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Spring 5-1-2007

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Psychological Predictors of Success in Bariatric Surgery Patients: A Meta-Analytic Review

INTRODUCTION

With increasing rates of obesity, weight loss is quickly becoming a major focus of health care. Although obesity is a serious problem sometimes referred to as an epidemic in the United States, obese individuals have increasing hope of reducing their weight through bariatric surgery. This surgery is meant to be the last resort for weight loss when all other methods have failed and the patient suffers from severe obesity and related health problems.

There are multiple procedures for weight loss surgery that are categorized as either restrictive, i.e., procedures that reduce the size of the stomach restricting food intake and promoting satiety, or malabsorptive, i.e., procedures that reduce the size of the stomach as in restrictive procedures and, additionally, bypass a section of the small intestine reducing the absorption of calories (American Society for Bariatric Surgery, 2007). Restrictive procedures (i.e. Adjustable Gastric Banding and Vertical Banded Gastroplasty) do not irreversibly alter the structure of the stomach and do not significantly affect the absorption of vitamins and nutrients. For these reasons restrictive procedures often result in less weight loss than malabsorptive procedures and, due to the relatively flexible nature of the bands, the stomach is able to stretch out more easily than with malabsorptive procedures that utilize more permanent stapling techniques. Further, the temporary option inherent in the use of bands in Adjustable Gastric Banding

allows for patients to reverse the procedures altogether by having the bands removed.

Malabsorptive procedures (i.e. Roux-en-Y Gastric Bypass, Fobi Pouch Gastric Bypass, Biliopancreatic Diversion and Duodenal Switch) are often more successful in terms of weight lost post-surgically, however these procedures often produce nutritional deficiencies as a result of the intestinal bypass techniques designed to reduce caloric intake. Due to the more invasive nature of the surgery, malabsorptive procedures also result in higher rates of mortality. Despite the differences in procedures, all surgeries require that patients are actively willing and able to change their lifestyle and adhere to strict dietary restrictions after surgery in order to achieve long-term weight reduction.

Successful surgical procedures can result in drastic weight loss and significant improvements in co-morbidities and quality of life (Dixon, Dixon & O'Brien, 2001, de Zwaan et al., 2002, Dymek et al., 2001). In a review and meta-analysis including 136 studies and 22,094 patients, Buchwald et al. (2004) found that "Bariatric surgery in morbidly obese individuals reverses, eliminates, or significantly ameliorates diabetes, hyperlipidemia, hypertension, and obstructive sleep apnea. These benefits occur in the majority of patients who undergo surgery" (p.1730). Additionally, "with respect to type 2 diabetes, more than three quarters of the patients experienced complete resolution of their diabetes following bariatric surgery" (p.1730) . Although the benefits of bariatric surgery can be substantial, there are many risks associated with the procedures. According

to the American Society for Bariatric Surgery (2005), 12.8% of surgery patients suffer from complications within a thirty day postoperative period and the thirty day mortality rate is .24%. The four most common procedures have a thirty day morbidity rate of approximately 5%, whereas the thirty day mortality rate varies between surgeries with the rates of both adjustable gastric banding and vertical banded gastroplasty being .1%, gastric bypass being .5% and biliopancreatic diversion, the most drastic bypass, being 1% (Buchwald, 2005). Recent evidence, however, suggests that rates may be higher as one study found that out of 16,155 patients, "the rates of 30-day, 90-day, and 1-year mortality were 2.0%, 2.8%, and 4.6%, respectively" (Flum et. al., 2005, p. 1903).

Bariatric surgeries require drastic lifestyle changes for patients and failure results not only from post-operative physiological complications but also from patients' long-term inability to modify their lifestyles in order to lose weight. There is a significant population of patients that do not achieve substantial long-term improvements in weight or obesity-related medical conditions as the American Obesity Association points out, "weight loss usually occurs soon after obesity surgery and continues for 18 months to two years. Most patients regain some weight after this time" (American Obesity Association, 2005, General Benefits of Obesity Surgery section para. 3). It has been reported that as many as 30% of patients regain their weight 18-24 months after surgery (Hsu et al., 1998). Although this finding is a bit dated, the fact that weight regain poses a realistic threat to surgery patients demands a critical investigation into the factors that

influence an individual's success. Unsuccessful outcomes may be attributed to psychological and emotional factors that influence a patient's ability to comply with post-surgical regimens and lifestyles changes. These factors may also inhibit weight loss on a physiological level regardless of a patient's post-surgical compliance due to chemical and hormonal influences. With this in mind, it is important to develop better understanding of pre-surgical physical and psychological variables that may influence outcomes with the goal of optimizing these outcomes so that scarce resources are not spent on unproductive and potentially harmful surgeries.

