

**Evaluating the psychological predictors of long term weight loss following
bariatric surgery**

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THE STATEMENT OF INTEGRITY

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ABSTRACT

Introduction: Weight loss surgery (WLS) is cost effective for managing obesity. Yet nearly a third of patients do not achieve successful weight loss (WL) long-term. Furthermore identifying psychological characteristics of long-term successful WL, remain largely undetermined.

Aims: To examine the psychological and WL outcomes of patients who had WLS 2-10 years ago and to identify which preoperative and/or postoperative psychological factors might predict successful WL long term.

Method: 24 patients, who had undergone WLS 2-10 years ago, participated. Two data sets were used: (1) retrospective data from participants' medical records on their surgical procedure, physical and psychological health before and after surgery and (2) follow-up data from eight questionnaires, on postoperative psychological functioning, eating behaviours, physical health and adherence to professional support.

Results: Participants were predominantly female ($n=19$), had undergone Roux-en-Y gastric bypass (RYGB, $n=19$), on average four years prior to follow-up. Mean postoperative WL was 41kg ($SD = 18.47$) and two thirds of participants ($n =16$) achieved more than 25% WL. Fifty per cent had a probable anxiety disorder, a third were hazardously drinking alcohol and most had weight related quality of life concerns. RYGB patients with successful WL ($n=14$) had significantly fewer disordered eating symptoms ($p < 0.005$), than the unsuccessful WL group ($n=5$). Disordered eating symptoms also significantly correlated with %WL, even after controlling for years since surgery ($F(2,16) = 5.77, p < 0.013$). The relationship between preoperative psychological factors and %WL was not determined due to a lack of data in the medical records.

Conclusion: While WLS is successful in reducing obesity, it is unclear whether the presence of postoperative psychological difficulties in this sample is a consequence of this procedure. Further research is required to determine if key psychological characteristics can predict %WL.

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ABBREVIATIONS

AN Anorexia Nervosa
AGB Adjustable Gastric Band
AUDIT Alcohol Use Disorders Identification Test
AWL Alterable Weight Loss
BPD Bilio-Pancreatic Diversion
BDI Beck Depression Inventory
BED Binge Eating Disorder
BMI Body Mass Index
BN Bulimia Nervosa
BOMSS British Obesity & Metabolic Surgery Society
BPS British Psychological Society
CMHT Community Mental Health Team
CR Cognitive Restraint
DS Duodenal Switch
DOH Department of Health
ED Eating Disorder
EDI Eating Disorders Inventory
EE Emotional Eating
EWL Excess Weight Loss
FTO Fat mass and obesity associated (gene)
GBP Gastric Bypass Procedure
GB Gastric Banding
HADS Hospital Anxiety and Depression Scale
HRQoL Health Related Quality of Life
IBW Ideal Body Weight
IWQOL-Lite Impact of Weight on Quality of Life
KSR2 Kinase Suppressor of Ras 2
LAGB Laparoscopic Adjustable Gastric Banding
LC Loss of control
MDT Multi-Disciplinary Team
NBSR National Bariatric Surgery Register
NES Night Eating Syndrome
NIDDK National Institute of Diabetes and Digestive and Kidney Diseases
NOO National Obesity Observatory
NR Not Reported
NRES National Research Ethics Service
OFCOM Office of Communication
PD Personality Disorder
QoL Quality of Life
RCT Randomised Control Trial
RIS Recruitment Information sheet
RYGB Roux-en-Y Gastric Bypass
SA Sexual Abuse
SAGB Swedish Adjustable Gastric Band
SRRS Social Readjustment Rating scale
TFEQ Three Factor Eating Questionnaire
UE Uncontrolled Eating
VBG Vertical Band Gastroplasty
VSG Vertical Sleeve Gastrectomy
WHO World Health Organisation
WL Weight Loss
WLS Weight Loss Surgery

CHAPTER 1: INTRODUCTION

1.1 Introduction

Being overweight and obese are the leading risk factors for mortality and are associated with more deaths worldwide than being underweight (World Health Organisation [WHO], 2015). Recent data suggest that the Yorkshire and Humber region is amongst the highest in the UK in terms of prevalence of obesity (Health and Social Care Information Centre, 2013). Therefore, the management of obesity is of great concern both locally and globally.

Bariatric surgery is one of the most cost effective approaches to managing obesity. It is recommended for people who are morbidly obese, with or without the presence of obesity related comorbidities such as type 2 diabetes (National Institute for Health and Clinical Excellence [NICE], 2006, amended 2014). However, nearly a third of bariatric surgery patients do not achieve successful weight loss or maintain this long term (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005). Many attempts have been made to identify why some patients achieve successful weight loss post-surgery whilst others do not. This has included assessing patients' psychological functioning, eating behaviours and lifestyle. However, the factors which identify those who are most likely to benefit from surgery, and successfully lose weight, remain undetermined. Consequently, the overall aim of the work presented in this thesis is to provide further data that may help to identify those patients who are most likely to achieve successful weight loss following bariatric surgery. This information could inform future clinical practice to improve the psychological assessment and preparation of patients preoperatively to better align patient characteristics with treatment options. Furthermore, it could suggest how post-operative psychological assessment might be improved in order to facilitate patients' weight loss and weight loss maintenance in the long term.

1.2 Obesity

Obesity is a medical term used to describe a person who has an excessive amount of body fat that presents a risk to their health. The NICE (2006, amended 2014)

guidelines (see Table 1 below) classify obesity according to a person’s Body Mass Index (BMI kg/m²).

Table 1 *Classification of overweight or obesity in adults*

Classification	BMI (kg/m ²)
Healthy weight	18.5–24.9
Overweight	25–29.9
Obesity I	30–34.9
Obesity II	35–39.9
Obesity III	≥ 40

Note: From NICE guidelines (2006, amended 2014)

Worldwide, the incidence of obesity has nearly doubled since 1980 and rates are still rising (WHO, 2015). Obesity rates in the UK are reported by WHO to be the worst in Europe. It is now predicted that by 2050, half of the UK adult population will be obese, with health care costs reaching £50 billion a year (National Obesity Forum, 2014).

Obesity can impact on a person’s physical health, social needs and psychological wellbeing. Worldwide, 44% of diabetes cases, 23% of heart disease cases and between 7% and 41% of certain cancer cases, are attributed to being overweight or obesity (WHO, 2014). People who are obese are more likely to be socially excluded, experience discrimination and have reduced earnings (Puhl & Brownell., 2011; McCormick, Stone, & Corporate Analytical Team., 2007; Morris, 2004). Socio-economic status is strongly associated with obesity, with higher obesity in more socially disadvantaged groups (Marmot, 2010). Overall, obesity inflicts considerable costs on both individuals and society.

1.3 Causes of obesity

There is no single cause of obesity. Instead, obesity is thought to occur from an imbalance between energy intake (e.g. from energy dense, high fat and high sugar foods and alcohol) and energy expenditure (i.e. physical activity) sustained over a long period of time. The reason for this energy imbalance is thought to be due to a combination of changes in environmental, human behaviour and biological factors. Environmental factors include advances in technology which promotes living a sedentary lifestyle as well as the ease to which people can access energy dense foods

(DoH, 2013); biological factors include hormones and genes which regulate appetite (Revelli et al., 2011; Karra et al, 2013) and psychological factors include eating in response to environmental triggers or emotional states (e.g. depression or anxiety) or dietary restraint leading to uncontrolled eating such as binge eating (BPS, 2011; Bekker et al., 2004; Keys et al. 1950; Bocchieri et al., 2002; Ogden, 2003; Provencher, Drapeau, Tremblay, Despres, Lemieux, 2003). The aetiology of obesity is multifactorial. Thus the importance of identifying and improving cost effective treatment for those people who are most affected by severe obesity is of clear health, economic and psychosocial importance.

1.4 Bariatric surgery as a treatment for obesity

Several methods have been developed to manage weight in obese people. These include diet and exercise programmes, behavioural therapies, support groups, medication and surgery (DoH, 2013). Bariatric surgery or weight loss surgery (WLS), is the recommended (NICE, 2006, 2014) and long term, (measured up to 10 years after surgery), cost effective treatment for adult obesity (Picot et al., 2009) and type 2 diabetes (Schauer et al., 2012). NICE (2006, 2014) recommends bariatric surgery for patients with a BMI of 40 kg/m² or over, or a BMI of 35 kg/m² or over who have another comorbidity (e.g. type 2 diabetes or hypertension).

1.4.1 Types of bariatric surgical procedures

There are three main types of WLS performed in the UK (NOO, 2010; see Figure 1). The two most commonly performed WLS procedures are Roux–en–Y gastric bypass (RYGB), which is a type of gastric bypass procedure (GBP), and adjustable gastric banding (AGB), which is a type of gastric band procedure (NOO, 2010). These procedures are usually performed through key-hole or laparoscopic surgery.

In GBPs such as RYGB, a small pouch is made from the top half of the stomach which is then connected to a shorter length of the small intestine. This surgical procedure restricts the foods that can be digested and absorbed because the route taken by food through the digestive system has been altered. Consequently, this procedure results in an average reduction in bodyweight of 40% and has consistently been shown to result in more WL than AGB (Picot et al., 2009).

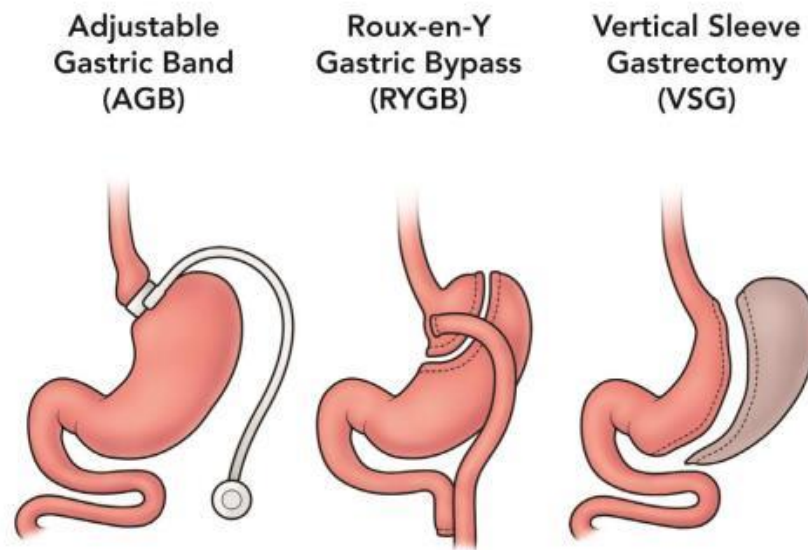


Figure 1. The three common types of WLS procedures. Reprinted from Bariatric Surgery and the Endocrine System. *In Hormone Health Network*, n.d., Retrieved August 3, 2015 from www.hormone.org/questions-and-answers/2012/bariatric-surgery.

In AGB, an adjustable silicone band is placed around the top half of the stomach which restricts food intake. The band can be adjusted to alter food restriction and can also be removed. This procedure results in an average reduction in bodyweight of 28% (Picot et al., 2009).

For people with a BMI over 40 kg/m², the vertical sleeve gastrectomy (VSG, see Figure 1) is recommended because it results in the highest WL for extremely obese individuals and can be a safer form of surgery for these patients compared to other types of WLS (Prachand, Davee & Alverdy 2006). It often involves reducing the size of the stomach by approximately 75%. This procedure might be the first stage for a RYGB or biliopancreatic diversion with duodenal switch (BPD-DS) with the main difference being that a BPD-DS results in a larger section of the small intestine being bypassed. More than 80% of patients who receive a BPD-DS lose at least 50% of excess body weight within two years of surgery (Prachand et al., 2006).

1.4.2 Criteria for successful weight loss following surgery

Weight loss (WL) is considered the primary outcome of bariatric surgery. Patients usually lose most weight within the first one to three years after surgery (Buchwald et

al., 2004; Sjöström, et al., 2007). However, there is no agreement about the method to calculate WL and the criteria that should be used to determine whether patients have achieved successful WL postoperatively. Three WL outcome methods are most prevalent in the literature: percentage excess WL; percentage alterable WL and percentage WL. For each method a specific cut off criterion is used to determine whether WL has been successful postoperatively.

Percentage excess WL (%EWL) is the most widely used method for judging the success of bariatric surgery (Elder & Wolfe, 2007; Picot et al., 2009). A 50% loss of excess weight or more indicates that the WLS procedure has been successful.

Percentage alterable weight loss (%AWL) is the most recently proposed method for judging the success of WLS. This alternative method was developed by van de Laar (2011, 2012, 2013, 2014a, 2014b) after identifying that it was more suitable than %EWL for both lighter and heavier patients, for women and for patients younger than 40 years. Additionally, AWL takes into account the unalterable portion of body mass which is not affected by a decrease in consumption in calories. This is based on van de Laar's review of research into starvation in anorexia nervosa and famine (Rosling, Sparén, Norring, et al. 2011).

The literature on WL interventions for obese populations has also used percentage WL (%WL). Two cutoff criteria have been used. Firstly, a 10% loss in weight maintained for at least one year postoperatively, since this has been shown to significantly reduce individuals' risk of developing diabetes and heart disease (Wing et al., 1995). Secondly, a 25% loss in weight, given that 75% of patients lose more than 25% weight in the first two years after surgery (van de Laar & Acherman. 2014). Whilst %WL is more commonly used in the literature, %AWL appears to be the most suitable method because it takes into account unalterable weight and is more accurate in detecting statistical changes in WL (van de Laar, 2011, 2012, 2013, 2014a, 2014b). However, for small samples van de Laar recommends %WL (2015, personal communication, Appendix 1).

1.4.3 Bariatric surgery and weight loss

A review of WLS procedures by Picot et al. (2009) found that the GBP was the most clinically effective procedure for obese patients. In three randomised control trials (RCT), patients with GBP lost significantly more excess weight at 12, 24 and 30 months post-surgery, compared to those who underwent Vertical Banded Gastroplasty (VBG), which is a form of AGB (Sugerman et al., 1987; Howard et al., 1995; Olbers et al., 2005). EWL for GBP patients ranged between 62-84%, thus exceeding the 50% threshold for successful WL. In addition, six GBP patients who were followed up five years post-surgery had lost 70% of their excess weight (Howard et al., 1995). This EWL was significantly higher than in the six patients who had VBG surgery (Howard et al., 1995). These findings, therefore, indicate that the type of WLS is an important determinant of WL.

Conversely, a literature review by O'Brien et al (2004) illustrated that despite short term (< 3 years since surgery) differences in EWL between three WLS procedures, success dissipated at five years (Figure 2). In a more recent literature review by O'Brien et al. (2013), %WL following RYGB (mean 54.0%, range 27%–68%) and AGB procedure (mean 54.2%, range 33%-60%) were similar over a decade. Hence, the length of follow-up, rather than the type of WLS is likely to be a significant factor when assessing postoperative WL.

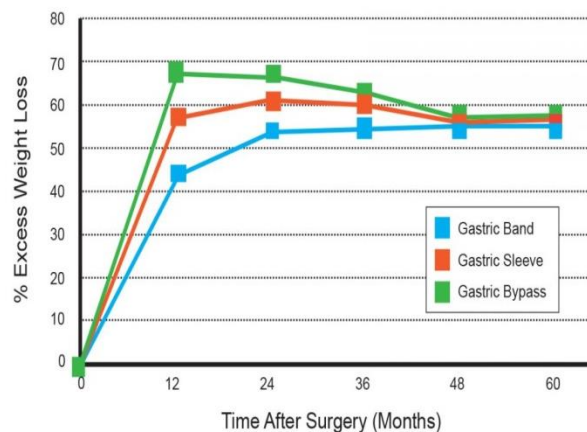


Figure 2. Percentage of excess WL following AGB, VSG and GBP. Reprinted from Obesity is a Surgical Disease: Overview of Obesity and Bariatric Surgery by O'Brien et al. 2004. *ANZ Journal of Surgery*, 74, 200-204.

1.4.4 Criteria for referral

The referral criteria for WLS across many clinics, including those within the Mid Yorkshire NHS Healthcare Trust (where the present research was carried out) requires patients to try other weight management methods, lose a small percentage of weight (i.e. 5%) and undergo a preoperative psychological assessment (NICE, 2014). Half of the studies in a recent systematic review found a positive relationship between preoperative WL and postoperative WL, suggesting pre-operative WL is a good indicator for identifying suitable candidates for surgery (Livhits et al., 2012; Alger-Mayer, Polimeni, Malone, 2008).

The preoperative psychological assessment of patients assesses their level of motivation to change, psychological functioning, eating behaviours (e.g. binge eating, snacking), lifestyle (e.g. exercise, alcohol use and smoking) and level of support from friends and family (NICE, 2014). This information informs suitability for surgery, since these factors are likely to affect patients' ability to adjust to postoperative lifestyle and bodily changes, compliance with medical advice, and to ensure that patients are prepared for the procedure (Grothe, Dubbert & O'Jile, 2006). However, as there are no studies evaluating the outcomes of psychological screening in relation to postoperative WL, the utility of these assessments in identifying patients who are likely to achieve successful WL postoperatively is still unknown. Given that 20% to 30% of WLS patients fail to maintain WL long term (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005; Odom et al., 2009; Karlsson, et al., 2007), identifying factors which affect WLS outcomes is needed in order to reduce the prevalence of poor outcomes.

1.5 Factors which influence weight loss

It is not fully understood why some patients benefit from WLS and others do not. A range of factors have been studied in an attempt to understand why between 20% and 30% of WLS patients fail to maintain WL long term (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005). This includes surgical (e.g. mandatory WL pre-surgery, length of hospital stay and post-surgery complications), physiological (e.g. changes in leptin levels and other appetite hormones), psychological factors (e.g. the presence of eating disorders such as Binge Eating Disorder [BED]), eating behaviours (e.g. disinhibition and dietary restraint) and psycho-social factors (e.g. preoperative and

postoperative psychological support). However, as this thesis focuses on the psychological aspects of bariatric surgery, a review of the physiological and surgical factors will not be presented. Instead, the literature on the psychological factors related to both preoperative and postoperative WLS will be examined.

1.5.1 Psychological and psychiatric characteristics

Several reviews (Table 2) and studies (Table 3) have attempted to evaluate the evidence for preoperative and postoperative psychiatric characteristics associated with WL after bariatric surgery. The majority of the studies and reviews investigating patients with a psychiatric condition (e.g. eating disorder, anxiety or depression) preoperatively found no relationship with WL (Gorin et al., 2009; Alger-Mayer et al., 2009; Belanger et al., 2010; Rutledge et al., 2011; Kinzl et al., 2006; van Hout et al., 2009; O'Brien & Dixon., 2001; Kopec-Schrader, Gertler, Ramsey-Stewart, Beumont, 1994; Powers, Rosemurgy, Boyd, Perez, 1997; Powers, Boyd, Blair, Stevens, Rosemurgy, 1992; Schrader, Stefanovic, Gibbs, Elmslie, Higgins, Slavotinek., 1990). These studies included reasonable follow-up periods ranging from two to six years, encompassing the period when patients' WL plateaus or declines (Hsu et al., 1998; Buchwald et al., 2004). These studies also included patients who had undergone a range of WLS procedures (e.g. GBP, RYGB, VBG and AGB) and are important because procedures such as RYGB lead to more WL (see section 1.4.3) and strengthen the reliability of these findings (Rutledge et al., 2011; Kinzl et al., 2006, Zwaan et al. 2010).

Patients with a severe psychiatric disorder, or two Axis 1 DSM-5 (e.g. generalised anxiety or depression) conditions, or a personality disorder at the time of surgery or in the patients' lifetime predicted poorer WL (Rutledge et al., 2011; Dubovsky, Haddenhorst, Murphy, Liechty, Coyle., 1985; Barrash, Rodriguez, Scott, Mason, Sines., 1987; Hafner, Watts, Rogers. 1991; Larsen, 1990; Delin, Watts, Bassett., 1995; Legenbauer, Petrak, Zwaan & Herpertz. 2011; Kinzl et al., 2006). Studies which found a significant relationship between psychological factors and WL had shorter follow-up periods than those which failed to find a relationship (Herpertz et al., 2004). Nevertheless, findings suggest that a psychiatric condition identified before surgery negatively impacts on patients' WLS outcomes. However, it could be the severity of the psychiatric condition or having two conditions means the patient's presentation is

more complex and this impacts on WL. Herpertz et al. (2004) concluded that patients with serious and chronic psychiatric conditions who required inpatient treatment had significantly less WL than those with no psychopathology. Similarly, in the only published UK study, the severity of preoperative depression predicted those patients with poor WL, eight months after WLS (Kynaston, Mitchell, Morrow, & Bruce., 2011). The presence of a psychiatric condition should not be a reason to exclude patients from having bariatric surgery but the evidence suggests that severe psychopathology is associated with poorer outcomes.

