37-FO)	○	○	○	○	○	○
I usually do what I believe is right regardless of what others say (DSI_41-IP)	○	○	○	○	○	○

I tend to feel pretty stable under stress (DSI_43-IP)	○	○	○	○	○	○

End of Block: DIFFERENTIATION OF SELF INVENTORY REVISED - 46 Questions

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