There is presently a lack of cohesive data regarding the predictive validity of psychological profiles for bariatric surgery outcomes. This information has, however, been investigated with other pre-surgical samples and has been found to predict surgical results. In one study investigating low-back surgery outcomes, three subgroups based on pre-operative Minnesota Multiphasic Personality Inventory-2 (MMPI-2) scores were formed and the "normal" type patients were more likely than the other types to report positive outcomes from surgery after one year (Masters et. al., 2003). These results were consistent with past studies, suggesting that MMPI-2 cluster analyses are helpful in predicting post-surgical outcomes. Additionally, in a study by Scheier and colleagues (as cited in Kiecolt-Glaser et al, 1998) investigating personality variables and their effects on post surgical outcomes, optimistic men when compared with pessimistic men "fared better on perioperative physiological indexes--they began walking faster after

surgery, and rehabilitation staff rated them as showing a more favorable physical recovery” (p.1214).

Several studies have found that psychological variables other than personality characteristics also affect patients’ recoveries from surgeries. Reviewing work in the area of psychological influences on surgical recovery, Kiecolt-Glaser and colleagues (1998), noted that, “in general, high preoperative fear or stress is predictive of a variety of poorer outcomes, including greater pain, longer hospital stays, more postoperative complications, and poorer treatment compliance (p.1214).

Depression in particular has been implicated as a psychological condition that has drastic effects on exacerbating existing medical conditions, preventing or delaying improvement and reducing adherence to treatment plans. A study by Contrada et al. (2004) found that depression was associated with longer hospital stays for patients after heart surgery. This suggests that depression slows physical recovery after surgery. Additionally, in a review of 29 studies of orthopedic surgery patients, Rosenberger et al. (2006) investigated the effects on surgical outcome of psychosocial factors. Rosenberger asserts that "psychosocial factors play a large role in a patient's physical surgical outcomes, not just their quality of life” and consequently “the results suggest that preoperative consideration of attitudinal and mood factors will assist the surgeon in estimating both the speed and extent of postoperative recovery” (Rosenberger et al., p. 404).

Previously many psychological factors have been proposed as correlates of

successful and unsuccessful weight loss following bariatric surgery. These include depression, binge eating disorder (Averbukh et al, 2003), distress over obesity (Vallis & Ross, 1993), and hysteria, paranoia and health concerns (Tsushima, Bridenstine & Balfour, 2004). Based on this past research, however, no strong conclusions have been drawn due, in part, to the lack of replications of past studies, varying methods of research and lack of standardized assessments (Vallis & Ross, 1993). In order to improve the efficacy of bariatric surgery procedures, it is necessary to follow up on past research and identify the factors that predict the outcomes of patients.

Previous Bariatric Surgery Studies

Previous research in the area of bariatric surgery and psychological correlates of success has produced conflicting findings. Several studies have found that the prevalence of psychological conditions such as depression is greater among obese populations and, additionally, these rates decrease after surgical weight loss procedures. Glinski et al. (2001) administered the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) to patients prior to surgery and found "a high prevalence of psychopathology and personality disturbances in patients seeking surgery for morbid obesity" (p.581). The lifetime prevalence of depressive disorders for patients in this study, as determined by clinical interview, was 56%, with 19% exhibiting a current depressive disorder. Glinski et al. note that other studies have found the lifetime prevalence of depression in obese individuals to be between 29% and 51%. These rates of depression are

significantly higher than the lifetime prevalence of depression in the general population which is about 17%.