Postoperatively, there are fewer studies which have focused on the impact of psychological health and WL. On the whole, studies indicate that concerns about psychological health (i.e. depression, well-being, self-esteem) were linked to poorer WL or more weight gain (Zwaan et al. 2011; Odom et al 2010; Beck, et al. 2010). Specifically, depression identified postoperatively has been linked to poorer WL (Zwaan et al. 2011), as has a decrease in wellbeing up to twenty-eight months post-RYGB, a procedure that was also associated with more weight regain (Odom et al 2010). Similarly, higher scores of feeling inadequate, reporting lower self-esteem at least two years after RYGB, has been linked to unsuccessful WL (Beck, et al. 2010). Therefore, these studies point to the notion that a patient's mood or negative perception of themselves is linked to poorer WL. This evidence might support the emotional theory of overeating (Chesler, 2012), that is, some patients manage their distress through overeating. However, what is unclear is whether poor mood existed prior to surgery or because the patient was less successful at losing weight postoperatively, this impacted on their mood.

Table 2. *Reviews of the psychological factors associated with WL following WLS*

References	Scope of reviews €	Follow-up range	Negative factors associated with less WL	Positive factors associated with more WL	Comments
Wimmelmann et al., (2014)	19 articles 2003-2012 AGB GBP	1 - 6 years	Preoperative cognitive deficits Severe or multiple psychiatric disorders preoperatively Postoperative psychopathology Preoperative BED Postoperative uncontrolled eating and grazing	Preoperative depression (1 study) Family support	
Adams et al., (2013) ○	92 studies 1990-2011 RYGB	12 - 40 months	Preoperative BED Postoperative snacking	Preoperative BED	History of psychiatric condition or reported SA not associated with WL. Successful WL was associated with preoperative WL, Caucasian or Hispanic, ethnicity, higher educational status, non-shift working patterns, female, divorced or single status, increase in physical activity. No search criteria or validity checks reported.
Livhits et al., (2012)	115 studies. 1988 -April 2010 AGB, GBP	12 – 24 months	Preoperative personality disorder		Preoperative WL & higher BMI levels predicted postoperative WL No search criteria or validity checks reported
Pataky et al., (2011) △	42 studies 2004-2010 SAGB, RYGB, AGB	6-72 months	2+ psychiatric conditions (e.g. ED, depression or anxiety) identified in preoperative in SAGB only	1 or no psychiatric condition identified preoperative SAGB only	Preoperative ED, depression, HRQoL, body image, anxiety or psychological functioning were not associated with WL. Search criteria: country of publication and no validity checks. 1 study included a sample

Table 2. *Reviews of the psychological factors associated with WL following WLS*

References	Scope of reviews €	Follow-up range	Negative factors associated with less WL	Positive factors associated with more WL	Comments
Continued..Pataky et al., (2011) Δ					who had been attending postoperative visits.
Mercado et al., (2010) ○	20 studies Range of WLS types.	NR	Preoperative BED (From 4 studies)	Preoperative BED (From 2 studies)	14 studies found that patients who had BED preoperatively did not achieve significantly different WL to those without BED No other search criteria or validity checks
Herpertz et al., (2004)	29 studies 1980-2002 GBP, AGB, VSG, VBG	1-13 years	Preoperative consumption of high energy dense foods	Preoperative high levels of depression, anxiety, phobias or low self esteem	Personality traits did not predict WL Participant drop-out 20-50%
van Hout et al., (2005)	72 studies 1984-2004 RYGB, GBP, AGB, VBG	1-6 years	Preoperative and postoperative disturbed eating behaviours, BED, severe or poorly managed psychopathology	Preoperative good mental health and no disturbed eating behaviours Postoperative high self-esteem and no disturbed eating behaviours	Other factors associated with successful WL: Young, female, satisfactory marriage, high social economic status, realistic expectations of WLS

Note: All methods of WL outcomes are included. € The scope of the reviews includes the number and year of publications included in the reviews, as well as the WLS Types. RYGB Roux-en-Y Gastric Bypass GB Gastric Banding GBP Gastric Bypass Produce SAGB Swedish AGB Adjustable Gastric Band VBG Vertical Banded Gastroplasty. BN Bulimia Nervosa BED Binge Eating Disorder LC Loss of control WL Weight loss SA Sexual Abuse F Female M Male MA Mean Age NR Not reported ○ cited in Adams et al. 2013 Δ cited in Livhits et al. (2012) □ cited in Pataky et al. (2011)

Table 3 Empirical studies of the psychological factors associated with WL following WLS

References	Sample No.; (% of F); country; <i>M</i> age (<i>SD</i>); BMI (<i>SD</i>); WLS type.	Follow-up <i>M</i> (<i>SD</i>) months	Negative factors	Positive factors	Comments
Beck, Mehlsen, & Støving., (2012)	45 (82%); Denmark; 43.6 years (9.16); BMI 46.06 (5.76); RYGB	23.2 (4.35)	Postoperative BED Ineffectiveness on EDI	None identified	Standardised questionnaire (EDI) Non-standardized tool for BED
Lent et al., (2013)	155 (81%); USA; 50.1 (11.3) years; BMI 45.7 (7.0 kg/m ²); RYGB	34.9 (12.8)	None identified	None identified	Alcohol use & smoking not related to postoperative WL Non-standardised tool for alcohol use
King et al., (2012)	1945 (79%); USA; median age 47 years; BMI 45.8 kg/m ² ; RYGB, AGB	12, 24	None identified	None identified	Postoperative alcohol use not related to WL. Standardised questionnaire for alcohol use disorder.
Rutledge Groesz & Savu., (2011) Δ	60 (24.6% GBP; 50% LAGB); USA; 51.7-52.4 years (7-11.6) Mandatory WL of 5% pre-surgery; BMI \geq 39.5-46 kg/m ² (3.9-7.5); GBP LAGB	12, 24	2+ psychiatric conditions (i.e. ED, depression or anxiety) before GBP only	No psychiatric condition (i.e. ED, depression or anxiety) before GBP or LAGB	Routine clinical interview by a psychologist
de Zwaan et al. (2011)	107 (70%); Germany; 37.5 (9.7) years; BMI 49.4 (7.4) kg/m ² . AGB, GBP.	24-36	Preoperative history of anxiety disorder or combined with depression Postoperative depressive disorder	None identified	Research interview Preoperative lifetime & current depression unrelated to WL.

Table 3 *Empirical studies of the psychological factors associated with WL following WLS*

References	Sample No.; (% of F); country; <i>M</i> age (<i>SD</i>); BMI (<i>SD</i>); WLS type.	Follow-up <i>M</i> (<i>SD</i>) months	Negative factors	Positive factors	Comments
Kynaston, Mitchell, Morrow, & Bruce., (2011)	105 (71%); Scotland; Median 47 years (25-62); Types of surgery & BMI not reported.	Median 8	Preoperative depression	None identified	Standardised questionnaires Limitations: Only the abstract published.
Legenbauer, Petrak, Zwaan & Herpertz., (2011)	151 (66.6%); Germany; 38.8 (10.3) years; BMI 50.9 (8.0) kg/m ² ; GB & VBG	1, 4 years	History of depression & preoperative depression	History of an eating disorder (i.e. AN, BN, BED or eating disorders not otherwise specified)	Clinical interview
Thoney et al., (2010) Δ	43(100%); Switzerland; 39.3 (1.4) years; BMI 44.7 (0.4) kg/m ² ; GBP	24	None identified	None identified	Standardised questionnaire Pre-surgery depression, anxiety & ED did not predict WL
Livhits et al., (2010). Δ	148 (84%); USA; 45.9 (NR) years; BMI 46.2 (NR) kg/m ² ; RYGB	40.1 (15.3)	Postoperative lower self-esteem & higher binge eating symptom score	Postoperative attendance at support groups, high physical activity, higher self-esteem, less disinhibited and binge eating	Standardised questionnaires Incidences of preoperative psychiatric issues or depression not associated with WL
White et al., (2010) Δ	361 (86%); USA 43.7 years; BMI 51.1; GBP	24	LC over eating postoperatively	None identified	Standardised questionnaire. LC preoperatively did not predict WL postoperatively. 39% of patients reported LC over eating, 24-months after surgery

Table 3 Empirical studies of the psychological factors associated with WL following WLS

References	Sample No.; (% of F); country; <i>M</i> age (<i>SD</i>); BMI (<i>SD</i>); WLS type.	Follow-up <i>M</i> (<i>SD</i>) months	Negative factors	Positive factors	Comments
Zwaan et al (2010) Δ	59 (85%); Germany; 44.5 years; BMI 51.3 kg/m ² ; RYGB.	24	Preoperative BED Postoperative bulimic episodes, vomit for weight control or LC over eating	None identified	Eating behaviours measured by interview and standardised questionnaires, retrospectively. 12% vomit for weight-control, after surgery.
van Hout et al., (2009) Δ	112 (87.5%); Netherland; 38.8 (8.3) years; BMI 45.3 (5.1); VBG	24	None identified	None identified	Standardised questionnaire. Preoperative HRQoL, personality, psychosocial functioning, body image & eating behaviours were not associated with WL. 10% preoperative mandatory WL
Alger-Mayer et al., (2009) Δ \circ Ω	157 (86%); USA; 45 (10) years; BMI 50.7 (8.0) kg/m ² ; GBP	72 (6 years)	None identified	None identified	Standardised questionnaires Preoperative ED, depression and HRQoL was not predictive of WL 12 months adherence to post-surgery appointments

Note: Where no range for follow-up is stated, follow-up was the same for each participant. RYGB Roux-en-Y Gastric Bypass GB Gastric Banding GBP Gastric Bypass Produce VBG Vertical Banded Gastroplasty BN Bulimia Nervosa BED Binge Eating Disorder LC Loss of Control SA Sexual Abuse HRQoL Health Related Quality of Life BDI Beck Depression Inventory WL weight loss SA Sexual Abuse F Female M Male MA Mean Age M Mean NR Not reported \circ cited in Adams et al. 2013 Δ cited in Livhits et al. (2012) Δ cited in Pataky et al. (2011) Ω cited in Wimmelmann et al. 2014. Followed up period reported in mean *M* and *SD* in months

1.5.2 Eating disorders

Disordered eating behaviours are likely to be prevalent in bariatric surgery candidates in part by the very nature of becoming overweight through overeating and many failed attempts at dieting in order to lose weight. Therefore, investigating patients' eating history, preoperatively and postoperatively might highlight both positive and negative styles of eating that affect postoperative WL. For example, there is evidence that patients who have been able to overcome an ED (e.g. Anorexia Nervosa, Bulimia Nervosa, BED and Eating Disorders Not Otherwise Specified) in the past may find it easier to adhere to dietary advice and maybe more likely to achieve successful WL (Legenbauer, Petrak, Zwaan & Herpertz, 2011; Mercado et al., 2010; Wedin et al., 2014).

The Diagnostic and statistical manual of mental disorders (DSM-5, American Psychiatric Association, 2013) state that a BED is a psychiatric condition in which a person overeats to excess, feels this behaviour is out of their control and is often ashamed about their eating behaviour afterwards. A BED identified preoperatively has been linked to less WL following RYGB (Adams et al. 2013; Legenbauer et al., 2011). Therefore, the disordered eating (e.g. eating to excess) may remain postoperatively explaining the poor WL outcome (Adams et al., 2013). However, RYGB leads to a significant reduction in the size of the stomach and so it is unclear how these patients are still able to overeat after surgery. However, research is not consistent with some studies finding no relationship between preoperative BED and postoperative WL (Alger-Mayer et al., 2009; White, Masheb, Rothschild, Burke-Martindale & Grilo, 2006). Additionally, the postoperative prevalence of BED has been found in patients up to eight years post-surgery (Kruseman et al., 2010; Kalarchian, et al. 2002; Kofman, Lent, Swencionis, 2010) and has been linked to unsuccessful WL (see Table 3, Livhits et al. 2010; Beck, Mehlsen, & Støvning, 2012). A reduction in binge eating scores postoperatively led to significant WL (Wonderlich, de Zwaan, Mitchell, Peterson, & Crow, 2003). One of the reasons for these differences in findings might relate to the type of assessment tool used. Self-report measures, however, have been suggested to overestimate the prevalence of BED (Allison et al. 2006). In those seeking WLS, estimates range from 5-50% when a self-report measure is used, compared to 5-25% when a clinical interview is carried out (Zimmerman et

al., 2007; Allison et al. 2006). Thus the prevalence of BED and its relevance to WLS outcomes might be less robust.

Patients who have undergone WLS have also reported self-induced vomiting after food consumption (Zwaan et al, 2010). This potential psychological factor has not received much attention, partly because reported vomiting was regarded as a side effect of WLS and often studies did not capture whether vomiting was self-induced or involuntary. One such study, found that self-induced vomiting postoperatively used as a method for weight control, was associated with less WL (Zwaan et al, 2010). This finding is counter intuitive as vomiting up food should reduce the calories absorbed. Hence, the act of vomiting may encourage greater food intake and subsequently result in less WL. Another hypothesis could be that patients overeat to such an extent that they become forced to vomit to reduce the physical discomfort of overeating. This latter hypothesis seems more probable given that poorer WL was also associated with less control overeating. Moreover, in these patients there was a high prevalence of BED preoperatively and this was also linked to less WL postoperatively (Zwaan et al., 2010). Postoperatively, it is difficult for patients to binge without vomiting because of reduced stomach capacity and thus they need to vomit if their BED continues. It is plausible that disordered eating behaviours may have changed following WLS in these patients because vomiting can be a side effect of WLS. Therefore, it is important that studies investigate whether self-induced vomiting is a psychological (e.g. a strategy to manage difficult emotions, a means to control weight) or a physiological behavior (e.g. the result of needing to remove food lodged in the digestive system).

1.5.3 Eating behaviours

The literature into eating behaviours has also been considered with patients who do not meet the criteria for a specific eating disorder but who still present with unhealthy eating behaviours that affect WL. These behaviours include uncontrolled eating (disinhibition), cognitive restraint and emotional eating, which can be identified from the revised 18 item Three Factor Eating Questionnaire (TFEQ-R18, Karlsson et al., 2000). Uncontrolled eating (UE) is defined as a loss of control over eating. Cognitive restraint (CR) is concerned with the level of self-control a person has over their eating. Emotional eating (EE) is the extent to which a person eats in response to an emotional cue (e.g. anxiety or low mood).

Preoperative scores on CR and UE preoperatively predicted WL one year after bariatric surgery (Miras et al., 2015). Postoperatively, UE and grazing have been associated with poorer WL one year after LAGB (Colles, Dixon & O'Brien, 2008) or two years after GBP (White et al., 2010). Greater postoperative restraint was associated with significantly more WL, one and two years post-surgery, compared to those with lower restraint (Banerjee, Ding, Mikami & Needleman, 2013).

In terms of emotional eating, the link between this behaviour and WL is less consistent and less well studied. One study found that RYGB surgery had an equally positive impact on eating behaviour and weight loss at 8 months postoperatively for both high emotional eaters and low emotional eaters (Fisher et al., 2007). Two other studies found that a higher score on EE was linked to poor outcomes (Grothe, Dubbert, & O'Jile, 2006; Zimmerman et al., 2007). The evidence suggests that these eating styles, whilst not clinical eating disorders, can negatively impact on WLS outcomes.

1.5.4 Psychosocial related factors

Psychosocial factors which influence WL could relate to services provided and patients' engagement with these, as well as organic social support available to the patient from their family and wider network. Engagement and access to these forms of support and advice might aid patients' motivation to make lifestyle changes such as monitoring body weight and physical activity. The contribution of these factors to WL may, however, be confounded since those who engage most in follow-up care may be more likely to adapt to these strategies.

1.5.4.1 Engagement with professional support

The NICE guidelines (2014) state that all WLS patients should have access to a multi-disciplinary team offering psychological support both preoperatively and postoperatively. Interventions might include group or individual therapy which is led by mental health professionals, other professionals or service users, which support patients in maintaining lifestyle changes and managing mental health that could impact on weight. However, there is much debate about what this support should include and that many UK services do not offer a psychology based package of care

(Hollywood, Ogden, & Pring, 2012). As studies in this field have varied in terms of types of behavioural or psychological interventions used and who facilitates the interventions, this might account for differences in WL outcomes. A meta-analysis of 13 out of 15 studies considering a range of bariatric surgical procedures found that patients who had either attended support groups or lifestyle interventions following WLS had significantly greater WL than those who did not access this support (Rudolph & Hilbert, 2013). Also, data from five RCTs, with an average follow-up of 12 months, found that patients engaging in lifestyle interventions lost 2% more excess weight than those who did not (Kalarchian et al. 2012; Nijamkin et al., 2012; Papalazarou et al., 2010; Sarwer et al., 2012; Tucker, Samo, Rand & Woodward., 1991).

There are, however, only two published studies which have investigated psychology led interventions. One study, conducted in Switzerland with female bariatric surgery patients, found that attendance at preoperative psychological therapy sessions, which addressed disordered eating habits, predicted successful WL (Kruseman, Leimgruber, Zumbach & Golay, 2010). This finding highlights the potential benefit of preoperative psychological support and may ameliorate the possible effect of patients' eating pathology on postoperative WL outcomes. However, the study failed to report whether patients also received postoperative psychological therapy.

The other study was a UK-based RCT, which investigated the impact of preoperative and postoperative psychological support on postoperative WL with RYGB patients who received health-psychology led treatment compared to those who did not (Hollywood, Ogden & Pring, 2015). It was predicted that those in the intervention group would have greater WL in comparison to the control group. However, at one year post bariatric surgery, postoperative BMI or change in BMI did not significantly vary between those in the intervention and the control group (Hollywood, Ogden, & Pring, 2015).

A relationship between the amount of WL and attendance at postoperative psychological and behavioural interventions might also be dependent on the number of sessions patients completed. In a postal-study by Peacock and Zizzi (2012), the number of completed psychological and behavioural interventions was significantly

positively related to greater %EWL. Overall, in general, there is evidence that adherence and attendance to lifestyle, behavioural or psychology related interventions can facilitate more WL in patients who have undergone WLS.

1.5.4.2 Engagement with postoperative weight management strategies

The NICE (2014) guidelines for bariatric surgery, also state that patients should be offered follow-up care for a minimum of two years postoperatively. This package of care should include monitoring of nutritional intake, advice on lifestyle changes (e.g. diet and exercise), information on relevant support groups and access to a multi-disciplinary team. However, such advice is not standardised and it is likely that professionals providing support will draw on their training and current recommendations in their field. Nonetheless, attendance at postoperative medical appointments and support groups may encourage monitoring behaviours and physical exercise.

Monitoring behaviours, such as food intake, weight and exercise are thought to contribute to maintaining WL. There is, however, limited research on these strategies in bariatric surgery patients. In one study by Odam et al., (2010), RYGB patients who monitored their weight postoperatively were significantly less likely to regain weight that they had lost. Further evidence from a RCT with overweight patients, who were not seeking WLS, found that frequent self-monitoring of weight (i.e. daily weighing) supported WL (Pacanowski & Levitsky., 2015). In particular, patients who weighed themselves daily lost on average 2.6kg, compared to those patients who did not weigh themselves at all, who lost on average 0.5kg in weight, over a one year period. However, significant weight loss was seen only in men, suggesting effective weight loss strategies may vary by gender.

There is evidence that engagement in more exercise postoperatively leads to better postoperative WL in bariatric surgery patients (Livhits et al., 2010; Jacobi, Ciangura, Couet & Oppert, 2011). In particular, 10 of the 13 studies reviewed by Jacobi et al., (2011) showed a positive relationship between the amount of self-reported physical activity and postoperative WL. The meta-analysis by Livhits et al., (2010) estimated that physical activity and exercise significantly predicted a 4.2% increase in WL each year at both one year and two years postoperatively. However, these findings might be

affected by patients level of motivation, psychological and physical functioning, which were not controlled for. There was also variability across the studies in how exercise was measured. Therefore, the appropriate amount of exercise to recommend for bariatric surgery patients, to achieve and maintain postoperative WL, is not clear. Overall, there is evidence that patients' adherence to recommended advice on monitoring weight or participating in physical activity can contribute to more WL or less weight regain in patients who have undergone WLS.

1.5.4.3 Organic social support

Another form of support which might contribute to the outcome of WLS is the level of organic social support a bariatric surgery patient has. This form of support is long term and has been formed naturally, in comparison to support from medical professionals which is time and resource limited (Geraci et al., 2014). The evidence in this area is sparse. However, one study found that patients who reported their friends and family as being supportive about their decision to undergo WLS achieved more WL than those who reported not to have such support (Livhits et al., 2010).

Marital status is another potential form of support which has been linked to WL. Patients who were married before WLS had 7.1 times greater odds of WL success two years postoperatively (Wedin et al., 2014). In contrast, earlier studies have found that being single was linked to more WL at least one year after surgery (Livhits et al., 2010). Positive changes in patients' relationships with important relations after surgery was also associated with significantly greater %EWL, compared to those who did not report this change at on average 7.7 years after surgery (Clark, Saules, Schuh, Stote, & Creel, 2014). Thus, organic support, which is helpful in maintaining lifestyle changes following WLS, might aid WL for bariatric surgery patients.

1.6 Psychological outcomes of bariatric surgery

An improvement in long term psychological functioning is thought to be an outcome of WLS. Therefore a further aim of this thesis is to report on the long term psychological outcomes of WLS from a UK sample. According to four systematic reviews, WLS has a positive impact on psychosocial functioning, including improvements in depression and health related quality of life (QoL) (Bocchieri et al., 2002; Herpertz et al., 2003; van Hout, 2005; van Hout et al., 2006). Herpertz et al.'s

(2003) review of 40 studies, which varied in research design (e.g. including a control group, comparing preoperative and postoperative functioning), found reductions in anxiety and depression, improvements in binge eating symptoms, improved QoL as well as social relations and employment opportunities. These positive outcomes of WLS are supported mostly by evidence that is based on short term follow-up periods and, therefore, it is unclear whether these outcomes persist in the long term. Additionally, Boochieri et al. (2002) found that some psychological improvements declined two years post-surgery and were also linked to weight regain. Another study found that WLS could have a negative impact on well-being (Zaldívar, Horcajadas, Martínez, & Romero., 2009). Psychosocial difficulties such as body dissatisfaction, depression, binge eating disorder and night eating syndrome were found in patients at least 2 years after surgery (Kinzl, Schrattenecker & Traweger., 2006). Differential study findings on the association between WLS and postoperative psychological improvements might depend on the severity of patients' psychiatric condition preoperatively. In particular, it appears that in those with a severe level of psychiatric illness preoperatively, symptoms did not improve postoperatively (Herpertz et al., 2003).

In the long term, WLS is thought to contribute to changes in eating behaviour and, thus, significant WL. However, there is some evidence to suggest that patients who might have managed their emotions preoperatively with overeating, could develop alternative ways of managing their affect postoperatively. This could include self-induced vomiting, as suggested in a review by Herpertz et al. (2003), who found that patients who had undergone GBP or AGB reported an increase in vomiting postoperatively.

The use of substances such as illicit drugs, alcohol or smoking tobacco to manage emotions is another potential outcome of WLS. These ideas have come from the theory of transfer addiction or the concept of symptom substitution (Heinberg, Ashton, & Coughlin, 2012; Conason, et al., 2013). Patients may transfer their preoperative overeating behaviours to substance misuse. There is evidence to support this theory in bariatric surgery patients. Alcohol use has been shown to increase up to two years postoperative WLS (King et al., 2012; Conason, et al., 2013), and was linked to admission to an inpatient unit for alcohol or drug abuse treatment (Ostlund et al.,

2013). Furthermore, patients assessed eight years post-RYGB reported that they were concerned about their alcohol or cannabis use as they were substituting this for food (Kruseman, et al., 2010). However, as with other studies investigating potential predictors of WL, this study was based on a small sample size and a possibly unrepresentative sample. In addition, data on substance misuse is typically collected retrospectively and, because of the focus on these types of problem behaviours, people may be less likely to report honestly (Ertelt et al., 2008; Suzuki, Haimovici, & Chang, 2012). There is also evidence that WLS patients go on to develop drug or alcohol use disorder (Wiedemann, Saules & Ivezaj, 2013). For example, a study carried out in the USA found that 60% of patients reported their first episode of substance misuse occurred on average 1.6 years ($SD = 1.62$) postoperatively (Wiedemann, Saules & Ivezaj, 2013).

Overall, there is evidence that WLS can positively improve patients' psychological health in the short term especially if preoperative difficulties are not severe. However, some bariatric surgery patients might be at greater risk of developing other forms of disordered eating such as vomiting and, or addictions postoperatively.

1.7 Summary of literature review

This chapter has provided an overview of bariatric surgery in terms of the types of surgical procedures, the criteria for evaluating when surgery results in successful WL, the likely amount of WL following surgery and the typical referral criteria. The main findings were that RYGB and AGB are the most commonly performed procedures in the UK and that WLS appears to be effective for up to 70% of those who undergo any of the three main procedures (Figure 1, p.15) in terms of WL. There is however much variability in the amount of WL expected across the range of WLS procedures and some variation in the way that WL is calculated. These inconsistencies in the literature, and amongst clinicians, about the best method for defining successful WL, the cut-off criteria, the timeframe and how long this should be maintained for are important to consider when evaluating WL success postoperatively. The most suitable method for evaluating successful WL is %AWL, although an alternative would be to use %WL in smaller samples (van de Laar, 2014).

A key consideration is the referral criteria for WLS which usually include the assessment of factors known to lead to successful WL (e.g. mandatory preoperative weight loss; Livhits et al., 2012) and psychological characteristics which are likely to impact on the ability to make appropriate lifestyle changes postoperatively. This point led onto the main focus of this thesis; to evaluate candidate psychological factors which might predict long term postoperative WL. This information may ultimately lead to improvements in the referral and management of bariatric surgery patients. The main findings of this review indicate a paucity of evidence to determine the key psychological factors that should be screened for preoperatively and the associated psychological assessments useful to focus on. Despite this rather limited evidence, it appears that there are a combination of factors, that impact on postoperative WL including type of surgery, demographic makeup of patients and the criteria used to define successful WL. Most of the literature in this area has focused on preoperative psychological and psychiatric characteristics. This suggests that severe psychopathology negatively impacts on WL. Postoperatively, abnormal eating behaviours, such as BED, are negative associated with WL. Conversely, access and adherence to psychological and behavioural interventions, support groups and organic support can facilitate WL postoperatively.

The secondary aim of the literature review and one of the aims of this thesis was to report on the evidence for psychological outcomes following WLS. In general there is some evidence to suggest that WLS might improve psychological health in the short term, provided that preoperative difficulties are not severe. However, these findings contrast with those of studies which follow-up patients over a longer period. Here, there appears to be some risk that bariatric surgery patients might develop other forms of psychopathology, such as substance misuse or disordered eating, such as vomiting. Clearly these differential study findings need to be considered in the light of several methodological issues.

Firstly, differences in findings may be attributed to variations in study designs and how psychological factors were defined and measured. Sample characteristics also varied in terms of preoperative BMI, surgery type, gender balance and whether they had been required to have lost weight before surgery, amongst other individual differences. Moreover, these findings can only tell us about patients who were

attending routine clinic appointments, chose to participate or who did not drop out from the research. For example, the participants in the study by Alger-Mayer et al. (2009) had all attended routine post-surgery clinic appointments, for at least twelve months. They found no evidence that having a psychiatric condition preoperatively predicted poorer WL outcomes as long as patients were adhering to the treatment plan. Yet, this does not tell us about those patients who were not attending appointments and whose access to psychological or other professional support and its effects, if any, is unknown. Thus, most of the studies to date are difficult to generalise to the wider WLS population.

Finally, the length of follow-up varied considerably between studies and is an important factor to consider when assessing the outcome of WL because obesity is a chronic relapsing condition, with most weight regain, occurring two to three years post-surgery (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005). In addition, most research on bariatric surgery comes from the USA or Europe, where the inclusion criteria for surgery may differ from the UK, and where surgery may not be state funded. Therefore, research to identify the patient characteristics associated with successful or unsuccessful long term WL maintenance in a UK sample is needed.

CHAPTER 2: RESEARCH RATIONALE, AIMS & HYPOTHESES

2.1. Rationale for the present study

The literature review (Chapter 1) identified both preoperative and postoperative psychological characteristics which may contribute to WL, following bariatric surgery. However, methodological issues and variations in follow up period between studies makes it difficult to determine the relative importance of these psychological characteristics. There are also no published studies in the UK which have evaluated the psychological predictors of WL following bariatric surgery, with a follow-up period beyond one year after surgery (Kynaston, Mitchell, Morrow, & Bruce., 2011; Ogden, Hollywood, & Pring, 2015). There are however two qualitative studies which investigated the long term consequences or outcomes of a small group of patients, up to 10 years post-WLS (Ogden, Clementi & Aylwin, 2011; Wood & Ogden, 2015). However, no objective measure of eating behaviours, relationship with food and quality of life were taken. Additionally, no criteria were used to categorize whether patients had achieved successful WL. Therefore, the findings are less reliable and likely to reflect patients' perceptions, ultimately making it difficult to apply these results to the wider UK bariatric surgery population. Hence, the present study is the first in the UK to examine which preoperative and postoperative psychological factors might predict long term WL (2-10 years post-surgery) using both clinically relevant measures of eating behaviours and quality of life, as well as specific criteria to categorize successful WL.

It was anticipated that the study findings would provide an important insight into factors associated with successful WL in the long term and have implications for the treatment of patients both prior to and after surgery. A further aim of the present study was to investigate the long term psychological outcomes of WLS patients in the UK, given this might inform best practice for postoperative care of bariatric surgery patients in the future. In addition to making a contribution to existing literature in this area, it was expected that the present study findings would yield valuable information for the Mid Yorkshire NHS Trust, the study site. These issues are pertinent to this Trust since it serves a region reported to have the third highest prevalence of obesity in the UK (Health & Social Care Information Centre, 2012).

2.2 Aims & hypotheses

The work presented in this thesis was carried out to achieve the following aims, and to test the associated hypotheses, in a local sample of patients, who had undergone WLS at Mid Yorkshire NHS Healthcare Trust between 2002 and 2012.

Aim 1: To examine the demographic characteristics and weight loss outcomes of patients who underwent WLS 2-10 years ago

Hypothesis 1: The majority of the sample (~ 70%) will have achieved successful weight loss at postoperative follow-up.

Aim 2: To examine the long-term psychological and behavioural outcomes of patients who underwent WLS 2-10 years ago

Aim 3: To identify key pre-operative and/or post-operative psychological factors, eating behaviours and weight management strategies that discriminate between patients who were successful or unsuccessful at weight loss.

Hypothesis 2: Participants with successful postoperative WL will have better psychological health in terms of lower symptoms of anxiety, depression, weight related quality of life and substance misuse compared to those who have achieved less WL.

Hypothesis 3: Participants who are unsuccessful in terms of postoperative WL will have higher levels of eating pathology, uncontrolled eating and emotional eating, compared to those who have achieved a successful amount of WL postoperatively.

Aim 4: To determine which pre-operative and/or post-operative psychological factors, or combination of these factors, predict successful long-term WL.

Hypothesis 4: Psychological functioning (i.e. symptoms of anxiety, depression and substance misuse, levels of weight related quality of life) will have a negative correlation with postoperative WL.

Hypothesis 5: Eating pathology (i.e. symptoms of disordered eating, uncontrolled eating or emotional eating) will have a negative correlation with postoperative WL.

Hypothesis 6: High levels of restraint over eating will have a positive correlation with postoperative WL.

Aim 5: To make recommendations regarding the psychological factors that should be assessed pre-operatively in order to evaluate suitability for surgery and to better align patient characteristics with treatment options.

Aim 6: To make recommendations on psychological factors that should be assessed post-operatively in order to identify those WLS patients who might benefit from further intervention in order to facilitate successful weight loss and long term weight loss maintenance as well as reduce the incidences of postoperative psychological/behavioural problems e.g. self-introduced vomiting, substance misuse.

CHAPTER 3: METHOD

3.1 Design

The present study was designed to investigate which preoperative and postoperative psychological and other factors might influence WL in a local sample of patients, who had undergone WLS at Mid Yorkshire NHS Healthcare Trust between 2002 and 2012. Two data sets were used: (1) retrospective data extracted from the participants' medical records (2) responses to eight questionnaires, completed by participants 2-10 years post-surgery in an interview situation.

The study: (1) explored the preoperative and postoperative characteristics and long term outcomes of the whole sample ($n=24$) (2) compared the characteristics of RYGB patients who had been successful at WL ($n=14$) with those who had been unsuccessful at WL ($n=5$) and (3) examined whether psychological outcomes could predict %WL in RYGB patients.

3.2 Sample

Twenty-four participants were included in the study, based on the inclusion criteria in Table 4. The majority of participants were female ($n = 19$, 79%) and who had undergone RYGB ($n = 19$, 79%), on average, 4.38 years, prior to follow-up ($SD = 1.90$, range 2.33 - 10 years).

Table 4 *Inclusion criteria for patients who have undergone WLS*

Inclusion Criteria
≥ Aged 18 years
Adequate comprehension of written and spoken English
Able to provide informed consent
Undergone WLS between January 2003 and December 2013
WLS performed in Mid Yorkshire Healthcare NHS Trust

3.3 Measures

3.3.1 Medical records

Retrospective data on participants' preoperative and postoperative psychological functioning and surgery related factors were retrieved from their medical records (see data capture sheets Appendices 2-3) by the chief investigator (CI; Ann Lanham, Psychologist in Clinical Training).

3.3.2 Questionnaires completed at follow-up

Eight questionnaires were administered to participants by the CI. All questionnaires were selected on the basis of their psychometric properties and appropriateness for use in this sample (Coulman et al., 2013; Table 5).

Table 5 - *Questionnaires administered to participants at follow-up*

Questionnaire	Completion time (minutes) *
Recruitment Information Sheet (RIS)	20
Hospital Anxiety and Depression Scale (HADS)	2
Social Readjustment Rating Scale (SRRS)	5
Impact of Weight on Quality of Life-Lite (IWQOL-Lite)	3
Alcohol Use Disorders Identification Test (AUDIT) & a question on drug use	5
Disordered Eating Symptoms Questionnaire	5
Three Factor Eating Questionnaire (TFEQ)	10
Participant experience of taking part in the study	5

*Note: *Authors' reported administration time for each questionnaire*

3.3.2.1 Recruitment information sheet (RIS)

The RIS (Appendix 4) captured the participants' contact details, age, education, employment, marital status, current weight in pounds and current BMI (from their height and weight), pre-surgery and post-surgery obesity related health conditions (e.g. type 2 diabetes, hypertension, sleep apnea, arthritis), current lifestyle factors (e.g. smoking, alcohol use and exercise), details of their bariatric surgical procedure (e.g. date, number and type of procedure) and post-surgery advice (e.g. post-surgery checks with surgeon, dietitian and psychologist, taking nutritional supplements, attending support groups and exercise). Dichotomous (yes or no) response questions were also asked to ascertain whether participants monitored their weight, food intake and exercise, and whether they craved sugary foods pre-surgery and/or post-surgery.

3.3.2.2 Depression and anxiety disorders

The Hospital Anxiety and Depression Scale (HADS, Zigmond, & Snaith, 1983, Appendix 5) was used to determine the levels of anxiety and depression the participants experienced during the week prior to completing the questionnaire. This 14 item self-report questionnaire contains seven questions relating to anxiety and seven relating to depression. Each item is scored from 0-3 and in total, a person can score between 0 and 21 for anxiety or depression. Total scores of 8-10 indicate mild distress, scores of 11-14 suggest moderate distress, and scores of 15-21 indicate a severe level of distress. The specificity and sensitivity of the HADS, for detecting anxiety and depression, is reasonable to good: for anxiety it has a specificity of 78% and sensitivity of 90%; and for depression, it has a specificity of 79% and a sensitivity of 83% (Bjelland, et al., 2002).

3.3.2.3 Stress

The Social Readjustment Rating Scale (SRRS, Holmes & Rahe, 1967, Appendices 6) was used to assess whether participants had experienced any significant life events after surgery. This 41 item self-report scale has a 'Life Change Unit' (LCU) for each life event, which yields a measure of stress and the risk of illness for that year. This is based on the idea that after a life event, people are required to put effort into adapting to the changes and then further effort into regaining stability. For example, "death of a spouse" is considered to have a LCU value of 100, whereas, a "change in social activities" has a LCU value of 18. A total score in one year of 300 or more indicates, statistically, that a person has a high chance (nearly 80%) of becoming ill in the near future. Scores of 150 to 299 in one year suggest a moderate chance (50%) and scores less than 150 indicate a low likelihood (30%) that a person will become ill. For the purposes of this study, the SRRS instructions were amended to ask whether participants had experienced any of the 41 life events since having WLS and the approximate date this occurred. In addition, the wording of items 20 and 37 were changed from 'mortgage over \$50,000' and 'mortgage or loan less than \$50,000' to 'large mortgage' and 'loan or debt', respectively. This is because the amounts in the original questionnaire do not relate to British currency and were outdated.

3.3.2.4 Weight related quality of life

The Impact of Weight on Quality of Life-Lite (IWQOL-Lite, Kolotkin, Crosby, 2000, see Appendix 7) was used to measure participants' self-reported quality of life. This 31 item questionnaire covers five specific domains: physical functioning, self-esteem, sexual life, public distress and work. Each item is rated using a 5 point Likert scale. These scores are then transformed according to the authors' guidance (Crosby et al., 2004). Total domain scores range from 0 to 100, with 100 indicating the best and 0 representing the worst quality of life. The total score for this measure has good internal consistency with Cronbach α coefficients ranging from 0.90 to 0.96 (Kolotkin, Crosby, Kosloski & Williams., 2001), and good test-retest reliability ranging from 0.83 to 0.94 (Kolotkin & Crosby., 2002). As a proxy measure of severity, total cut off scores from a normative and overweight population were used for interpretation and defined as none = > 87.1, mild = 79.5-87.0, moderate 71.9-79.4 and severe <71.9 (Crosby et al., 2004).

3.3.2.5 Substance misuse

The Alcohol Use Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor et al., 1993, Appendix 8) is a 10 item self-report questionnaire measuring alcohol use during the past twelve months. Each item is rated using a 0 to 4 scale. A total score of 8, out of a possible 40, strongly indicates hazardous drinking and a score of 20 indicates alcohol dependency. Based on a sample of 913 drinking patients, this measure has been shown to have excellent reliability, with 92% sensitivity and 94% specificity when using a cut off score of 8 (Saunders, Aasland, Babor, 1993). AUDIT was developed by the WHO and is considered to be the gold standard measure for identifying harmful drinking or dependency. It is also being used by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK, unpublished) in a longitudinal study with bariatric surgery patients in the USA. Additional questions on participants illicit drug use (e.g. opiates, hallucinogens, amphetamines, inhalants, marijuana or cocaine) within the last twelve months and current as well as history of smoking tobacco, were also used.

3.3.2.6 Symptoms of disordered eating

To assess whether participants had disordered eating symptoms an eight item self-report questionnaire (Appendix 9) was developed from symptoms of eating disorders

as classified by the DSM-5 (2013), such as binge eating disorder (BED) and bulimia nervosa (BN). BED is classified as recurring episodes of binge eating, in which a person overeats within a short timeframe (i.e. within two hours) and feels this eating is out of their control, coupled with negative feelings about their binge eating (DSM-5, 2013). BN is classified as bingeing on food excessively or compulsively, followed by purging or other extreme compensatory behaviours (e.g. frequent dieting, excessive exercise, self-induced vomiting and use of laxatives) coupled with extreme dissatisfaction with body weight and shape (DSM-5, 2013). Participants rated each question using a 5 point Likert scale, where 4 = very often, and 0 = never. As this is a non-standardised tool, test-retest reliability and validity are not available. However because the questions are derived from the diagnostic classification system, it has good face validity (A.J.Hill, 2015, personal communication).

3.3.2.7 Eating behaviours

The 18 item Three Factor Eating Questionnaire (TFEQ-R-18, Karlsson et al., 2000, Appendix 10) was used to measure three eating behaviours that have been identified from studying an obese population. The behaviours include cognitive restraint over eating (CR), uncontrolled eating (UE) and emotional eating (EE). The CR scale measures the extent to which a person can limit their food intake in order to control body weight and the total scores range from 1-20. The UE scale measures the tendency to lose control over eating in response to hunger or external stimuli, with total scores ranging from 1-27. The EE scale assesses the tendency to eat in response to negative feelings and total scores range from 1-12. Responses to all questions are coded on a 4 point Likert scale (Karlsson, 2000). A total domain score is calculated by adding up all the scores which relate to that particular domain (CR, UE and EE). These raw scores are then converted to a 0-100 scale using the following formula: $(\text{raw score} - \text{lowest possible score}) \div (\text{possible raw score range}) \times 100$. Currently there are no defined cut off scores, although it has been suggested that higher scores indicate higher levels of CR, UE and EE (Karlsson, 2000).

3.3.2.8 Participant experience of taking part in the study

A 13 item open ended questionnaire was used to capture participants' experiences of taking part in the study. The questions asked participants about whether there were any positive or negative aspects of taking part in the study, if there were aspects of the

study that could be improved, the potential implications of the study's findings and whether they thought they would benefit from seeking further support from a dietitian or psychologist. This information has not been reported in this report.