Maddi et al. (2001) also administered the MMPI-2 to patients prior to surgery and again six and twelve months after surgery and corroborated that psychopathology is high in obese patients before surgery and additionally, declines to normal or lower levels after surgery. Depression was one of the clinical scales that were shown to decrease post-surgically. This raises a question about the relationship between psychological factors and weight loss surgery as the results indicate that surgery has a positive effect on psychopathology and depression in particular. Unfortunately, neither of these MMPI-2 studies contained a follow-up investigation into the relation between personality profiles and success of weight loss after surgery (Tsushima, Bridenstine & Balfour, 2004). Nonetheless, based on the higher incidence of depression among obese individuals, these studies suggest a heightened sensitivity for depression within this population and this information may prove valuable in the assessment and treatment of bariatric surgery patients.

In addition to research indicating that depression improves after surgery, there are in fact several studies that have found that higher rates of depression prior to surgery are associated with more successful weight loss post-surgically. In a study by Averbukh et al. (2003), the Beck Depression Inventory (BDI) was administered to patients prior to and after surgery and BDI scores were found to be a significant predictor of weight loss. Higher levels of depression were

associated with greater weight loss, a phenomenon that can perhaps be explained by the high incidence of co-morbid Binge Eating Disorder (BED) among depressed obese individuals. The researchers suggest that because surgery restricts the intake of food and BED is often resolved with surgery, individuals that previously had this disorder experience more weight loss (Averbukh et al., 2003).

In another study, Brolin et al. (1986) administered the Symptom Checklist 90 (SCL-90) to 42 patients prior to surgery and found that the patients who were most successful in approximating their ideal body weight post-surgically had a greater number of pre-surgical symptoms on the scales of Interpersonal Sensitivity, Anxiety and Depression. The researchers in this study suggest that, based on these data, success is associated with greater psychological disturbances attributed specifically to obesity.

In addition to the findings that support the association between depression and successful surgical outcomes, there is a substantial body of conflicting literature that indicates that this relationship may *not* be statistically significant. Research by Tsushima, Bridenstine & Balfour (2004) found MMPI-2 scores to be a predictive measurement of weight loss. In this study the medical records of patients who had been administered the MMPI-2 prior to surgery were compared to their results with the amount of weight lost one year after surgery. This study found that less weight loss was correlated with significantly higher scores on the Hysteria, Paranoia and Health Concerns scales and also on the “F” validity scale that measures deviant response patterns. In addition, less weight loss was also

correlated with lower scores on the Masculinity-Femininity scale. These findings suggest that some personality characteristics may have substantial relations with post-surgical outcomes however, the depression scale was not one of these predictors. Although depression scores showed some improvement post-operatively, depression was not found to be significantly related to the success of surgery. One limitation of this study is that it is a retrospective analysis and therefore is limited to the data found in patients' medical records. In addition, as the authors note, this study conceptualized success exclusively in terms of weight loss. Though weight loss is the primary measure of outcome, a holistic approach to considering criteria for success includes measures of psychological functioning and assessment of other co-morbidities.

In addition to this past research using the MMPI-2, there are other studies that have utilized different methods of personality profiling regarding bariatric surgery patients and found similar results. In a study by Papageorgiou et al. (2002), the Symptom Checklist 90-Revised (SCL-90-R) was administered prior to and one year after bariatric surgery. This study found that general symptom profiles of patients improved significantly after weight loss. Depression scores also improved post-surgically however these improvements were not found to be statistically significant.

Still more research investigating aspects of psychopathology suggests no relation with outcomes. In a study by Barrash et al. (1986) the MMPI was administered to 138 female patients prior to surgery and no MMPI scales,

including depression, were found to be statistically significant predictors of post-surgical weight loss. Davidson, Rohde and Wastell (1991) found that there were no statistically significant differences in weight loss between groups of patients evaluated by a psychiatrist and found to have either no psychiatric conditions, minor psychiatric disorders or major psychiatric disturbances. These findings suggest that conditions such as depression may have no effect on the success of surgery, however the sample size of this study was rather small ($N=18$).