3.4 Procedure

3.4.1 Recruitment

The recruitment period occurred between November 2014 and April 2015 (Figure 3). A list of current or previous WLS patients was obtained from the dietitian and the clinical psychologist in the Weight Management and Specialist Obesity/ Bariatric Service, Mid Yorkshire NHS Healthcare Trust. The dietitian's list contained names of 1020 patients who had been referred to their service and the clinical psychologist's list contained 33 names of patients who had been assessed before WLS. Eligible participants were identified by the CI using the current hospital electronic system where all patients' medical records are recorded, 'SystmOne', and a previous system 'Patient Administration System', along with the research criteria (Table 4, section 3.2). This process was lengthier than anticipated because the information contained within the medical records that was used to check whether participants were eligible for the study, was coded in different ways and in different areas.

From these checks, 246 eligible participants (see Table 10, page 53, for characteristics) met the research criteria and were sent a recruitment pack containing a covering letter, participant information sheet and consent form (Appendices 11-13). The covering letter invited potential participants to opt into the study by contacting the CI by telephone, e-mail or by returning an opt-in slip. Participants were offered the option to have their research appointment at the hospital, to coincide with their routine hospital appointments, or at the WLS support group.

To facilitate a good response rate, posters were displayed in one of the Mid Yorkshire NHS Healthcare Trust hospitals (Appendix 14). The CI also attended three of the service user led bariatric support groups in Dewsbury, to inform attendees that they might receive a letter about the research study. Finally, a prize draw of one £50 Love2shop voucher was used to enhance study participation.

A total of 24 (10%) eligible participants who had undergone WLS at this hospital agreed to participate and were recruited into the study. A further eight (3%) expressed an initial interest to take part but then became unreachable. Quota sampling was also performed to target participants who had undergone WLS more than four years ago, in order to even out the distribution of years since surgery in the recruited sample. These identified eligible participants ($n = 21$), were re-sent recruitment packs, however, none of them responded.

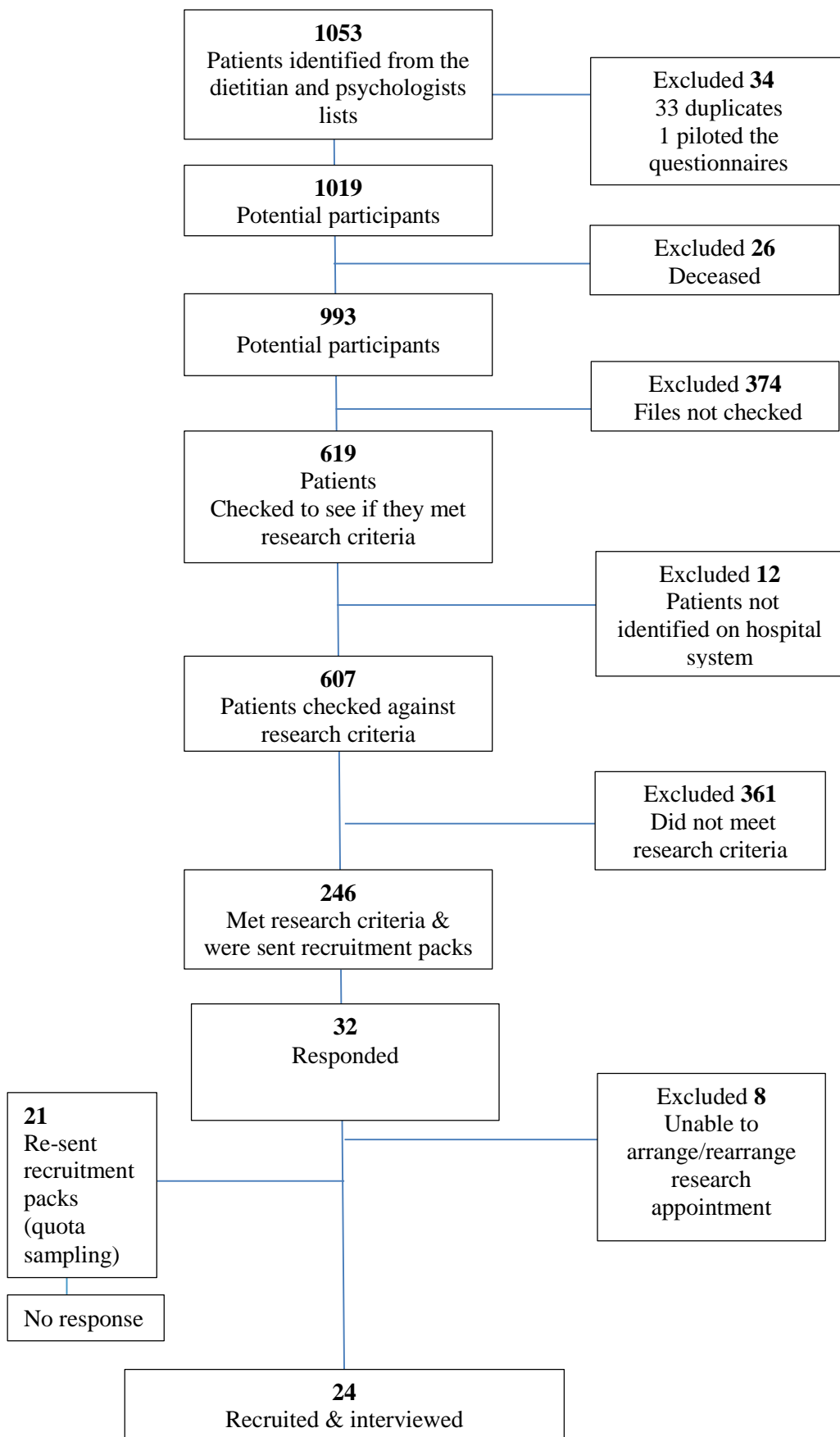


Figure 3. Flow chart showing the recruitment process

3.4.2 Collection of postoperative questionnaire data

The CI made a research appointment with each consenting participant. The appointments took place in a private room in a hospital within the Mid Yorkshire NHS Healthcare Trust. Participants were informed verbally and in writing about right to withdraw from the study at any point without having to give a reason. They were also informed that their responses to the questionnaires would be kept confidential and anonymised by allocating them a unique study ID code and that this data would be kept separate to any identifying personal data. Finally, given that this is a sensitive research topic and that there was a possibility this population might be vulnerable (i.e. previous or current mental health problems), participants were informed about the limits of confidentiality. Hence, they were told that if they chose to disclose high risk issues, the researcher would need to consider breaching confidentiality and sharing this information with other professionals. Also, in cases where participants were to disclose issues, such as non-adherence to treatment advice or symptoms of mental health or physical health decline, the CI would discuss these concerns with the participant and provide a list of contacts for them to access appropriate support. After participants had provided written informed consent, the eight questionnaires were administered. The total administration time for these questionnaires ranged from thirty minutes to one hour, which was in line with the pilot study timing (see Section 3.4.4).

3.4.3 Collection of data from medical records

The CI extracted data available retrospective data from 'SystmOne' on participants' preoperative psychological functioning and surgery related factors. This information was obtained after participants had consented and when all interviews were completed (April 2015). For each participant the electronic system was interrogated by searching for specific preoperative and postoperative variables, which were recorded onto a data capture sheet (Appendices 2-3). However, the availability of this information varied significantly across participants. This was partly attributed to the fact that this study relied on being able to extract information from their preoperative psychology assessment reports. Yet, the data on preoperative screening was sparse. Therefore, variables which had less than 50% of the data for the sample or of poor quality (e.g. exercise) were removed from the final dataset. In total, 4 out of 15 preoperative variables and 3 out of 11 postoperative variables were retained for analysis (Table 1, Appendix 15 gives a summary of the data).

Participants' actual preoperative body weight was also obtained from the medical records, with exception for one participant whose weight was estimated from information in a report dated postoperatively which stated they had lost 50kg since surgery. For three participants, whose preoperative weight was not identified on the hospital system, their self-reported weight was used instead.

3.4.4 Ethics

NHS ethical approval was obtained from the NRES Committee South Central Berkshire in November 2014 (Reference: 14/SC/1186). Prior to NHS ethical submission, the CI conducted an informal consultation at a user-led bariatric surgery support group. Service users appeared open to discussing their WLS journey and seemed to have a good recollection of their experiences. Further service user involvement was also sought from the 'Everybody's Voice' Service User and Carer Group, run by the Doctorate of Clinical Psychology Training Programme, at the University of Leeds. At this group, service users reviewed the recruitment letter, information sheet and consent form (Appendices 11-13). The group recommended that the length of the participant letter be reduced and a picture of the CI be added. Additionally, a group facilitator from the WLS user-led group piloted seven of the eight questionnaires intended for use in the study. They reported the questionnaires were straightforward to complete without the CI being present, and took, in total, approximately thirty minutes to complete.

3.4.5 Power & Sample size considerations

The required sample size for a range of statistical operations was calculated from information taken from a study by Kruseman, et al. (2010) and using the GPower 3.1 software. This calculation revealed that assuming that 50 percent of patients achieved successful WL, a sample size of 80 was likely to detect a mean difference between successful WL and unsuccessful WL patients, of 0.63 standard deviations on any continuous variable, with power of 80% and a type 1 error probability of 5%. Therefore, it was intended to recruit 100 patients to allow for dropouts and missing data. However, it was only possible to recruit and retain 24 participants.

3.5 Data processing and statistical analysis

3.5.1 Data processing

All quantitative data were entered into SPSS version 20.0 (SPSS Inc, Chicago, Illinois) for analysis. The entered data were checked for missing scores, obvious errors and extreme scores by calculating and reviewing the minimum and maximum scores obtained for all of the variables. Obvious errors and missing scores were corrected, when identified. To assess the data distribution, histograms were produced, skew, kurtosis and the Shapiro-Wilk Test were calculated for each continuous variable. Data was considered normally distributed if the skew and kurtosis scores were lower than +/- 1.96 ($p < .05$, Field, 2013) and if the Shapiro-Wilk statistic, was significant ($p < 0.05$).

3.5.2 Statistical analysis

3.5.2.1 Demographic characteristics preoperatively (2-10 years ago)

To summarise the demographic characteristics of the sample preoperatively, data from the medical records (see data capture sheets, Appendices 2-3) were summated (e.g. mean, standard deviation, range and percentages determined as appropriate) and where appropriate, independent sample t -tests or Fishers' Exact Tests (*FET*) were performed to explore whether there were any significant differences across gender.

To assess the representativeness of the recruited sample, their demographic characteristics were compared to the eligible sample who were sent a letter ($n = 246$), and to the UK National Bariatric Surgery Register (NBSR, 2014) for all NHS procedures performed in 2012/13 and 2013/14.

3.5.2.2 Demographic characteristics postoperatively

To summarise the demographic characteristics of the sample postoperatively, data from the RIS at follow-up was summated (e.g. mean, standard deviation, range and percentages determined as appropriate) and where appropriate, independent sample t -tests or *FET* were performed to explore whether there were any significant differences across gender.

3.5.2.3 Postoperative weight and weight loss

Postoperative weight was obtained from the RIS (Appendix 4) at follow-up and was expressed in several ways; by calculating each participant's BMI, body weight in kilograms, weight loss (WL) in kilograms and percentage weight loss (%WL). Percentage WL (%WL) was calculated, according to Equation 1 below;

Equation 1 – *Calculating percentage weight loss*

Initial preoperative weight in kilograms – postoperative weight in kilograms
= (a)

$$\frac{(a)}{\text{Initial weight}} \times 100 = \%WL$$

Shapiro-Wilks tests revealed that the data on weight in kilograms, BMI, %WL and WL in kilograms, did not significantly differ to a normal distribution (all $p < 0.05$), and therefore the data did not need transforming prior to carrying out further analysis.

For the whole sample ($n=24$), two criteria were used to consider whether participants had achieved a successful amount of weight loss, postoperatively. The first was a 25% loss in initial body weight, given that 75% of patients lose more than 25% weight in the first two years after surgery (van de Laar & Acherman, 2014) and second, a reduction in the severity of participants' obesity condition, as indicated by their postoperative BMI.

3.5.2.4 Long term physical health and psychological outcomes of bariatric surgery

Responses to the postoperative questionnaires were used to determine the long term physical health, psychological health (i.e. levels of anxiety, depression, weight related quality of life, stress during the last year), substance misuse (i.e. alcohol, illicit drugs and smoking behaviours), eating behaviours (i.e. symptoms of disordered eating, uncontrolled, restraint and emotional eating behaviours, as well as changes in cravings for sugary foods preoperatively to postoperatively), and adherence to postoperative advice and weight management strategies, of the whole sample ($n = 24$). Scores were summated (e.g. mean, standard deviation, range and percentages determined as appropriate) for the whole sample and by gender.

For questionnaires which had clinical cut offs available, these standard clinical metrics were used to indicate the level of caseness within the whole sample and for the individual participants. For other outcomes that did not have a predetermined cut off criteria (e.g. adherence to postoperative advice and weight management strategies) scores were summated in terms of percentages. Fishers' Exact Tests were performed to explore proportional differences across gender and Paired Samples T-Tests were calculated for comparing differences in preoperative and postoperative obesity related conditions.

3.5.2.5 Qualitative analysis

Qualitative data from the medical records were analysed using content analysis (Bryman, 2001). This involved extracting the nouns, verbs and adjectives from the data, coding and classifying these data, in order to highlight key themes (Table 1, Appendix 15, summary of data extracted from the medical records).

3.5.2.6 RYGB patients: Characteristics of successful versus unsuccessful WL groups

Differences between those who achieved successful WL (successful group) were compared to those who achieved less WL (unsuccessful group) on measures assessed postoperatively (e.g. demographic characteristics, WL outcomes, physical health, psychological and eating behaviours). Five of the recruited participants were not included in this analysis because they had undergone VSG or AGB procedures and since it is known that WL can vary across different WLS procedures (Picot et al., 2009). Data from the remaining 19 participants who had undergone RYGB procedure were retained for analysis.

The most preferable WL outcome method for determining successful WL is AWL, based on the literature review, as it takes into account unalterable weight and is unaffected by gender and initial BMI, compared to %EWL (van de Laar 2011, 2012, 2013, 2014a, 2014b.). However, for the present study after consultation with van de Laar, %WL was used instead to determine success of WL because of the small sample size (2015, personal communication, Appendix 1). Van de Laar advised to compare patients whose %WL was below the 25th percentile (unsuccessful group), to everyone who achieved %WL above the 25th percentile (successful group). This criteria was

based on evidence that approximately 75% of patients lose more than 25% weight in the first two years following WLS (van de Laar & Acherman. 2014). Figure 4 illustrates individual %WL for participants in the present study and the percentile rank used to divide them into two groups, resulting in 14 participants in the successful group and five in the unsuccessful group.

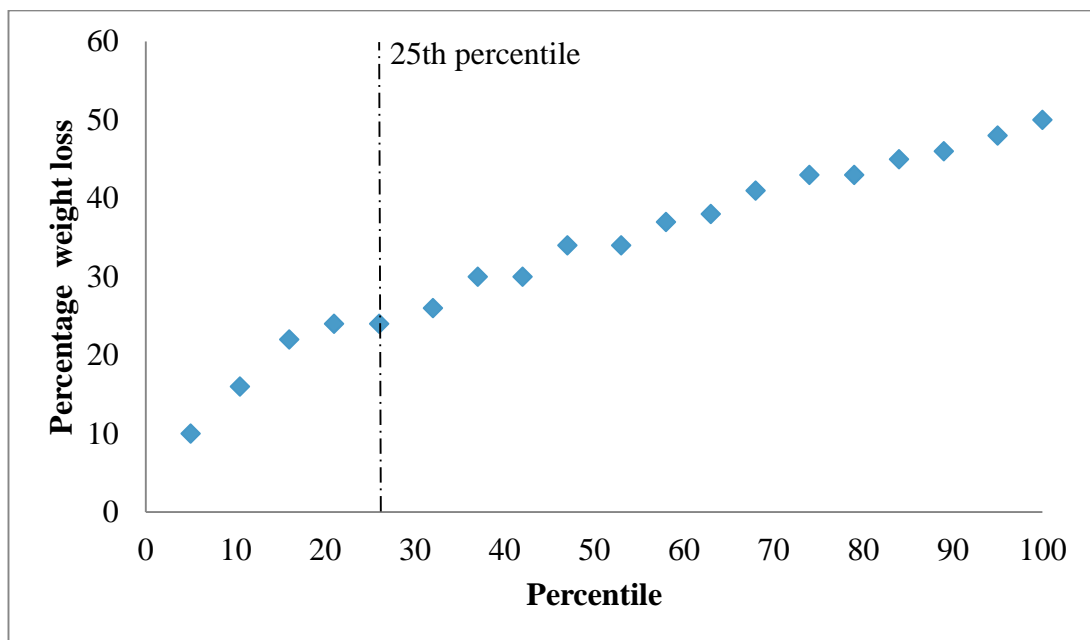


Figure 4 *RYGB participants' percentage weight loss, across percentiles*

Next, preoperative data (e.g. body weight (kg), BMI, obesity related conditions and cravings for sugary foods), and postoperative follow-up data on demographic, psychological, eating behaviours and adherence/weight management strategies were summated (e.g. mean, standard deviation, range and percentages determined as appropriate) for each group. Where observable differences in outcomes emerged across groups, independent sample *t*-tests (continuous data) or FET (categorical or frequency data) were performed to explore whether differences were significant between the successful and unsuccessful WL groups.

3.5.2.7 *RYGB patients: Predicting weight loss using postoperative factors*

To explore which postoperative factors might predict %WL, Pearson correlation coefficients (*r*) for each postoperative psychological variable against %WL were calculated. Postoperative factors found to correlate with %WL, were entered into a multiple regression (MR) model and evaluated. Field (2013) recommends using at

least 10 cases for each independent variable, in a regression model. Therefore, in this study with 19 RYGB patients only two potential predictor variables could be entered into a model simultaneously. Potential covariates were considered before carrying out the MR. Where potential covariates (i.e. years since surgery and preoperative BMI) were identified and needed to be controlled for in each analysis, this further restricted the number of predictor variables that could be entered.

Homoscedasticity, and multi-collinearity between predictor variables were checked according to the method described by Field (2013). If heteroscedasticity was evident then the bootstrap method of the regression analysis was performed. This method re-estimates the standard errors and is suitable when the assumptions of normality and homoscedasticity are not fulfilled (Field, 2013).

To identify any multi-collinearity between potential predictor variables, Pearson correlation coefficient analyses were performed. Field (2013) advises that substantial correlations (i.e. $r > .9$) between predictor variables indicates multi-collinearity and hence both variables should not then be entered into the same predictive model.

Hierarchical MR analysis was performed using an enter procedure, with the covariate (e.g. years since surgery) entered in the first block and the psychological factor (potential predictor variable) entered in the second block, with %WL as the outcome variable.

CHAPTER 4: RESULTS

4.1 Preoperative data

4.1.1 Demographic characteristics preoperatively (2-10 years ago)

Demographic details, where available from the participants' medical records are shown in Table 6. The majority of participants were female ($n = 19$, 79.2%), all were White-British with an average age of 45.08 years ($SD = 9.90$) prior to undergoing WLS.

Table 6 *Participant characteristics based on medical records*

Characteristics	Whole sample ($n = 24$)	Males ($n = 5$)	Females ($n = 19$)
<u>Ethnicity n (%)</u>			
White British	24 (100)	5 (20.8)	19 (79.2)
<u>Age in years</u>			
Mean	45.08	47.40	44.46
(SD)	(9.9)	(14.9)	(8.60)
Range	22-62	22-61	27-62
<u>Preoperative body weight (kg)</u>			
Mean	125.44	131.45	123.85
(SD)	(20.4)	(10.1)	(22.3)
Range	92-170	116-141	92-170
<u>Preoperative BMI (kg/m²)</u>			
Mean	46.21	42.54	47.18
(SD)	(6.8)	(2.8)	(7.2)
Range	35-62	39-46	35-62

Participants' preoperative body weight and BMI placed them, on average, in the Obesity III category (see Table 1, p.13). However, there were four participants whose preoperative BMI was in the Obesity II category. Preoperative body weight and BMI were similar across both genders $t(22) = 1.38$, $p < 0.18$; $t(22) = -0.73$, $p < 0.47$, respectively. On average females were 3 years younger than males, but this difference was not significant, $t(22) = 0.58$, $p < 0.57$.

4.1.2 Surgery related factors

Table 7 shows that the majority of participants had undergone Roux-en-Y Gastric Bypass (RYGB, $n = 19$), on average, just over four years prior to follow-up. Most had

undergone one WLS procedure, with only three requiring two operations. Hospital admission data were available for 15 participants (67%) and showed that 13 of these (63% of the whole sample) had no complications during bariatric surgery. On average, the mean length of hospital stay for these 16 participants was 6.31 days ($SD = 6.47$) and this did not vary significantly across gender, $t(22) = 0.54$, $p = 0.59$. No information was available on the remaining patients.

Table 7 *Participants' surgery related factors based on medical records*

Characteristics	Whole sample ($n = 24$)	Males ($n = 5$)	Females ($n = 19$)
<u>Type of surgery</u>			
RYGB n (%)	19 (79.2)	4 (80)	15 (78.9)
LAGB n (%)	1 (4.2)	0 (0)	1 (5.3)
VSG n (%)	4 (16.7)	1 (20)	3 (15.8)
<u>Years since surgery</u>			
Mean	4.38	3.88	4.53
(SD)	(1.90)	(0.65)	(2.09)
Range	2-10	2-5	2-10
<u>No. of WLS procedures</u>			
1 n (%)	21 (87.5)	3 (60)	18 (94.7)
2 n (%)	3 (12.5)	2 (40)	1 (5.3)
<u>Days in hospital</u>			
Mean	6.31	4.75	6.83
(SD)	(6.5)	(1.5)	(7.4)
Range	2-30 ($n=16$)	3-6 ($n=4$)	2-30 ($n=12$)
<u>WLS complications</u>			
n of participants n (%)	2 (8)	2 (40)	1 (5)
n missing n (%)	9 (38) ($n=24$)	1 (20) ($n=5$)	7 (37) ($n=19$)

4.1.3 Representativeness of the sample

Table 8 shows that in general, the final recruited sample is similar to both the eligible sample (i.e. potential participants) and the national sample in terms of gender split. The recruited sample is also similar to the national sample in terms of mean age and BMI at WLS, but is different in terms of preoperative body weight (kg). Hence, the recruited sample had a lower preoperative body weight than the national sample. It would also appear that the proportion of the sample undergoing the RYGB type WLS procedure is overrepresented in this specific region of the UK compared to the national sample.

Table 8 Comparison of the sample characteristics with the potential recruited sample and the UK bariatric surgery population

Characteristics	Recruited sample (<i>n</i> = 24)	Eligible sample (<i>n</i> = 246)	UK population* (<i>n</i> = 18,028) [□]
<u>Year of surgery</u>	2007-2012	1999-2012	2011-2013
<u>Age in years at WLS</u>			
<i>Mean</i>	45.08	(NE)	43.84
(<i>SD</i>)	(9.9)	(NE)	(NR)
Range	22-62	(NE)	15-75+
<u>Gender (%)</u>			
Females	79	82	74
Males	21	18	27
<u>Preoperative weight (kg)</u>			
<i>Mean</i>	125.44	(NE)	139.7
(<i>SD</i>)	(20.4)	(NE)	(NR)
<u>Preoperative weight BMI (kg/m²)</u>			
<i>Mean</i>	46.21	(NE)	48.8
(<i>SD</i>)	(6.8)	(NE)	(NR)
<u>Type of surgery (%)</u>			
AGB	4	15	26.1
RYGB	79	70	52.8
VSG	17	13	21.1
Duodenal switch		0.4	
Not specified		2	
<u>Number of obesity related conditions preoperatively</u>			
<i>Mean</i>	2.04	(NE)	3.4
(<i>SD</i>)	(1.5)	(NE)	(NR)

Notes: * National Bariatric Surgery Register (NBSR), Source: The Health and Social Care Information Centre, 2012-2014, □ NR=not reported, NE=not extracted by chief investigator.

4.2 Postoperative data

4.2.1 Demographic characteristics at follow-up

Demographic characteristics from the follow-up data are summarised in Table 9. The mean age of participants was 48.96 years (*SD* = 10.27). Most were employed (63%), with 54% in full-time employment. Half of the sample were either married or cohabiting (*n* = 12) at the time of the interview. Educational attainment varied, with the highest proportion of participants achieving GCSEs or GCEs (*n* = 11, 43%).

Table 9 *Participants' characteristics at follow-up, based on questionnaire data*

Characteristics	Whole sample (n=24)	Males (n=5)	Females (n=19)
<u>Age in years</u>			
<i>Mean</i>	48.96	51	48.42
<i>(SD)</i>	(10.3)	(14.8)	(9.2)
Range	26-65	26-65	29-64
<u>Marital status n (%)</u>			
Married / co-habiting	12 (50)	3 (60)	9 (47.3)
Divorced / separated	6 (25)	1 (20)	5 (26.3)
Single	6 (25)	1 (20)	5 (26.3)
<u>Employment status n (%)</u>			
Full/part-time employed	15 (62.5)	1 (20)	14 (73.7)
Unemployed	3 (12.5)	1 (20)	2 (10.5)
Retired	4 (16.7)	3 (60)	1 (5.3)
Other (e.g. student and carer)	2 (8.4)	0 (0)	2 (10.5)
<u>Highest education n (%)</u>			
None	4 (16.7)	2 (40)	2 (10.5)
GCSE / GCE O-levels	11 (42.8)	1 (20)	10 (52.6)
Diploma	5 (20.8)	2 (40)	3 (15.8)
Degree	3 (12.5)	0 (0)	3 (15.8)
PhD	1 (4.2)	0 (0)	1 (5.3)

4.2.2 Postoperative weight and weight loss

Table 10 shows that average weight at follow-up was 84.61 kilograms ($SD = 15.67$). Participants' mean weight in kilograms, preoperatively compared to postoperatively (see Table 6) resulted in a mean WL of 40.83 kilograms ($SD = 18.47$). This equates to participants losing, on average, about one third of their body weight following surgery ($M \%WL = 31.81$, $SD = 11.63$). Over two thirds of the participants ($n = 16$, 67%) achieved more than 25% WL, which is considered to be a successful WLS outcome (van de Laar & Acherman, 2014). Postoperative body weight (kg) was higher in males than in females, $t(22) = 1.89$, $p=0.07$, but there was no significant gender difference in %WL, $t(22) = 1.12$, $p = 0.27$.

Table 10 *Weight loss and BMI post-surgery*

	Whole sample (<i>n</i> = 24)	Males (<i>n</i> = 5)	Females (<i>n</i> = 19)
<u>Postoperative weight (kg)</u>			
<i>Mean</i>	84.61	95.79	81.66
(<i>SD</i>)	(15.67)	(16.45)	(14.48)
Range	64-117	77-117	64-115
<u>%WL</u>			
<i>Mean</i>	31.81	26.61	33.18
(<i>SD</i>)	(11.63)	(14.59)	(10.78)
Range	10-50	10-45	12-50
<u>BMI (kg/m²)</u>			
<i>Mean</i>	31.36	32.24	31.13
(<i>SD</i>)	(5.61)	(8.12)	(5.03)
Range	23-43	23-43	26-42

Participants' mean postoperative BMI was 31.36 kg/m² (SD = 5.61), which indicates that the majority were still obese at follow-up, but in general had moved from the Obese III category, preoperatively, to the Obese I category postoperatively. This equates to an average change in BMI of 14.87 kg/m² (SD = 6.97, range 2-27). Across gender, the average BMI of males was similar to females, $t(22) = 0.39$, $p=0.70$.

Figure 5 shows there was substantial variance in postoperative BMI (range 23-43). Post-operatively, BMI data indicated that one participant was now a healthy weight (BMI of 18.5-24.9), 11 were overweight (BMI of 25-29.9), five were in obesity I category (BMI of 30-34.9), four were in obesity category II (BMI of 35-39.9) and three were still in obesity category III (BMI of ≥ 40), at follow-up.

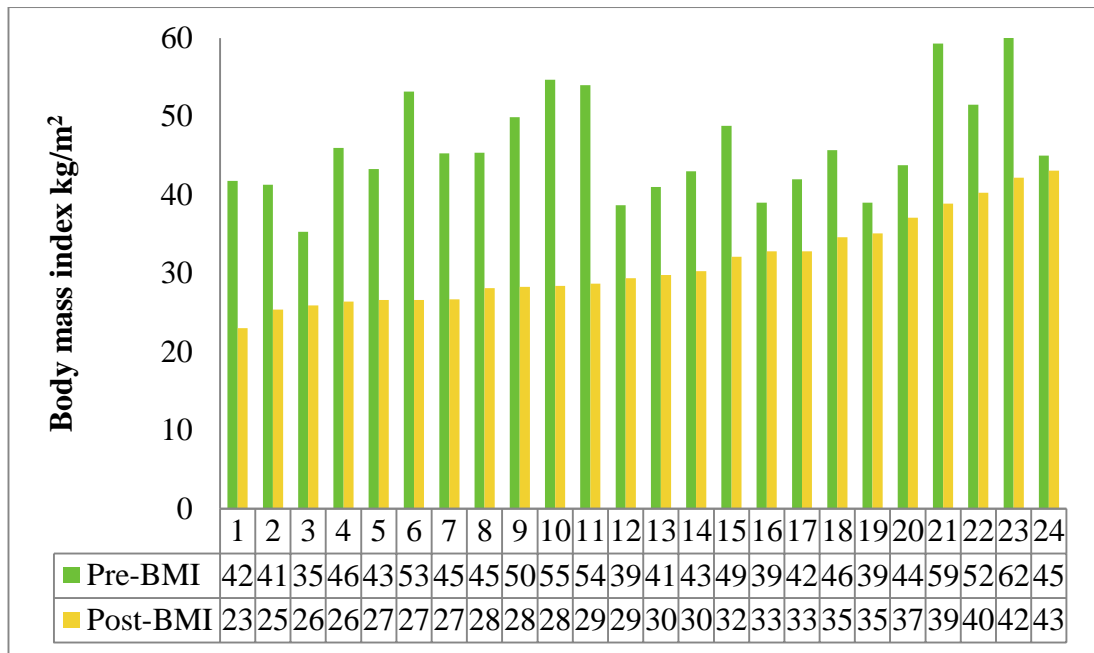


Figure 5 Preoperative and postoperative BMI for each of the 24 participants

Historically the lowest postoperative mean weight, recorded in the medical records, for the whole sample, was 84.07 kilograms ($SD = 14.04$), which occurred, on average, 15 months after surgery ($M = 475.33$ days, $SD = 26$). This mean weight is similar to participants' weight, on average, four years postoperatively (see Table 10). This suggests that on average participants' were maintaining their WL from 15 months to four years.

Overall, these findings indicate that, at an average of 4 years postoperatively, participants' body weight in kilograms and level of obesity had changed significantly. Over a third of the sample of participants had been successful at reducing their body weight and level of obesity, suggesting that the WLS procedure had been effective. There were no significant differences in %WL, weight in kilograms, or in BMI, by gender (see Table 10), however, there was a trend for BMI ($p = 0.07$), suggesting that the level of obesity classification was higher in males than in females.

4.3 Long term physical and psychological outcomes of bariatric surgery

This section presents the long term physical health, psychological outcomes, eating behaviours and types of postoperative weight management strategies for the whole sample of recruited participants ($n = 24$).

4.3.1 Physical health outcomes

Based on the 10-point Likert scale question posed in the RIS (Appendix 4), participants reported feeling moderately healthy at follow-up ($M = 6.67$, $SD = 2.18$). On average, participants reported having at least two obesity-related conditions preoperatively ($M = 2.04$, $SD = 1.55$) and less than two postoperatively ($M = 1.67$, $SD = 1.05$). However, there was no significant improvement in health postoperatively, $t(23) = 1.619$, $p < 0.119$. Across gender, there was no significant difference between the number of preoperative obesity related conditions or postoperative obesity related conditions, $t(22) = .904$, $p < 0.376$, $t(22) = .792$, $p < 0.437$.

Nine out of 11 reported preoperative obesity related conditions remained postoperatively. These included, type 2 diabetes, hypertension, sleep apnoea, asthma, hypercholesterolemia, type 1 diabetes, arthritis, hypothyroidism and chronic inflammation.

4.3.2 Psychological outcomes

4.3.2.1 Anxiety and depression

Data from participants' responses to the HADS questionnaire (Appendix 5) were used to determine clinical anxiety and depression, with a score of 8 or more for each subscale indicating a likely chance of a clinical disorder. At follow up mean anxiety was 8.25 ($SD = 4.96$) indicating a probable anxiety disorder in about 50% of the sample.

Eight participants' (33%) anxiety scores were in the moderate to severe clinical range and four were in the mild range (17%). There were no statistically significant differences between female scores ($M = 9.11$, $SD = 4.80$) compared to male scores (M

= 5.00, $SD = 4.64$), $t(22) = -1.71$, $p = 0.10$. However, of those who were anxious at follow-up, the majority were female (10 vs 2).

At follow-up mean depression was 3.83 ($SD = 4.07$), indicating that the majority of the sample were not clinically depressed. However, three (13%) participants met the criteria for mild depression, and two (8.4%) for moderate to severe depression. Across gender, although males ($M = 4.80$, $SD = 3.42$) scored higher than females ($M = 3.58$, $SD = 4.27$) in levels of depression this was non-significant, $t(22) = -.59$, $p = 0.56$.

4.3.2.2 Stress during the last year

Participants' mean score for stress (Appendices 6) caused by significant life events in the last year was 63.38 ($SD = 74.04$, range 0-249). This score was below the clinical threshold (score > 150), indicating that participants' had low risk of physical or mental health illness in the future. In terms of participants' individual scores, only four (17%) had a moderate chance of developing an illness and/or mental health problem in the future because of the extent of significant life events experienced in the last year. In terms of gender, proportionally more females ($n = 16$, 84%) than males ($n = 1$, 20%) had a moderate chance of developing illness and/or mental health problems in the future based on their life event scores.

4.3.2.3 Weight related quality of life

Overall weight related quality of life (Appendix 7) mean score at follow-up was in the moderate concern range (cut off = 71.9-79.4; see Table 11). From the individual dimensions, participants' self-esteem and sexual life were in the severely low range (cut off = < 71.9). In contrast, participants physical and work related functioning, as well as experience of public distress, were only in the mild range (cut off = 79.5-87.0). There were no significant differences in scores across gender (see Table 11).

Table 11 Average scores for weight related quality of life

Quality of life dimensions	Whole sample (<i>n</i> = 24)	Females (<i>n</i> = 19)	Males (<i>n</i> = 5)	<i>t</i> (<i>df</i>) =, <i>p</i>
	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	
Self-esteem	62.00 (31.65) 0-100	59.21 (33.08) 0-100	72.60 (25.63) 32-96	<i>t</i> (22) = 0-.84, <i>p</i> < 0.41
Sexual life	70.29 (34.09) 0-100	69.47 (33.33) 0-100	73.40 (40.85) 4-100	<i>t</i> (22) = -0.22, <i>p</i> < 0.82
Physical functioning	83.54 (17.66) 41-100	83.63 (18.21) 41-100	83.20 (17.34) 57-100	<i>t</i> (22) = 0.05, <i>p</i> < 0.96
Work related functioning	84.88 (23.39) 4-100	88.89 (17.04) 50-100	69.60 (38.34) 4-100	<i>t</i> (22) = 1.71, <i>p</i> < 0.10
Public distress	85.21 (28.72) 0-100	87.37 (25.57) 0-100	77.00 (41.17) 5-100	<i>t</i> (22) = 0.71, <i>p</i> < 0.48
Overall quality of life	78.58 (18.94) 23-100	76.95 (20.65) 23-100	84.80 (9.09) 77-97	<i>t</i> (22) = -0.82, <i>p</i> < 0.42

Note: All scores are expressed as mean, standard deviation (SD) and range. Cut off scores were None > 87.1; Mild 79.5-87.0; Moderate 71.9-79.4; Severe < 71.9. *p* > .05*

4.3.2.4 Substance misuse

Participants' average scores for alcohol use (*M* = 6.21, *SD* = 6.51) were below the clinical cut-off (scores ≥ 8) for hazardous consumption. However, participants' individual scores were also reviewed and showed that over one third (*n* = 10, 38%) were drinking alcohol to a hazardous level and one met the criteria for alcohol dependency. No illicit substance use was reported in the sample.

In the RIS (Appendix 4), participants were also asked about their current and past smoking habits. Half of the sample had never smoked before, three were current smokers and over a quarter had given up smoking (*n* = 9, 38%) on average 13 years ago (*M* = 12.94, *SD* = 6.5).

4.3.3 Eating disorders and behaviours

4.3.3.1 Disordered eating

Symptoms of disordered eating were obtained from participants' responses to the disordered eating symptoms questionnaire (Appendix 9). The mean total score for disordered eating symptoms was 4.63 ($SD = 4.03$, range 0-13). Females scored ($M = 4.84$, $SD = 4.17$) higher than males ($M = 3.80$, $SD = 3.77$), but this difference was not significant, $t(22) = .506$, $p < 0.62$. As there is no clinical cut off point for this tool to interpret whether participants met the criteria for a specific eating disorder, a proxy measure in assessing the severity of participants disordered eating behaviours is represented in Table 12. The table examines the range and frequency of disordered eating symptoms reported.

Table 12 *Total number of reported symptoms of disordered eating for whole sample (n=24)*

Frequency	Fasting for a day	Diet pills	Vomiting	Exercising	Urges to overeat	Bingeing	Feeling guilty
Rarely	1			5	1	5	
Sometimes	1	3	1	1	5	3	7
Often	1			4	1	1	4
Very often				2	1	1	2

Table 12 shows that most participants engaged in a range of behaviours to manage their weight, with exercising being the most commonly reported ($n = 12$, 50%) and more extreme behaviours (e.g. vomiting, fasting and using diet pills) being reported less often ($n = 7$). Over half ($n = 13$, 54%) reported feeling guilty about over eating and a third ($n = 8$, 33%) had urges to overeat. In terms of the severity of participants' reported engagement in compensatory behaviours, most of the reported symptoms fell in the 'rarely' and 'sometimes' categories, suggesting that the severity of these behaviours was low or infrequent.

4.3.3.2 Eating behaviours

To determine participants' postoperative eating behaviours, responses were analysed from the TFEQ-R18 (Karlsson et al., 2000, Appendix 10). Table 13 shows that, based

on the average overall sample scores, participants had higher levels of Cognitive Restraint (CR) relative to Uncontrolled Eating (UE) and Emotional Eating (EE). Across gender, differences in scores were not statistically significant.

Table 13 *Postoperative eating behaviours scores in bariatric surgery patients*

TFEQ- R18 Subscales	Whole sample (<i>n</i> =24)	Females (<i>n</i> =19)	Males (<i>n</i> =5)	<i>t</i> (<i>df</i>) <i>p</i>
	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	
Cognitive Restraint	50.46 (19.99) 17-83	53.80 (18.89) 17-83	37.78 (20.93) 17-61	<i>t</i> (22) =1.65, <i>p</i> = 0.11
Emotional Eating	37.75 (36.06) 0-100	41.25 (34.39) 0-100	24.44 (43.32) 0-100	<i>t</i> (22) = 0.92, <i>p</i> = 0.36
Uncontrolled Eating	20.68 (20.17) 0-67	21.64 (18.32) 0-56	17.04 (28.40) 0-67	<i>t</i> (22) = 0.45, <i>p</i> =0.66

4.3.3.3 Changes in cravings for sugary foods

In the RIS (Appendix 4), participants were asked about whether they craved sweet foods preoperatively and postoperatively. Over half the sample craved sugary foods preoperatively (*n*=14, 58%) and a similar proportion experienced the same postoperatively (*n*=12, 50%). Of those participants who reported craving sweet foods preoperatively, 21% (*n*=5) no longer did so postoperatively. However, three participants (13%) developed a ‘sweet tooth’ postoperatively. Males and females were proportionally similar in terms of those who craved sugary foods preoperatively and postoperatively, (*FET* = 3.90, *p* <.122, *FET* = 0.25, *p* < 1.00).

4.3.4 Postoperative support and adherence to weight management strategies

4.3.4.1 Monitoring behaviours

In the RIS (Appendix 4), participants were asked about their postoperative monitoring behaviours. Most participants engaged in monitoring their body weight (*n* = 20, 83%) and two thirds checked their food intake (*n* = 16, 67%). However, fewer participants monitored their exercise (*n* = 9, 38%), although this was not found to be statistically different from those who monitored their weight (*FET* = 0.34, *p* < 1.00). In addition,

across gender there were no significant differences in the proportion of males and females who engaged in monitoring behaviours (see Table 14).

Table 14 *Postoperative monitoring behaviours in bariatric surgery patients*

Types of behaviours monitored	Whole sample (<i>n</i> = 24)	Females (<i>n</i> = 19)	Males (<i>n</i> = 5)	<i>FET, p</i>
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Exercise	9 (38)	17 (90)	1 (20)	0.89, <i>p</i> < .615
Food intake	16 (67)	14 (74)	2 (40)	1.92, <i>p</i> < .289
Weight	20 (83)	8 (42)	3 (60)	2.11, <i>p</i> < .179

4.3.4.2 Adherence to postoperative advice

Table 15 shows that after WLS, the majority of participants reported being offered postoperative appointments with the surgeon and the dietitian, as well as advice about taking nutritional supplements. To a lesser extent, participants reported being advised to attend WLS support groups and engage in exercise. None of the participants reported being advised to attend physiotherapy appointments. However, over a quarter reported being advised to access support from a mental health professional. Participants also provided further details on other forms of postoperative advice, which included them being given leaflets about surgery and eating (4), relevant websites (2) and advice about consuming small food portions (3).