Using the Psychosocial Stress and Symptom Questionnaire (PSSQ), Buddenberg-Fischer et al. (2004) found that greater or lesser levels of psychosocial stress were not associated with more or less post-surgical weight loss. Undergoing surgery, however, was related to improved psychological well-being as the non-surgical participants in this study had the worst psychosocial outcomes. These findings suggest that although pre-surgical psychosocial factors may not significantly relate to the degree of weight loss for those who have undergone surgery, surgical weight loss procedures may themselves be associated with improved mental health outcomes.

The conclusions that can be reached from this past research are difficult to decipher given the varying methodological approaches and results between studies. The body of literature is characterized by multiple research questions, widely varying sample sizes and assessment tools, different types of recorded data and different measures of outcome. Lacking a quantitative review of the literature, it is difficult to draw conclusions strictly based on a narrative summation of the

studies. Consequently, the purpose of this study is to combine the statistical findings of the literature in a comprehensive meta-analysis to determine the overall statistical significance of psychological variables including depression, anxiety, binge eating disorder and self-esteem as predictors of weight loss for bariatric surgery patients.

METHODS

Search Criteria

The studies included in this meta-analysis were found by searching Medline and Psycinfo databases at Syracuse University and State University of New York (SUNY) Upstate Medical University. Articles investigating psychological variables in bariatric patients and surgery outcomes were found using keyword searches including combinations of terms including “bariatric surgery,” “weight loss surgery,” “depression,” “psychopathology,” and “personality.” Citation lists from studies found on these databases were also searched for relevant articles. Inclusion criteria required that studies be published prior to April 2007, report at least one measure of a pre-surgical psychological variable, and that the measure was reported in a manner that could be quantified for statistical analysis (either a standardized tool was utilized or a measurement was developed by a professional evaluating the symptoms and severity of depression in participants).

A total of 29 studies were found that met preliminary search criteria, however 22 studies lacked adequate statistical information to properly include

them in a meta-analysis. Efforts were made on at least two separate occasions via email to contact researchers from each study requesting the additional data. One researcher refused to supply the data, seven researchers were unable to locate or supply the data due to extenuating circumstances (such as files lost in moving or files purged after several years), seven researchers, one of whom completed three relevant studies, did not respond to the data requests and two researchers were unable to be located. Only three researchers were willing and able to supply the necessary data to include their studies in the present meta-analysis.

Consequently, a total of ten studies were obtained that met the search criteria and contained adequate statistical data. Six of the ten studies utilized prospective designs, three studies were archival prospectives using presurgical data from patient's charts in relation to currently collected data and one study used a retrospective design that incorporated patients' medical charts and previously-recorded data. The average follow-up time was 12 months post-surgery, with a follow-up range from 3-48 months. The meta-analysis includes a total of 1,315 subjects. The study characteristics and general findings for each study are summarized in Table 1.

Instruments

There were several standardized instruments that were utilized for measuring various psychological characteristics within the studies. The first of these is the Minnesota Multiphasic Personality Inventory (MMPI) which is the most widely used standardized instrument designed to assess personality

characteristics of adults and was utilized in two of the included studies. This instrument which, in its current revision consists of 567 items is a self-report inventory that requires a sixth grade reading level for completion and thus is a good tool for accessing multiple populations. The MMPI includes validity scales and 10 clinical scales (Butcher, 2005; Pearson Education Inc., 2007).

Two other instruments were utilized within the studies to assess general personality variables. The Dutch Personality Questionnaire used by Larsen et al. (2004) is a validated instrument designed to assess seven scales of personality including neuroticism, social anxiety, rigidity, hostility, egoism, dominance and self-esteem (Luteijn, Starren & van Dijk, 2000). The Temperament and Character Inventory (TCI) (Cloninger et al., 1994) was used by De Panfilis et al. (2006) to assess personality characteristics in participants along seven dimensions of personality including harm avoidance, novelty seeking, reward dependence, persistence, self-directedness, cooperativeness and self-transcendence.

Two of the studies, Averbukh et al. (2003) and Malone & Alger-Mayer (2004), used the Beck Depression Inventory (BDI) to assess depression in subjects. The BDI is a self report inventory consisting of 21 questions designed to assess the presence and severity of depressive symptoms. This is a reliable and widely used instrument that has been shown to be very effective in helping clinicians evaluate the affect of patients (Beck, Steer & Brown, 1996).

Buddenberg-Fischer et al. (2004) used the Psychosocial Stress and Symptom Questionnaire (PSSQ) in their pre-surgical assessment of subjects. This

instrument consists of three separate instruments including the Hospital Anxiety and Depression Scale (HADS-D), a validated instrument similar to the BDI that is used in research to assess the presence of depressive and anxiety symptoms (Zigmond, 1983).

The Hamilton Depression Rating Scale (HAM-D) is another widely utilized instrument consisting of 21 questions designed to assess the severity of depression in subjects diagnosed with depression (Hamilton, 1960). Similarly, the Hamilton Anxiety Rating Scale (HAM-A) is an instrument consisting of 14 items that is widely used in clinical and research settings to assess the severity of anxiety in subjects diagnosed with anxiety (Schutte & Malouff, 1995). Both of these instruments were used in the study by De Panfilis et al. (2006).

The 36-item short-form Medical Outcomes Survey (SF-36) was distributed in two of the included studies to assess the overall health of participants. This is a widely distributed health survey used in practice and in research to assesses eight health concepts including limitations in physical activities because of health problems, limitations in social activities because of physical or emotional problems, limitations in usual role activities because of physical or emotional health problems, bodily pain, general mental health (psychological distress and well-being), vitality (energy and fatigue), and general health perceptions (Ware, 1993). The mental health and social functioning scales along with the mental composite summary (MCS) were utilized as part of the analysis.

The Eating Disorder Inventory-2 (EDI-2) utilized by De Panfilis et al.

(2006) is a 91-item self-report instrument used to evaluate symptoms of anorexia nervosa and bulimia nervosa. This instrument consists of 11 dimensions including drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation and social insecurity (Garner, 1991).

Malone & Alger-Mayer (2004) administered the Gormally Binge Eating Scale (BES), another instrument designed to assess disordered eating, specifically in the form of bingeing. This 16-item instrument is most commonly used to assess symptoms of Binge Eating in research participants (Gormally et al., 1982).

Statistical Analysis

The statistical analysis was completed using the computer statistics program Comprehensive Meta-Analysis (Biostat, 2002). Effect sizes were calculated within each study and then the overall effect size across the studies was calculated for each individual variable and for all the variables grouped together as one general psychological variable. The correlations were determined for the relations between each variable and weight loss and for general psychological characteristics and weight loss. Additionally, the Q statistic and the I^2 statistic were calculated to determine the heterogeneity between studies. The Q statistic is used to indicate whether a sample is heterogeneous. However, given the Q statistics limited ability to predict heterogeneity in small sample sizes, the I^2 statistic was used to determine the extent of heterogeneity across studies (Higgins et al., 2003).

RESULTS

Thirteen psychological variables were included in the analysis: Anxiety, Binge Eating, Bulimia, Depression, Inpatient Psychiatric Admissions, Mood Disorder Diagnosis, Personality Pathology, Psychiatric Diagnosis, Psychological Distress, Self-Esteem, Social Anxiety, Social Functioning and Social Sensitivity. These variables were considered in relation to post-surgery weight loss to determine their predictive value. When including all of the variables above in the analysis, no significant relationship was found between these psychological variables as a whole and weight loss ($k=10$, $r=.082$, $p=.122$). Further, the studies were found to be significantly (i.e., $I^2 > 50\%$) heterogeneous ($Q=19.15$, $p=.024$, $I^2=52.99$). This finding suggests that the individual study findings differed significantly indicating that the overall effect determined by the analysis may not accurately represent findings across studies.

When including only the variables of anxiety, social anxiety and depression, a small, statistically non-significant, relationship was found between anxiety/depression and weight loss ($k=4$, $r=.177$, $p=.13$). This indicates that more anxiety/depression may be associated with greater weight loss. As with the broad analysis, this narrower sample was also found to be heterogeneous ($Q=8.34$, $p=.04$, $I^2=64.01$), indicating that 64% of the variation can be attributed to true heterogeneity across studies rather than to sampling error (Huedo-Medina et al., 2006).