Postoperative adherence to professional advice was similar across the different forms of support and advice participants were offered. Greatest adherence was reported for engaging in exercise (*n* = 16, 88.9%) and attending surgery or dietitian appointments. Additionally, adherence to accessing support from a mental health professional was high, with only one participant not engaging with this advice. The lowest adherence was for attending WLS support groups.

Table 15 *Postoperative advice and support offered to participants'*

Types of postoperative support/advice	Offered	Adherence
	<i>n</i> (%)	<i>n</i> (%)
Surgeon	21 (88)*	18 (86)
Dietitian	22 (92)*	19 (86)
Nutritional supplements	21 (88)	18 (86)
Attend WLS support group	17 (71)	13 (77)
Exercise	18 (75)*	16 (89)
Mental Health Professional	8 (33)	7 (88)
Physiotherapist	0 (0) *	0 (0)

Note: *One participant's data not included because they could not remember.

4.3.4.3 Postoperative contact with mental health professionals

Based on the medical data, there was information on half of the participants ($n = 12$, 50%), about postoperative contact with mental health professionals (MHP). Table 16 shows that an equal proportion of these same participants either had contact with the Clinical and Health Psychology Department, or the Community Mental Health Team (CMHT). Table 17 shows the main reason for contact with a MHP was difficulties in adjusting to WLS procedure, followed by mood related difficulties.

Table 16 *Contact with mental health professionals, postoperatively*

	Whole sample	Females	Males
	($n = 12$)	($n = 11$)	($n = 1$)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
CMHT	6 (50)	5 (45)	1 (100)
Clinical Health Psychology Department	6 (50)	6 (55)	0 (0)

Table 17 *Main reasons for contact with mental health professionals, postoperatively*

	Whole sample	Females	Males
	($n = 12$)	($n = 11$)	($n = 1$)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Disordered eating	0 (0)	0 (0)	0 (0)
Mood disorders	4 (33)	4 (36)	0 (0)
Substance misuse (alcohol)	1 (8)	0 (0)	1 (100)
Personality disorder	1 (8)	1 (9)	0 (0)
Adjustment to WLS	6 (50)	6 (55)	0 (0)

For participants who achieved successful WL postoperatively (i.e. more than 25% WL, $n = 18$), data was available for 8 participants. Four of these were referred to the

CMHT (to manage mood or personality disorders) and four were referred to the Clinical and Health Psychology Department for difficulties adjusting to WLS procedure.

Of the participants who had not lost 25% body weight postoperatively ($n = 6$), data was available for four participants. Two of these participants were referred to the CMHT and two were referred to the Clinical and Health Psychology Department because of difficulties adjusting to WLS procedure, one was referred to CMHT for mood disorders and the other was referred for managing substance misuse issues.

4.3.5 Summary of findings

Analysis of the long term physical health and psychological outcomes of the whole recruited sample ($n = 24$), identified the following characteristics, on average four years postoperatively:

- There was no significant reduction in the number of obesity related conditions postoperatively, compared to preoperatively
- Weight related work and physical functioning was a mild concern for patients
- 50% of the sample had a probable anxiety disorder, ranging from mild to severe, with females accounting for the highest proportion (10 vs. 2)
- Participants were unlikely to experience physical and/or mental illness in the future based on their level of stress from significant life events experienced in the last twelve months
- In terms of weight related quality of life, participants greatest concern was their self-esteem and sexual life (severe range), followed by a moderate concern with their overall weight related quality of life, and lowest concern with their weight related distress from others (mild range)
- In general, participants' alcohol use was not a concern (below hazardous level), although a third of the sample were drinking over the recommended amount of alcohol and one was dependent on alcohol.
- The majority of the sample did not smoke, with three participants being current smokers and nine having quitted long before their WLS procedure (i.e. on average 13 years ago)

- In terms of eating behaviours, the frequency of disordered eating symptoms was low, with emotional responses about eating habits most common
- Participants' had higher scores for cognitive restraint, and relatively lower scores for uncontrolled eating and emotional eating
- There was little change in participants' cravings for sugary foods postoperatively compared to preoperatively
- Most participants monitored their weight (83%), two thirds monitored their food intake and over a third (38%) monitored their exercise
- The majority of participants were offered appointments with a dietitian and surgeon after WLS. They were also given advice about taking nutritional supplements
- Fewer participants reported being offered other forms of support such as WLS support groups and a referral to a mental health professional.
- 50% of participants had contact with the CMHT or Clinical and Health Psychology Department, the majority of whom were referred for issues related to adjusting to WLS.

4.4 RYGB patients: Characteristics of successful versus unsuccessful WL groups

4.4.1 Demographic characteristics of the RYGB sample

Table 18 provides a summary of the demographic characteristics of the successful and unsuccessful WL groups. There were 14 participants in the successful WL group and 5 in the unsuccessful WL group (see Figure 5, section 3.5.2.3). At follow-up, participants were similar in age, $t(17) = -0.69, p = 0.50$, and in years since surgery, $t(17) = -0.85, p = 0.41$.

The proportion of males and females in the successful WL group differed significantly from that of the unsuccessful WL group ($FET = 5.62, p = 0.04$), such that there were more females in the successful WL group. Statistically, proportionally more participants in the successful WL group were employed ($n = 11, 78.6\%$) compared to only one participant (20%) in the unsuccessful WL group ($FET = 7.21, p = 0.02$). There were no significant differences between groups in terms of marital status and educational achievements.

Table 18 *Demographic characteristics of the whole RYGB sample, plus the successful versus the unsuccessful WL groups*

Characteristics	All RYGB (n =19)	Successful (n =14)	Unsuccessful (n =5)
<u>Age at follow-up</u>			
Mean	51.37	50.50	53.80
(SD)	(9.08)	(9.58)	(7.92)
Range	29-65	29-64	43-65
<u>Years since surgery</u>			
Mean	4.58	4.82	3.90
(SD)	(2.06)	(2.34)	(0.72)
Range	2-10	2-10	2-4
<u>Gender n (%)</u>			
Female	15 (79)	13 (93)	2 (40)
Male	4 (21)	1 (7)	3 (60)
<u>Marital status n (%)</u>			
Married / co-habiting	11 (58)	8 (57)	3 (60)
Divorced/ Separated/ Single	8 (42)	6 (43)	2 (40)
<u>Employment status n (%)</u>			
Full/part-time employed	12 (63)	11(79)	1 (20)
Unemployed	1 (5)	0 (0)	1 (20)
Retired	4(21)	2 (14)	2 (40)
Other (e.g. student)	2 (11)	1 (7)	1 (20)
<u>Education n (%)</u>			
None	4(21)	3 (21)	1 (20)
GCSE /GCE O-levels	9(47)	7 (50)	2(40)
Diploma	3(16)	1 (7)	2(40)
Degree/PhD	3(16)	3 (21)	0 (0)

4.4.1.1 Body weight and WL

Table 19 shows that, preoperatively, across groups, participants were similar in terms of mean weight in kilograms and in BMI. As expected, at follow-up, those in the successful WL group were significantly different to participants in the unsuccessful WL group in terms of body weight in (kg), BMI, WL (kg) and %WL. Those in the successful WL group lost twice as much body weight (kg) compared to those in the unsuccessful WL group (50 vs 24 kg) and the severity of their obesity condition had moved from Obesity classification III to the overweight category. In contrast, postoperative BMI of the unsuccessful WL group placed them in the obesity category II, at follow-up (see Table 1, section 1.2 for the classification of obesity, according to BMI).

Table 19 *Body weight and weight loss of the whole RYGB sample, plus the successful versus the unsuccessful WL groups*

	All RYGB (n = 19)	Successful (n =14)	Unsuccessful (n=5)	<i>t(df)p</i>
<u>Preoperative</u>				
<u>weight</u>				
kg				
<i>Mean</i>	125.55	125.94	124.47	<i>t</i> (17)=0.15,
<i>(SD)</i>	(18.96)	(19.77)	(18.59)	<i>p</i> = 0.89
Range	92-159	92-159	97-141	
BMI (kg/m ²)				
<i>Mean</i>	46.36	47.21	43.96	<i>t</i> (17) =1.00,
<i>(SD)</i>	(6.23)	(6.48)	(5.33)	<i>p</i> = .33
Range	35-59	35-59	39-51	
<u>Postoperative</u>				
<u>Weight</u>				
kg				
<i>Mean</i>	82.36	75.90	100.46	<i>t</i> (17) =-4.07,
<i>(SD)</i>	(15.83)	(9.31)	(17.03)	<i>p</i> = .001**
Range	64-117	64-100	73-117	
BMI (kg/m ²)				
<i>Mean</i>	30.65	28.56	36.50	<i>t</i> (17) =-3.68,
<i>(SD)</i>	(5.40)	(3.70)	(5.34)	<i>p</i> =.002**
Range	23-43	23-39	29-43	
Weight loss (kg)				
<i>Mean</i>	43.19	50.02	24.04	<i>t</i> (17) =3.53,
<i>(SD)</i>	(18.07)	(15.51)	(8.08)	<i>p</i> = .003**
Range	11-79	28-79	11-31	
% WL				
<i>Mean</i>	33.85	39.02	19.36	<i>t</i> (17) =5.30,
<i>(SD)</i>	(11.27)	(7.36)	(6.26)	<i>p</i> = .000***
Range	10-50	26-50	10-24	

*Note: Significant at p < 0.05 *, p < 0.01 ** or p < 0.001***.*

4.4.1.2 Physical health

Preoperatively, the unsuccessful WL group ($M = 2.60$, $SD = 0.89$) was similar to the successful WL group ($M = 1.71$, $SD = 1.68$) in the average number of obesity-related conditions, $t(17) = -1.11$, $p = 0.28$. Conversely, at postoperative follow-up, those in the unsuccessful WL group had significantly more conditions ($M = 2.40$, $SD = 1.14$)

compared to those in the successful WL group ($M = 1.36$, $SD = 0.84$) $t(17) = -2.17$, $p=0.04$.

4.4.2 Psychological functioning

4.4.2.1 Anxiety and depression

Data from participants' responses to the HADS questionnaire were used to determine clinical anxiety and depression, with scores of 8, per subscale, indicating a likely chance of a clinical disorder. Table 20 shows that the successful WL group's mean score was not in the clinical range for anxiety ($M = 7.36$, $SD = 3.97$) or depression ($M = 2.36$, $SD = 3.50$). In contrast, the unsuccessful WL group's mean score was in the clinical range for anxiety ($M = 9.00$, $SD = 7.90$) but not for clinical depression ($M = 5.00$, $SD = 2.12$). However, when these differences were tested, groups did not significantly differ in mean scores for symptoms of anxiety $t(17) = -0.61$, $p = <0.55$ or depression $t(22) = -1.57$, $p = <0.14$). The proportion of participants who met the criteria for clinical anxiety or depression in the unsuccessful WL group ($n = 4$, 80%) whilst higher than the proportion in the successful WL group ($n = 8$, 57%) was not statistically different, ($FET = 0.43$, $p = 0.63$).

Table 20 Anxiety and depression scores of the whole RYGB sample, including for successful and unsuccessful WL groups

	All RYGB (n=19)	Successful (n=14)	Unsuccessful (n=5)
<u>Anxiety</u>			
Mean	7.79	7.36	9.00
(SD)	(5.08)	(3.97)	(7.90)
Range	1-20	2-13	1-20
<u>Depression</u>			
Mean	3.05	2.36	5.00
(SD)	(3.36)	(3.50)	(2.12)
Range	0-11	0-11	3-8
<u>Clinical disorder n (%)</u>			
Mild anxiety	3 (16)	2 (14)	1 (20)
Moderate anxiety	5 (26)	4 (29)	1 (20)
Severe anxiety	1 (5)	0 (0)	1 (20)
Mild depression	2 (10)	1 (7)	1 (20)
Moderate depression	1 (5)	1 (7)	0 (0)
Severe depression		0 (0)	0 (0)
Any clinical disorder n (%)	12 (63)	8 (57)	4 (80)

4.4.2.2 Stress during the last year

For both groups, mean scores for stress (Appendices 6) caused by significant life events in the last year, were below the clinical threshold of 150, suggesting there was less than a 30% chance that participants would develop a physical or mental illness in the future. There were also no differences in the mean scores for stress during the last year, for the successful WL group ($M = 72.29$, $SD = 78.23$, range = 0-249) compared to the unsuccessful WL group ($M = 37.20$, $SD = 63.66$, range = 0-147), $t(17) = 0.90$, $p = .38$. However, two participants (14%) in the successful WL group, based on their level of stress (score of 216 and 249), had a 50% or moderate chance of illness in the future (cut off = 150 to 299), compared to none of the participants in the unsuccessful WL group.

4.4.2.3 Weight related quality of life

Table 21 shows that both groups were similar in mean scores for overall weight related quality of life and across all of the five dimensions (e.g. self-esteem, and experiences of public distress by others, Appendix 6).

Table 21 *Quality of life scores of the whole RYGB sample, including for successful and unsuccessful WL groups*

IWQOL-Lite Scores	All RYGB (n=19)	Successful group (n=14)	Unsuccessful group (n=5)	<i>t(df)p</i>
	<i>M (SD) range</i>	<i>M (SD) range</i>	<i>M (SD) range</i>	
Self-esteem	66.11 (31.05) 0-100	67.57 (32.00) 0-100	62.00 (31.34) 14-96	<i>t(17)=0.34,</i> <i>p= 0.74</i>
Sexual life	75.74 (32.90) 0-100	72.86 (36.61) 0-100	83.80 (20.13) 56-100	<i>t(17)=-0.63,</i> <i>p=0.54</i>
Physical functioning	84.53 (16.26) 48-100	87.07 (14.32) 48-100	77.40 (20.88) 55-100	<i>t(17) =0.15,</i> <i>p=0.27</i>
Work related functioning	90.58 (13.54) 50-100	92.93 (14.45) 50-100	84.00 (8.57) 75-94	<i>t(17)=1.29,</i> <i>p=0.22</i>
Public distress	90.00 (24.04) 0-100	88.57 (27.69) 0-100	94.00 (8.94) 80-100	<i>t(17)=-0.42,</i> <i>p=0.68</i>
Overall quality of life	80.26 (18.67) 19-23	80.43 (21.60) 23-100	79.80 (7.26) 73-92	<i>t(17)=0.06,</i> <i>p=0.95</i>

Note: Results expressed in mean and standard deviation in brackets, and range. Cut off scores for concern on each subscale: None > 87.1; Mild 79.5-87.0; Moderate 71.9-79.4; Severe<71.9.

In terms of the clinical cut-off, as a measure of severity, across both groups participants' levels of self-esteem were in the severe concern range. However, overall quality of life was a mild concern and there was no concern in experiencing weight related public distress. In contrast, groups differed, although not significantly, in terms of physical and work related functioning as well as satisfaction with sexual life. Participants in the successful group were functioning well in terms of their physical and work related functioning, whereas, for the unsuccessful group, there was a moderate level of difficulty in physical functioning and a mild concern about work related functioning. Participants in the successful group were moderately unsatisfied with their sexual life, compared to this being only a mild concern for the unsuccessful group.

4.4.2.4 Substance misuse

Statistically the amount of alcohol use reported by the unsuccessful WL group was similar ($M = 7.60$, $SD = 11.52$, range 0-26) to the successful WL group ($M = 6.50$, $SD = 4.59$, range 0-15), $t(17) = -0.37$, $p < 0.76$. These mean scores indicated that across both groups the majority of participants' were not drinking alcohol to a hazardous level (cut off score of 8+). One participant in the unsuccessful WL group met the criteria for hazardous drinking and one also was clinically dependent on alcohol (40%), compared to five participants in the successful group (36%) who met the criteria for hazardous drinking. The proportion of participants who met the criteria for hazardous or dependent drinking in the unsuccessful WL group was equivalent to the proportion in the successful WL group ($FET = 0.03$, $p = 1.00$). There was also no illicit substance use reported across either group.

In terms of groups' smoking habits, there was one current smoker in the successful group and none in the unsuccessful WL group. Three quarters ($n = 9$, 64%) of the successful WL group had never smoked tobacco, compared to 40% ($n = 2$) of the unsuccessful WL group. Proportionally, there were slightly more participants in the unsuccessful WL group ($n = 3$, 60%) who had given up smoking, compared to the successful WL group ($n = 4$, 29%). Statistically there was no difference between the number of years since the successful WL group quit smoking ($M = 14.00$, $SD = 5.89$, range 8-20), compared to the unsuccessful WL group, ($M = 9.17$, $SD = 5.96$, range 5-16), $t(5) = 1.069$, $p = .334$.

4.4.3 Eating behaviours

4.4.3.1 Disordered eating symptoms

Symptoms of disordered eating were obtained from participants' responses to the disordered eating questionnaire (Appendix 9). Across the two groups, average scores for disordered eating symptoms were significantly higher in the unsuccessful WL group ($M = 7.80$, $SD = 3.96$, range 3-11) compared to the successful WL group ($M = 2.71$, $SD = 2.70$, range 0-9), $t(17) = -3.21$, $p < 0.005$. These results indicate that symptoms of binge eating, urges to overeat, and use of compensatory behaviours to manage emotions or weight, were more common in the unsuccessful WL group.

4.4.3.2 Eating behaviours

To determine groups' postoperative eating behaviours, responses from the TFEQ-18 were analysed. Table 22 shows that both groups were similar in terms of mean scores in emotional eating (EE), uncontrolled eating (UE) and cognitive restraint (CR). However, the successful WL group had observably lower mean scores for UE and EE compared to the successful WL group.

Table 22 Summary of TFEQ-18 scores for the whole sample, plus for the successful and unsuccessful WL groups

TFEQ-18	All RYGB (n=19)	Successful group (n =14)	Unsuccessful group (n=5)	<i>t</i> (df) <i>p</i>
	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	<i>M</i> (<i>SD</i>) range	
Uncontrolled eating	18.32 (20.82) 0-67	14.81 (17.55) 0-56	28.15 (28.04) 0-67	<i>t</i> (17)=-1.25, <i>p</i> =.23
Emotional eating	35.99 (32.71) 0-100	32.97 (31.13) 0-100	44.44 (39.28) 0-100	<i>t</i> (17)=-0.66, <i>p</i> =.52
Cognitive restraint	48.83 (21.96) 17-83	49.60 (22.27) 17-83	46.67 (23.43) 17-78	<i>t</i> (17)=0.25, <i>p</i> =.81

4.4.3.3 Changes in cravings for sugary foods

In the RIS (Appendix 4), participants were asked about whether they craved sweet foods preoperatively and postoperatively. Table 23 shows that, preoperatively and postoperatively, the proportion of participants in the successful WL group, who craved sugary foods, was similar to the unsuccessful WL group. However, there was a trend towards a reduction in the proportion of the successful WL group craving sugary foods postoperatively compared to preoperatively, whereas there was no change for the unsuccessful WL group (*FET* = 5.66, *p* < .08; *FET* = 0.14, *p* < 1.00).

Table 23 *Participants who craved sugary foods preoperatively and postoperatively*

Cravings for sugary foods	All RYGB (n=19)	Successful group (n=14)	Unsuccessful group (n=5)	FET, p
	n (%)	n (%)	n (%)	
Preoperatively	13 (68)	10 (71)	3 (60)	0.22, p= 1.00
Postoperatively	9 (47)	6 (43)	3 (60)	0.44, p= 0.63

4.4.4 Postoperative support and adherence to weight management strategies

4.4.4.1 Monitoring behaviours

The proportion of participants who monitored their exercise, food intake and weight was similar across groups, as illustrated in Table 24. Interestingly, all participants in the successful WL group reported monitoring their weight.

Table 24 *Monitoring behaviours across groups*

	All RYGB (n=19)	Successful (n=14)	Unsuccessful (n=5)	FET, p
	n (%)	n (%)	n (%)	
Exercise	8 (42)	6 (43)	2 (40)	0.01, p = 1.00
Food intake	11 (58)	8 (57)	3 (60)	0.01, p = 1.00
Weight	18 (95)	14 (100)	4 (80)	2.83, p = 0.26

4.4.4.2 Adherence to postoperative advice

Tables 25, and 26, show that the types of postoperative advice and support offered was similar across groups, in terms of being offered appointments with a surgeon, a dietitian, a mental health professional and advice about taking nutritional supplements. Groups were also similar in not being offered physiotherapy appointments and in fewer participants being offered support from a mental health professional, relative to other sources of professional support offered. However, not all of the participants in the successful WL group were offered advice about attending WLS support groups, or engaging in regular exercise, compared to the unsuccessful WL group who were offered the full range of support and advice. Moreover, this trend was similar for adherence rates, with fewer adhering to postoperative offered advice and support, in the successful group compared to the unsuccessful group (despite high levels of adherence in both groups).

Table 25 *Professional advice offered to the successful WL group (n=14)*

Postoperative advice/support	Offered	Adherence
	<i>n (%)</i>	<i>n (%)</i>
Surgeon	12 (86)*	11 (92)
Dietitian	13 (93)*	11 (85)
Nutritional supplements	13 (93)	11 (85)
Attend WLS support group	9 (64)	7 (78)
Exercise	10 (72)*	8 (80)
Mental Health Professional	5 (36)	4 (80)
Physiotherapist	0 (0)	0 (0)

Note: *One participant's data was not included because they could not remember

Table 26 *Professional advice offered to the unsuccessful group (n =5)*

Postoperative advice/support	Offered	Adherence
	<i>n (%)</i>	<i>n (%)</i>
Surgeon	5 (100)	5 (100)
Dietician	5 (100)	5 (100)
Nutritional supplements	5 (100)	5 (100)
Attend WLS support group	4 (80)	4 (100)
Exercise	5 (100)	5 (100)
Mental Health Professional	2 (40)	2 (100)
Physiotherapist	0 (0)	0 (0)

4.4.4.3 *Postoperative contact with mental health professionals*

Based on medical data, Table 27 shows that a similar proportion of the successful WL group, compared to the unsuccessful WL group, had contact with mental health professionals following WLS. There were however, differences across groups in terms of the reasons for contact with a mental health professional (see Table 28).

Table 27 *Contact with mental health professionals postoperatively, across groups*

	All RYGB	Successful	Unsuccessful
	(n=19)	(n=14)	(n=5)
	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>
CMHT	5 (26)	3 (21)	2 (40)
Clinical Health Psychology Department	3 (16)	3 (21)	0 (0)

Table 28 *Reasons for contact with mental health professionals postoperatively, across groups*

	All RYGB (n=19) n (%)	Successful (n=14) n (%)	Unsuccessful (n=5) n (%)
Disordered eating	0 (0)	0 (0)	0 (0)
Mood disorders	3 (16)	2 (14)	1 (20)
Substance misuse	1 (5)	0 (0)	1 (20)
Personality disorder	1 (5)	1 (7)	0 (0)
Adjustment to WLS	3 (16)	3 (21)	0 (0)

4.4.5 Summary of findings

Statistical analysis of the differences in demographic, psychological, eating and lifestyle factors between the successful and unsuccessful WL groups overall revealed that these groups were comparable across the majority of these factors. In particular, groups were similar in terms of marital status, education, age, years since surgery, preoperative obesity related co-morbidities, preoperative body weight (kg) and preoperative BMI. In terms of postoperative psychological factors, groups were similar in symptoms of depression (below clinical range), overall weight related quality of life (mild), weight related self-esteem (severe concern), stress in the last year (below clinical range), alcohol use (below hazardous levels) and level of cognitive restraint. Groups were statistically different in gender, employment, postoperative health, postoperative body weight in kilograms, BMI, amount of WL and in %WL, specifically:

- The successful WL group were more likely to be female and employed
- The successful WL group had significantly fewer postoperative obesity related conditions than the unsuccessful WL group
- The successful WL group had a bigger shift in BMI, WL and %WL, as expected
- The unsuccessful WL group had significantly more disordered eating symptoms ($p < 0.005$) than the successful WL group

Although not statistically significant, there appeared to be further differences between the groups:

- The unsuccessful WL group were slightly more likely to be in the clinical range for anxiety
- In terms of quality of life, the successful WL group appeared to have less concern over their physical and work related functioning but a moderate concern over their sexual life, compared to the unsuccessful WL group
- The successful WL group appeared to have lower levels of uncontrolled and emotional eating than the unsuccessful WL group
- There was a trend towards a reduction in the proportion of the successful WL group who craved sugary foods postoperatively, compared to preoperatively, whereas this reduction was not observed in the unsuccessful WL group
- 100% of the successful WL group monitored their body weight, compared to 80% in the unsuccessful WL group
- The unsuccessful WL group appeared to have been offered more postoperative support and to be more adherent to that support than the successful WL group

4.5 RYGB patients: Relationship between weight loss and postoperative psychological factors

4.5.1 Correlating psychological factors with percentage weight loss

Table 29 shows that of the 14 postoperative psychological factors measured at follow-up, none significantly correlated with %WL. However, the negative correlation between %WL and disordered eating symptoms just failed to reach significance. This relationship suggests that an increase in %WL was related to a decrease in disordered eating symptoms (e.g. binge eating and urges to overeat).

Table 29 *Correlation of postoperative factors with percentage weight loss*

Postoperative factors	<i>r</i>	<i>p</i>
Depression	-.234	.334
Anxiety	-.014	.955
Stress in the last year	-.008	.974
Disordered eating symptoms	-.444	.059
Uncontrolled eating	-.178	.467
Cognitive restraint	-.084	.732
Emotional eating	-.627	.119
Quality of life – Physical functioning	.257	.289
Quality of life – Self-esteem	.027	.913
Quality of life – Sexual life	-.061	.805
Quality of life – Public distress	-.041	.868
Quality of life – Work functioning	.212	.383
Quality of life – Overall score	.013	.958
Alcohol use	-.295	.220

r = Pearson's product moment correlation coefficient

Multi-collinearity between potential predictors was identified. Disordered eating correlated significantly with uncontrolled eating ($r = .562$, $p < .012$) and current anxiety scores ($r = .490$, $p < .033$, see Table 1, Appendix 17). This multi-collinearity was not considered substantial ($r > .9$).

4.5.2 Multiple regression analysis

Given that 'disordered eating symptoms' were negatively correlated with %WL, and discriminated between successful and unsuccessful WL groups, (section 4.3.3.1), a multiple regression was performed to evaluate the extent to which disordered eating symptoms might be a predictor of %WL in the presence of important covariates. In a

multiple regression, the strength of the relationship between the predictor or independent variable with the dependent variable is estimated, controlling for the influence of other predictors included in the model. However, due to the small sample size, only two predictor variables could be entered in each multiple regression model. In the first block, preoperative BMI or years since surgery were included separately. Then disordered eating symptoms were added in the second block and the final model reported.

Table 30 shows that preoperative BMI and years since surgery were significantly positively correlated with %WL, $r = 0.48, p < 0.04$; $r = 0.51, p < 0.03$, respectively.

Table 30 *Correlation of potential covariates with percentage weight loss*

Potential covariates	<i>r</i>	<i>p</i>
Preoperative weight in kilograms	.338	.157
Preoperative BMI	.480	.037*
Age at surgery	-.027	.911
Age at follow-up	.089	.718
Years since surgery	.507	.027*

* $p < 0.05$

The distribution of %WL did not deviate significantly from normal (Figure 1-3, Appendix 16). However, the standardised residuals for %WL, (Figure 3, Appendix 16) showed that the assumption of homoscedasticity had been violated. Therefore, the bootstrap method was selected in the regression analysis to manage this heteroscedasticity.

4.5.2.1 *Relationship between percentage weight loss, disordered eating symptoms and years since surgery*

Table 31 shows the final model. The variables included in this model accounted for 35% (AdjR²) of the variance in %WL, which was significant, $F(2,16) = 5.77, p < 0.013$. Both years since surgery and disordered eating symptoms were significant predictors of %WL (see Table 22), when disordered eating symptoms were held constant. The *B* value for years since surgery indicates that for every additional year since surgery, the model predicts 2.77% more WL. Holding years since surgery

constant, the model predicts that a reduction of 1 unit of the disordered eating symptoms score would result in an additional 1.21% WL.

Table 31 *Summary of regression model for disordered eating, years since surgery and percentage weight loss*

Factor	B	SE B	β
Block 1			
Constant	21.15	5.15	
Years since surgery	2.77	0.91	0.51*
Block 2			
Constant	26.92	5.97	
Years since surgery	2.59	1.04	0.47*
<u>Disordered eating symptoms</u>	<u>-1.21</u>	<u>0.41</u>	<u>-0.40*</u>

Note: $R^2 = .26$, $AdjR^2 = 0.21$, $p < .027$ when the variables entered in Block 1 are included; $R^2 = .42$, $AdjR^2 = .35$, $p < .013$, when the variables entered in Block 2 are included. * $p < .05$.

4.5.2.2 Relationship between percentage weight loss, disordered eating symptoms and preoperative BMI

Multiple regression analysis was performed with preoperative BMI entered in the first block, and disordered eating symptoms entered in the second block. Table 32 shows the final model. This model accounted for 23% ($AdjR^2$) of the variance in %WL which was significant ($F(2,16) = 3.75$, $p < 0.046$). Preoperative BMI was a significant predictor of %WL ($p < 0.037$), when no other variables were in the model. The addition of disordered eating symptoms to the model rendered preoperative BMI non-significant. Therefore, the collinearity of preoperative BMI and disordered eating symptoms resulted in neither variable demonstrating a significant relationship with %WL in the final model, despite the overall significance of the model.

Table 32 Summary of regression model for disordered eating, preoperative BMI and percentage weight loss

Factor	B	SE B	β
Block 1			
Constant	-6.43	18.89	
Preoperative BMI	0.87	0.40	0.48*
Block 2			
Constant	6.48	24.03	
Preoperative BMI	0.67	0.48	0.37
Disordered eating symptoms	-0.95	0.72	-0.32

Note: $R^2 = .23$, $\text{Adj}R^2 = 0.18$, $p < .037$, when the variables entered in Block 1 are included; $R^2 = .32$, $\text{Adj}R^2 = .23$, $p < .046$, when the variables entered in Block 2 are included. * $p < .05$.

CHAPTER 5: DISCUSSION

The present study aimed to explore long term WL and psychological outcomes in a sample of UK patients who underwent WLS 2-10 years ago. A further aim was to identify preoperative and/or postoperative psychological factors that predict, long term WL.

Based on 24 participants who underwent WLS at least four years prior to follow-up, it would appear that the bariatric surgical procedure had been successful at reducing their weight, equivalent to non-surgical interventions (Friedman, 2003; Melin et al., 2003). Also, for over half of the sample, the WLS procedure had led to a clinically relevant reduction in their level of obesity. WL was comparable to previous study findings (van de Laar & Acherman, 2014).

Since type of WLS affects WL outcomes (Picot et al., 2009), and given that the majority of participants in this study had undergone RYGB, those who achieved successful WL following RYGB were compared with those whose WL was less successful. Postoperatively, successful WL was related to fewer obesity related conditions and fewer symptoms of disordered eating. Disordered eating symptoms predicted %WL even when years since surgery was accounted for. This study also highlighted that professional support offered and adherence to this was reportedly greater in those who were classified as unsuccessful in terms of %WL and the possible reasons for this are discussed below.

5.1 Postoperative weight and weight loss

In the current study, participants, on average, lost 40.83 kg, which equated to approximately a third of their body weight. Van de Laar and Acherman (2014) recommend that a 25% loss in initial body weight is considered a successful WLS outcome. In the current study, the sample exceeded this criterion, achieving an average of 32% loss in initial body weight. In addition, over two thirds of the sample ($n=16$; 67%) exceeded the 25% WL cut off considered “successful” (van de Laar & Acherman, 2014). WL at 15months and 4 years was similar in this sample which suggests that they are largely maintaining WL long term. A third of the current sample failed to maintain WL long term, which is consistent with other studies findings (Hsu

et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005; Angrisani, Lorenzo & Borrelli, 2007; Sjöström et al., 2004; van de Laar & Acherman, 2014). Therefore, it could be considered that the current sample is reasonably representative of patients undergoing WLS.

Successful WL should also correspond to a reduction in the severity of the patient's obesity condition, as indicated by their postoperative BMI. In the current study, the sample achieved an average reduction in BMI of 15 kg/m². This equates to the sample reducing their level of obesity classification from III to II. Moreover, when considering individuals' postoperative BMIs, 50% of the sample in the current study were no longer obese at follow up (Figure 5, section 4.2.2). These findings therefore substantiate the conclusion that WLS is an effective weight management intervention to significantly reduce participants' body weight and level of obesity.

5.2 The long term psychological outcomes of bariatric surgery

A key aim of this project was to report on the long term psychological outcomes of the recruited participants, who underwent WLS two to ten years prior. There were several reasons why this research focus was felt to be necessary. Firstly, no previous studies had followed-up UK patients to explore relationships between objectively measures of psychological factors and successful WL (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005; Angrisani, Lorenzo & Borrelli, 2007; Sjöström et al., 2004). Secondly, given that the project site was in the top three regions in the UK for obesity (Yorkshire and Humber region; Health and Social Care Information Centre, 2012), studying this under-researched population appeared to be pertinent. Finally, the literature into the long-term psychological outcomes of WLS is limited, with mixed findings and which are often restricted to a two year follow-up period. Thus, further research was merited. Data from eight questionnaires and participants' medical records were utilised to report on the long term WL, psychological functioning, eating behaviours and adherence factors of 24 participants who had undergone WLS, on average, 4 years prior to the research.

5.2.1 Physical health outcomes

Despite over two thirds of the sample achieving successful WL and half were no longer obese, no significant improvements were found in their physical health. Firstly, in terms of the number of self-reported obesity related conditions postoperatively compared to preoperatively, which did not significantly change and on average participants reported two conditions preoperatively and less than two postoperatively. Secondly, on average participants' had a mild concern regarding their postoperative weight related physical and work related functioning, which links with the findings that their obesity comorbidities were negatively impacting on their physical health. These findings are unexpected given that one of the benefits of WLS is the reduction of comorbidities associated with obesity (Buchwald, et al. 2004). However, in the current study, in obtaining data on participants' obesity related conditions, information was only collected on the presence or absence of conditions rather than whether the severity had reduced or the required medication had changed postoperatively. Therefore, even though there was no significant change in patients postoperative obesity related conditions, the symptoms or means to manage these might have provided evidence that they had improved, if this information had been captured. Additionally, since no preoperative measure of weight related physical functioning was obtained, there is no way of knowing whether this mild concern, reflects an improvement in their condition or not.

5.2.2 Psychological outcomes

It was anticipated that participants at follow-up would experience an improvement in psychological health, based on findings from four systematic reviews which reported long term improvements following WLS (Bocchieri et al., 2002; Herpertz et al., 2003; van Hout, 2005; van Hout et al., 2006). In the current study, the psychological functioning of participants postoperatively was assessed by clinical measures of anxiety, depression, weight related quality of life and stress caused by significant life events in the last year. Although there was little evidence of probable clinical depression in the current study or that stress caused by significant life events in the last year might increase risk of physical/mental health issues in the future, participants expressed other forms of difficulties. In particular, in 50% of the sample there was evidence of a probable anxiety disorder, with a large proportion of these participants falling in the moderate to severe range of clinical anxiety. Additionally, participants

expressed severe concerns about their weight related self-esteem and sexual life and moderate concern about their overall weight related quality of life. Finally, while there was no reported postoperative illicit drug use, over a third of the participants were drinking alcohol at a hazardous level, with one meeting the criteria for alcohol dependency, suggesting current addictive behaviours.

A quarter of participants reported being advised to seek support from a MHP after WLS, which suggests that there were concerns about their psychological functioning immediately after the procedure. The reasons for these referrals were not captured. They could have been, for example, related to psychopathology, difficulties in adjusting to WLS, or disordered eating behaviours. Moreover, based on the medical records 50% of participants had contact with a CMHT or the Clinical and Health Psychology Department, within the Mid Yorkshire NHS Healthcare Trust, between the period following WLS and postoperative follow-up. The highest proportion of these participants were referred for issues related to adjusting to WLS e.g. dissatisfaction with body image. These findings verify the presence of psychological difficulties post-surgery. They may also indicate that WLS increased patients' vulnerability to mental health issues after surgery. However, without verifying participants psychological functioning before surgery, it cannot be determined whether these difficulties arose only after WLS. Therefore, in an attempt to further understand these findings, they were compared to previous studies which had followed up participants at least two years after WLS.

5.2.2.1 Depression and anxiety

The absence of depression postoperatively is consistent with several studies and reviews of WLS outcomes. In particular, studies using the HADS or BDI found no depression 2-3 years postoperatively (Beck, Mehlsen & Stoving., 2012; Thonney, Pataky, Badel, Bobbioni-Harsch & Golay., 2010; Welch et al, 2011). Exceptions to these findings have been found when: participants regain weight after a period of postoperative WL (Bocchieri et al., 2002); a clinical interview is used to assess depression (Kinzl et al., 2006); or when participants were identified, at preoperative assessment, with a severe Axis I psychiatric disorder of the DSM (Herpertz et al., 2003). Two of these studies identified improvements and remission of anxiety disorders postoperatively and thus, suggest that the presence of anxiety disorder

postoperatively, as was found in the current study is unusual (Herpertz et al., 2003; Beck, Mehlsen & Stoving., 2012).

5.2.2.2 Quality of Life

The findings of the current study in relation to quality of life were not consistent with the literature, which demonstrates that WLS has a positive impact on postoperative quality of life (Bocchieri et al., 2002; Herpertz et al., 2003; van Hout, 2005; van Hout et al., 2006) across both generic and obesity-related quality of life measures. Additionally, a study by Strain et al. (2014), which also used the IWQOL Lite, found that 25 months postoperatively, participants' mean scores were higher than those in the present study in relation to their sexual life, self-esteem and overall quality of life. Overall, this would suggest that participants in the current study had poorer weight related quality of life than would be expected, based on previous studies findings. This however, is not unexpected given that half of the sample was still classified as obese at follow-up and therefore, this perhaps might account to some degree for the lower quality of life scores.

5.2.2.3 Substance misuse

It was anticipated that WLS might increase alcohol or illicit drug misuse long term in the current study sample, as identified in previous studies (King et al., 2012; Conason, et al., 2013; Wiedemann, Saules & Ivezaj, 2013; Kruseman, et al., 2010). However, as there was no preoperative measure of substance misuse, it is unclear whether this existed before WLS or not. Nevertheless for over 30% of participants their level of alcohol use met the criteria for hazardous drinking and one participant met the criteria for alcohol dependency. Additionally, during the research interview, four participants reported that their drinking had increased since surgery. Two of these expressed this was because they used alcohol to increase their calorie intake, due to difficulties in digesting food and a concern about not maintaining a healthy weight. These anecdotal findings concur with evidence from a study by Kruseman, et al. (2010) which found that patients assessed eight years post-RYGB were concerned they were substituting food for alcohol or cannabis. These findings might lend support to the theory of transfer addiction or symptom substitution (Heinberg, Ashton, & Coughlin, 2012; Conason, et al., 2013), which implies that people who overeat to manage their emotions are predisposed to addiction and therefore, following WLS, these patients

might transfer their desire to overeat onto other behaviours, such as misusing drugs, in order to cope.

It should also be considered that the environment (i.e. hospital, CI – Psychologist in Training) might have not facilitated participants accurately reporting alcohol use and illicit drug use given that these can be stigmatizing topics to discuss and have legal implications for the participants. Therefore, these findings are perhaps even more notable given this possibility of underreporting.

Other forms of substance addictions were also found in half of the participants who reported current and previous smoking habits. There were only three who were still smoking and the remaining nine had quit smoking a number of years before WLS, suggesting they had successfully been able to make behavioural changes preoperatively. However, this latter suggestion is dependent on the presumption that these participants had not transferred their desire to smoke onto other forms of coping with their emotions, such as alcohol use or overeating. Previous study findings are mixed with one study finding no significant changes in smoking behaviours 12 months after WLS (Lent et al., 2013) and the other finding a significant increase 24 months postoperatively (Conason, et al., 2013). Thus, participants' smoking and drinking habits, indicates evidence of substance misuse and also management of addictions. Additionally, there is a possibility of symptom substitution, given that 50% of the sample were likely to have an anxiety disorder, two thirds of the sample achieved significant WL and a third were misusing alcohol, thus some evidence of a transfer from overeating to other forms of addictive behaviours was evident. However, as there was no data on participants' preoperative substance use, no conclusion can be drawn as to whether hazardous drinking began after WLS and could be related to difficulties in being able to overeat to manage emotional arousal. Although, patients would have had blood tests to check their liver functioning before WLS and this might have highlighted alcohol or drug misuse, no data was available on this for this thesis. In the light of these limitations, further research is warranted to confirm these outcomes more specifically.

5.2.3 Eating behaviour in the long term

The short-term outcome of WLS is to restrict food intake, thus facilitating WL, and, theoretically, in the long term lead to changes in patients' eating habits. Therefore, it was anticipated, in the current study, that participants would show evidence of healthier eating behaviours postoperatively. Eating behaviours were measured by both standardised and non standardised measures assessing disordered eating symptoms, uncontrolled eating, emotional eating, cognitive restraint (CR) and changes in cravings for sugary foods postoperatively. Findings indicated evidence of disordered eating symptoms, lower uncontrolled and emotional eating, and higher levels of cognitive restraint (CR) over eating. There was however, little evidence that participants' cravings for sugary foods postoperatively had changed from preoperatively. These findings are difficult to interpret, due to the lack of preoperative measures of eating behaviours.