DISCUSSION

The results of this meta-analysis indicate that the presence of psychological symptoms in general are not predictive of weight loss in bariatric surgery. This suggests that at least some psychological and/or personality characteristics may not play a role in a person's ability to successfully lose weight post-surgically. These results also suggest that exclusion from surgery based on psychological symptomatology in general may not be an effective way to improve the efficacy of the surgery as it pertains to weight loss.

The results pertaining specifically to anxiety and depression, however, suggest that these specific variables may have a small relation with weight loss outcomes and be of use in predicting a patient's success. Based on the present findings, greater anxiety and/or depression *may* be related to more successful weight loss outcomes. However, given the weak nature of the statistical results in this study, further investigation into the relationship between anxiety and depression and successful surgical outcomes is necessary. If this relationship can be substantiated, it could be valuable for the process of selecting patients for weight loss surgery and improving the efficacy of these procedures. The positive relation between these factors and weight loss, i.e. higher levels of anxiety and depression correlate with greater weight loss, minimally indicates that individuals should not be excluded from surgery on the basis of the presence of depression or anxiety and these patients may in fact be more successful in losing weight. This also suggests that patients displaying symptoms of anxiety and/or depression need not postpone surgery until their symptoms have resolved.

The observation that the findings from past studies are not homogenous is important in that it suggests that the studies do not present a cohesive pattern of results that allow for accurate depiction by meta-analytic procedures. The goal of the current meta-analysis was to utilize the data from past research in a statistical analysis with the hope of presenting the data in the form of a cohesive mathematically derived conclusion. Prior to this analysis past data has been presented only in inconclusive narrative reviews. The result of the present analysis was that we were unable to achieve our goals given the nature of the existing data. Since the literature produced such varying effect sizes, etc. the meta-analysis does not seem to be a good summary representation of the literature. There were 14 studies found in our literature search that report findings on the relation between depression and weight loss. Six studies report no significant relation between any psychological variables and weight loss, four studies report no significant relation between depression and weight loss, three studies report a positive correlation between depression and weight loss and one study reports a negative correlation between depression and weight loss. Our current analysis of the variables of depression and anxiety included only four individual studies with a total of 286 subjects. In order to determine the true overall relationship of these variables with weight loss following bariatric surgery, more studies with relevant statistical data must be included in the analysis. This proves to be a difficult task due to the lack of available data and varying methods of assessment, however, with continuing research and cooperation between investigators, more reliable results are an

obtainable goal for the future of bariatric surgery research.

One hypothesis as to why findings differ so drastically between studies may be attributed to different origins of psychopathology such as depression. In the study by Averbukh et al. (2003), the BDI was administered prior to and after surgery and BDI scores were found to be a significant predictor of weight loss. The researchers' hypothesis was that depression in obese individuals is often accompanied by Binge Eating Disorder (BED) and since surgery restricts the intake of food and BED is resolved with surgery, individuals that previously had this disorder experience more weight loss (Averbukh et al., 2003). Perhaps this explains why certain depressed individuals, those with BED, do experience greater weight loss after surgery, however those that experience depression unrelated to BED may not see the same weight loss results post-surgically.

Similarly Brolin et al. (1986) administered the SCL-90 to 42 patients and found that the patients who were most successful in losing weight had a greater number of symptoms of not only depression but also anxiety and interpersonal sensitivity. This grouping of elevated scores seen within the most successful weight loss group suggests that the depressive symptoms may be associated specifically with the person's obese condition. Thus, Brolin and colleagues concluded that successful outcomes were more likely when depression was attributed specifically to obesity. Improvement in obesity after surgery helps resolve depressive symptoms and in turn promotes the maintenance of successful weight loss. If an individual's depression is unrelated or less directly related to

obesity, perhaps the predictive value of the depression is less significant. More research is necessary to isolate the type of depression (in terms of foci) a patient experiences and the relationship between that condition and successful outcomes.

Another hypothesis as to why findings differ across studies is that the length of follow-up after surgery plays an important role in the measure of the outcome variable of weight loss. Due to the drastic nature of the procedures, all patients inevitably lose weight post-surgically. A study that measures weight loss at 12 months post-surgery will naturally recognize less variation between subjects in terms of weight loss than would a study that records the outcome variable at 24 or more months because by this point, weight has begun to stabilize and weight loss maintenance has less to do with physiological constraints than with psychological constraints and individuals' ability to control their diet and exercise. The average follow-up period for the current data pool was 12 months post-surgery. This is a short follow-up period and may not accurately represent the participants' successes in regards to long-term weight loss. This limitation is in part due to the relatively recent development of bariatric surgeries in general and in terms of specific procedures. Long-term data for patients may not yet be available and thus longitudinal studies have yet to be published. The question of what factors are associated with weight loss success on a long-term basis is one that researchers should be able to answer more accurately in years to come as longitudinal data becomes more available.

There were several notable limitations to the current study. One

methodological limitation of the current study was the scope of the original search criteria. The original search included studies investigating psychological characteristics such as personality, depression and general psychopathology. Specific terms such as “anxiety,” “Binge Eating Disorder” and “self-esteem” were not included in the keyword search as the original scope of the study was to investigate psychological characteristics in general. These characteristics were noted in the current analysis because of their prevalence within the literature found. Studies that investigated these isolated characteristics may have been overlooked and thus, further research is needed to determine the relation between these specific characteristics and successful surgery outcomes. Nevertheless, by using the terms that were entered in the databases and following up by examining reference lists, it is unlikely that a substantial literature was missed.

Varying hypotheses and methodologies between studies limited our ability to merge the findings into one cohesive summary. Since bariatric surgery is a fairly new procedure that is constantly evolving, the elements at play in its success are, as yet, inadequately assessed in a standardized and validated manner. Additionally, the importance of various characteristics in achieving successful outcomes may be evolving as rapidly as the procedures themselves making researchers’ abilities to draw conclusions a particularly difficult task.

Similarly, one significant limitation to this study was our inability to quantify and represent many studies that did not use standardized measurements of psychological characteristics. Several of the studies included in the analysis

utilized standardized tests to evaluate patients. Additionally some non-standardized measurements were reported in a way that allowed us to incorporate them into the analysis such as anxiety diagnosis, physician depression rating, inpatient psychiatric admissions, and psychiatric diagnosis. There were several other studies that utilized non-standardized measures and did not adequately report data pertaining to their methods of assessment; thus their data could not be included. The findings from these excluded studies are difficult to quantify and compare to scores on standardized instruments, nonetheless the conclusions drawn from these studies may be noteworthy regarding the role psychological variables play in successful post-surgical outcomes. Many researchers that utilized interview criteria and diagnoses to categorize participants within their studies did report significant relations between psychopathology and successful surgery outcomes. These data may be of great value and accurately represent a relation between psychological variables and weight loss success; however, the value of such data may be underappreciated due to its inaccessibility to statistical analyses. These non-quantifiable data were beyond the scope of this analysis but may be useful for future endeavors in this topic.

Another significant limitation to the current study was the lack of appropriate reporting of findings in past literature. Overall a disappointingly low quality of scientific reporting was observed as many studies failed to adequately describe their research methods and lacked statistical data to support their findings. Lack of explanatory reporting in research makes replication and

validation a treacherous and unfulfilling task. Additionally, unsubstantiated findings are suspect to criticisms concerning methodology, validity and integrity. Whether these inadequacies are due to a lack of supporting data at all or a lack of motivation to include the necessary data, the limitations this presents for the practical application of such findings are substantial.

A final limitation to the current study that was both alarming and discouraging was the lack of response and cooperation from fellow researchers. Unresponsive researchers who were unable or unwilling to present data from their original investigations for inclusion in the meta-analysis limit the ability of the science to move forward. Science is based on a method of trial, error and repetition, a process that is dependent on the interplay of various research objectives, methods and participants. Ultimately the goal of all psychological research is to create an inclusive body of high quality literature that can be combined and quantified in ways that determine the overall implications for clinical practice and mental health. The future of psychology depends on the willingness of those in the field to cooperate and work together in the spirit of research.

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