In the current study, there was a low frequency of disordered eating symptoms, and therefore, participants were unlikely to meet the criteria for a specific eating disorder. Earlier studies into eating pathology have identified reductions in binge eating disorders postoperatively (van Hout, Boekestein, Fortuin, Pelle, & van Heck, 2006; Colles et al., 2008; by Herpertz et al., 2003). In contrast, other studies have found that up to a half of all WLS patients report binge eating symptoms postoperatively (Kalarchian, Marcus & Wilson et al., 2002; Kofman, Lent & Swencionis, 2010; Kruseman, Leimgruber, Zumbach et al., 2010). Here, with a lack of evidence of preoperative binge eating, it is not possible to conclude that overeating had abated and equally, this relatively successful sample may well have addressed any preoperative overeating thus contributing to their successful WL.

The evidence that participants exerted substantial effort to refrain from over eating (as reflected by high score on the CR scale) and less uncontrolled eating or eating in response to emotional difficulties fits with the data on binge eating in this sample. Other studies which used the TFEQ-R18 or other standardized questionnaires, showed significant reductions in patients' postoperative rates of uncontrolled eating and increases in cognitive restraint, 1 to 2 year after gastric banding (Colles et al., 2008; Herpertz et al., 2003; van Hout, Boekestein, Fortuin, Pelle, & van Heck, 2006). Considering these findings in light of the fact that participants in the current study had

significantly reduced their obesity, it would appear likely that WLS had resulted in long-term changes in their eating behaviours.

Another prediction made about participants' postoperative eating behaviours was that following WLS, preferences for eating sugary foods might be reduced. This outcome was anticipated since the majority of participants had undergone RYGB and previous studies have shown that up to 60% of such patients reported avoiding sweets post-surgery (Silver, Torquati, Jensen, et al. 2006; Aasheim, Björkman, Søvik, et al. 2009). The reason for this change in eating habits is suspected to be related to dumping syndrome, which is known to occur in up to 76% of RYGB patients (Kushner & Neff, 2010). This syndrome leads to increases in insulin and causes severe side effects (e.g. abdominal cramping, nausea, diarrhea, lightheadedness and sweating) after patients consume sugary foods. Thus participants' conditioned response to craving sugary foods might be expected to change as a result of experiencing recurring episodes of dumping syndrome.

In the current study, these predictions were not supported. Only two out of 14 (58.3%) participants, who reported craving sugary foods preoperatively, reported not craving sugary foods after WLS. Of interest is the fact that three participants (12.5%) in this study developed a 'sweet tooth' postoperatively, suggesting that WLS had a negative impact on their eating preferences, in some participants. However, as dumping syndrome was not captured in this study the connection between this side effect and cravings for sugary foods cannot be confirmed.

5.2.4 Postoperative support and adherence to weight management strategies

The NICE (2014) guidelines state that following WLS all patients should be offered a package of care for a minimum of two years which includes access to a multi-disciplinary team (MDT) that monitor, support and advise them on making lifestyle changes (e.g. diet and exercise). Therefore, it was anticipated that long term outcomes might be affected by postoperative support and adherence, thus, responses to questions on the RIS were used for this purpose to examine whether participants were engaging in monitoring behaviours and what professional support they were offered.

As might be expected, attendance at recommended postoperative appointments has been linked to the amount of postoperative WL. In one study, the number of completed psychological and behavioural interventions was significantly related to a greater percentage of excess weight loss (Peacock & Zizzi, 2012). Similarly, in another study, non-adherence to attending postoperative appointments was greatest in those who did not achieve successful WL (>50 % EWL; Vidal et al. 2014). Therefore, based on these findings, it was anticipated that if participants were adherent to medical advice, they would be more likely to achieve successful WL.

In general, participants monitored their weight, were offered a range of support from the MDT and to a lesser extent were advised about weight management strategies that did not involve medical professionals, such as attending WLS support groups or engaging in exercise. Further sources of advice that participants were able to recall included being given leaflets and information about relevant websites. The majority of participants reported being adherent to professional advice, which was highest for engaging in exercise and attending medical appointments, and lower for attending WLS support groups. Access to psychological services was not offered to the majority of the patients in this study. Therefore, considering these findings in relation to the fact that two thirds of the sample had successfully lost weight, engaging in monitoring of weight and access to a package of professional care, would support these interventions facilitating successful WL long term, in this sample.

This is further substantiated by the only study conducted with bariatric surgery patients which found that RYGB patients who monitored their weight postoperatively were significantly less likely to regain weight that they had already lost following WLS (Odam et al., 2010). Further evidence from a RCT with overweight patients who were not seeking WLS found that frequent self-monitoring of weight (i.e. daily weighing) supported WL (Pacanowski & Levitsky., 2015). However, those who weighed themselves daily over a one year period lost on average of 2.6kg, compared to 0.5kg in those patients who did not weigh themselves at all. Also, these differences only remained significant with men and not women, suggesting effective weight loss strategies may vary across gender. Therefore, the evidence into monitoring weight is limited and in general would indicate having a marginal effect on WL and thus, might only a subtle contributor to successful WL with this sample.

A quarter of participants at follow-up reported being advised to seek support from a MHP, postoperatively and this figure was higher when referring to the medical records, which showed that 50% of the sample had contact with MHP between having WLS and at follow-up. Therefore, this suggests that psychological support might have aided WL as well. These findings are consistent with other research into the positive benefits of participants engaging in psychological and behavioural interventions, on better postoperative WL (Peacock & Zizzi, 2012; Rudolph & Hilbert, 2013).

5.3 What characterises successful weight loss in RYGB patients?

Bariatric surgery is thought to be the most cost effective treatment for morbidly obese adults. However, there are still 20-30% of WLS patients who fail to maintain WL in the long term (Hsu et al., 1998; Buchwald et al., 2004; Sarwer et al., 2005; Angrisani, Lorenzo & Borrelli, 2007; Sjöström et al., 2004). To date there is no consistent evidence on what psychological characteristics influence postoperative WL. Therefore, the third aim of this study was to identify key pre-operative and/or post-operative psychological factors, eating behaviours and weight management strategies that might discriminate between patients who were successful or unsuccessful at weight loss. Since the type of WLS impacts on the likely WL outcome, only participants who had undergone RYGB were considered in addressing this research aim because most of the sample had undergone this procedure.

The successful WL group were significantly more likely to be female, employed and with less obesity comorbidities at postoperative follow up compared to the unsuccessful group. The successful WL group also had significantly fewer disordered eating symptoms, than the unsuccessful WL group. This was an anticipated outcome since previous findings had identified that patients with eating pathology, such as BED, differ significantly in %WL from those without eating pathology (Wadden et al., 2011; De zwann et al., 2002; Pekkarinen et al., 1994; Sallet et al 2007).

Trends in the data, although not statistically significant, indicated that the successful WL group were psychologically healthier compared to the unsuccessful WL group. These were levels of anxiety, depression and weight related physical as well as work

related functioning. This is consistent with previous research findings (Bocchieri et al., 2002; Herpertz et al., 2003; van Hout, 2005; van Hout et al., 2006). However, an unexpected finding in those who achieved successful WL, was a greater concern about their weight related sexual life (moderate range) compared to the unsuccessful WL group (mild range), albeit not significant. This finding was unexpected given that most of the literature points to postoperative improvements in satisfaction with sexual life (Larsen., 1990; Chandarana, Conlon, Holliday, Deslippe, Field., 1990; Rand, Macgregor, Hankins., 1986; Hawke, O'Brien, Watts, Hall, Dunstan, Walsh, Slavotinek, Elmslie., 1990; Hafner, Watts, Rogers., 1991; Kinzli, Trefalt, Fiala, Hotter, Biebl, Aigner., 2001) across generic measures of quality of life and in a study which used the same IWQOL-Lite, questionnaire, 25 months postoperatively (Strains et al., 2014). Differences in previous studies findings as compared with those of the current study, might be attributed to differences in sample size and the length of follow-up.

The successful group also had lower uncontrolled and emotional eating, compared to the unsuccessful group, though this again was not significant. These differences were consistent with previous studies, which had found that postoperative loss of control, or uncontrolled eating, was significantly associated with less postoperative WL, one to seven years after LAGB or RYGB surgery (Kalarchian, et al., 2002; Colles, Dixon & O'Brien, 2008; White, Kalarchian, Masheb, Marcus, Grilo., 2010). Moreover, the successful WL group had a trend towards a reduction in cravings for sugary foods postoperatively, compared to preoperatively, whereas there was no change for the unsuccessful WL group. This finding is consistent with a review by Herpertz et al., (2004) which found a negative relationship between preoperative consumption of high energy dense foods (e.g. sweet foods) and less WL, postoperatively. Patients undergoing RYGB might learn to avoid sugary foods, possibly because it is a conditioned response to experiencing recurring episodes of dumping syndrome that occurs when they eat sugary foods (Silver, Torquati, Jensen, et al. 2006; Aasheim, Björkman, Søvik, et al. 2009).

All of the successful WL group monitored their body weight, compared to 80% who did so in the unsuccessful WL group. Monitoring behaviours such as food intake, weight and exercise are thought to contribute to maintaining WL in overweight males

(Pacanowski & Levitsky., 2015) and in RYGB patients (Odam et al. 2010), following WLS.

Finally, an unexpected observation was that the successful WL group, appeared to be less likely to be offered a range full of postoperative professional support and to be adherent to this provision, than the successful WL group. Conversely, it was predicted that those who achieved greater weight loss would have been offered more and/or a wider range of postoperative support and that they would be more adherent to this support compared to those with less successful weight loss. This hypothesis was based on evidence from five RCTs and a meta-analysis which suggested that patients who were engaged in lifestyle interventions and/or attending support groups had significantly greater WL than those who did not access this support (Kalarchian et al. 2011; Nijamkin et al. 2012; Papalazarou et al., 2010; Sarwer et al., 2012; Tucker et al., 1991; Rudolph & Hilbert, 2013). Yet in the current study, this prediction was not supported. There are a number of possible reasons why the unsuccessful reported being offered more support than the unsuccessful group.

One explanation could be that medical professionals anticipated that these particular patients were likely to need more support after WLS and therefore gave greater encouragement to engage with support. It is surprising that all of the participants in the unsuccessful group reported being offered a wider range of services (with the exception of physiotherapy and psychological services) and that they were adherent to these offers. A more psychological explanation relates to the likelihood that information bias might have occurred with these patients, which is more often to occur when people complete self-report questionnaires (El-Masri., 2014). In particular, for these patients who have experienced repeated failure in WL attempts, after engagement in other weight management interventions that have been provided by the NHS, this topic might be sensitive (Fildes, Charlton, Rudisill, Littlejohns Prevost, & Gulliford., 2015). Therefore, they might want to pose themselves in the best light, or perceive reporting adherence to professional advice as the most socially desirable response (Fisher, 1993).

5.3.1 Characteristics which did not discriminate between successful and unsuccessful WL

There were postoperative psychological factors and eating behaviours that did not discriminate those with successful WL from those with unsuccessful WL. These included symptoms of depression, stress in the last year caused by significant life events, other dimensions of weight related quality of life, substance misuse and cognitive restraint over eating. The reasons for these findings might be attributed to the fact that stress in the last year, symptoms of depression and alcohol misuse were below the clinical range for the majority of the sample.

With exception of stress in the last year, which has not been assessed with WLS patients in studies to date, the findings relating to each of these aspects of psychological functioning are not consistent with previous studies. In particular, previous studies had identified that depression found postoperatively was linked to poorer WL (Zwaan et al. 2011), as was more alcohol use which was positively associated with more weight regain at 28 months after RYGB (Odom et al. 2010). This finding is supported by the theory of transfer addiction, that is, people might transfer their addictive behaviours to other compensatory behaviours to manage their emotional difficulties. These unexpected findings might be attributed to the fact that in other studies the sample sizes have been large and/or that alcohol use was assessed with non-standardised questionnaires or qualitative methods, whereas in the current study, the AUDIT (Saunders, Aasland, Babor et al., 1993) questionnaire, a standardised instrument was used.

For subscales of the weight related quality of life measure, unexpectedly both groups' average scores were in the highest clinical range (severe concern) for self-esteem and sexual life. These findings contrast with a review of the literature by van Hout et al. (2005) which concluded that postoperative higher self-esteem was positively associated with WL and more recently, a study which reported that lower self-esteem, at least two years after RYGB, was linked to unsuccessful WL (Beck, et al. 2010). Again, differences in findings might be attributed to variations in measures used to assess quality of life, self-esteem and satisfaction with sexual life. Nevertheless, the clinical measures employed in this study did not differentiate participants with varying %WL.

With respect to cognitive restraint over eating, both groups scored high postoperatively and yet in other studies, high restraint has been positively associated with WL one and two years postoperatively (Banerjee et al., 2013). However, in the current study, measures of cognitive restraint were assessed much later (on average four years after WLS), this might explain the failure of restraint to discriminate between successful and unsuccessful groups.

5.4 Can weight loss following bariatric surgery be predicted on the basis of psychological characteristics?

In the UK, all patients before bariatric surgery undergo a psychological assessment and for up to 2 years after WLS, are offered follow-up care by the MDT (NICE, 2006, 2014). However, the assessment and follow-up care is not standardised, nor is it clear from the literature what psychological characteristics consistently impact on postoperative WL. Therefore, the principle aim of the current study was to examine what psychological factors might predict %WL following bariatric surgery, in order to improve the preoperative psychological screening and the follow-up care of patients. However, because preoperative data from the medical records was not available, this aim was not achieved. Thus, based on this study alone, it is unclear whether psychological characteristics assessed before surgery can predict %WL.

Instead, data on patients' psychological characteristics after surgery, at the average four year follow-up point, were used to examine their relationship with %WL. It was anticipated that this might highlight factors that the MDT should assess postoperatively in order to improve WLS outcomes. However, a significant relationship between %WL and one out of the fourteen postoperative psychological characteristics was identified. Specifically, a weak negative correlation was found between %WL and the total score of a crude measure of disordered eating symptoms. Additionally, a multiple regression analysis revealed that disordered eating symptoms accounted for 35% of the variance in %WL, only when years since surgery and not when preoperative BMI was included in the model. Thus, eating attitudes and behaviours (such as guilty feelings, urges to overeat and vomiting), appear to be related to the amount of WL, at on average, four years after WLS. The validity of

these findings are partly strengthened by the fact that years since surgery and the type of procedure were controlled for. Additionally, these findings are consistent with previous studies examining the relationship between postoperative disordered eating symptoms (White et al., 2010; Burgmer et al., 2005; Kalarchian et al., 2002; Colles et al., 2008) or BED and %WL (Livhits et al. 2010; Beck, Mehlsen, & Støving, 2012).

Despite these strengths, the multiple regression analysis only provided an estimate of the relationship between the dependent variable and one or more independent variables (or 'predictors'). Thus, this does not imply causation or the direction of causation (Field, 2013). Causation is present when a change in one variable results in a direct change in another variable. Thus, whilst disordered eating symptoms, with years since surgery held constant, predicted a small percentage of %WL, this does not confirm a causative relationship between these variables. There might be other non-measured factors that might directly interact with %WL and disordered eating symptoms (e.g. levels of leptin and ghrelin hormones or other psychological factors). Moreover, these estimated relationships were only identified at one time point, at on average, four years after WLS. Therefore, it is unclear whether this relationship occurred by chance alone. Further testing of this relationship at multiple time points, after WLS, would be needed to strengthen the reliability of these findings. Thus, due to the limitations of the current study analysis, a single or combination of psychological characteristics were not able to predict %WL. Ultimately, based on the current study, psychological characteristics cannot predict %WL.

5.5 Methodological considerations

5.5.1 Strengths

There are several strengths to this study. Firstly, postoperative data was obtained from clinically relevant and standardised instruments. Three of these had also been used in similar studies with WLS patients (Coulman, et al., 2013). Thus, the study had good internal validity. Secondly, service users were involved in the planning stages of the project and thus, this helped to improve the appropriateness of the recruitment material. Thirdly, this was the first UK study to follow-up UK NHS patients, over a longer term (4-10 years) and with clinically relevant standardised questionnaires. Despite these strengths, there are several limitations in the present study that should be considered.

5.5.2 No data on patients' preoperative psychology health

A major limitation of this study was that no preoperative data on patients' psychological health was available before surgery. This therefore prevented the study being able to address the main research aim, to evaluate the psychological predictors of long term WL following bariatric surgery. It was intended that preoperative data would be extracted from the current NHS electronic records system ('SystemOne') and where possible from patients' preoperative psychology assessment reports. However, data were not always available, or in one place (e.g. uploaded medical letters, journal logs and summary pages) and recorded systematically. This was unforeseen given that it is common in the WLS literature for studies to rely on retrieving data from the hospital records systems (Connor, Tremblay, Moher & Gorber, 2007; Christian, King, Yanovski, Courcoulas & Belle, 2013).

Additionally, psychology reports were only available for eleven of the 24 recruited participants. This was despite there being evidence of referrals to psychology for a preoperative screening but with no psychology report or journal entry to confirm the outcome of the assessment. In the Trust, routine preoperative screening commenced four years ago and prior to this only those patients with a history of psychological difficulties were screened. Since 58% of recruited patients underwent WLS at least four years ago, this might explain why there were a limited number of psychology reports available (n = 11, 46%). However, what could not be inferred from this is

whether the absence of a preoperative psychology report, was evidence of no significant psychopathology, before surgery, or not. To strength the reliability of the dataset, only data which was available for at least half of the sample was included.

The implications for these decisions were that a key research aim to determine whether a single or combination of preoperative psychological characteristics could predict %WL, could not be examined. Secondly, the psychological characteristics which differentiated those RYGB patients with successful %WL from those with unsuccessful %WL, as well as the correlational analysis, were based on data captured at one follow-up time point. Hence, these findings might differ at other follow-up time points and thus reduces their reliability. Additionally, as there was no measure of patients' psychological health preoperatively, there was no way of determining whether patients psychological functioning (e.g. alcohol use) had improved, remained the same or deteriorated since WLS. Therefore, due to these limitations, caution should be exercised when interpreting the findings of the current study.

5.5.3 Sample size and representativeness

The CI went to great lengths to contact and recruit a large sample of WLS patients and tried also to focus on recruiting patients who might not attend routine hospital appointments. Strategies to do so included the CI attending WLS support groups, sending postal invitations to participate and displaying posters in the hospital. However, despite these efforts, there was a 10% response rate which is typical for postal recruitment (Patel, Doku, Tennakoon, 2003). Despite these strategies only 24 participants were recruited and completed the questionnaire packs. The reasons for the low response rate could be due to the restriction imposed by the Trust's Research and Development Team to contact eligible participants by post only and enclose the entire recruitment packs which may have appeared onerous. Secondly, it was unclear whether participants' home addresses were up to date given that they were obtained from the hospital computer system and many had been discharged by the dietitian or psychology service. The resulting small sample had implications for the statistical analysis possible and the representativeness of the sample.

The recruited sample size was small and therefore the analyses are likely to be underpowered. The implication of this outcome is that this increased the likelihood of

a type II error that occurs when the null hypothesis is incorrectly accepted, when in fact it is false and there is a difference between the proposed variables or groups. In particular, for the analysis which compared the postoperative differences between those who achieved successful WL from those who did not, the required sample size calculated, prior to recruitment indicated that at least 80 patients, and assuming that 50 percent of these patients achieved successful WL, would need to be recruited. It was anticipated that this sample size would likely detect a mean difference between the successful WL and unsuccessful WL patients, of 0.63 standard deviations on any continuous variable, with power of 80% and a type 1 error probability of 5%. However, only 24 participants were recruited and six had to be removed from the subgroup analysis because they had undergone a different WLS procedure. This resulted in a sample size of nineteen and uneven numbers of participants in each group which can affect the reliability of parametric tests. Confining the analysis to those that had undergone RYGB attempted to remove the variation in weight loss that can occur across different WLS procedures to improve the sensitivity of the analysis given the already small sample and increased the reliability of the study's findings. In addition, many of the psychological factors had high standard deviations relative to the mean which poses a problem for parametric statistics especially when coupled with uneven groups as was the case for the successful and unsuccessful WL groups.

Secondly, examining what combination of variables might predict %WL could have included up to 14 psychological factors measured post-surgery. Moreover, Field (2013) recommends that in order to carry out a multiple regression analysis, there needs to be at least 10 cases for each variable. The small sample size prevented more than two predictor/covariates being entered into the model simultaneously. Thus the analysis of the relationship of symptoms of disordered eating with %WL, was only based on controlling for one covariate in each analysis. Therefore, it is unclear if the sample size was larger and both covariates were entered into the statistical model, whether disordered eating symptoms would still account for a similar proportion of the variance in %WL.

The low response rate and small sample size was also likely to impact on the representativeness of the sample to the wider population. It is proposed that postal response rates of 70% are more likely to ensure that the obtained sample sufficiently

represents the relevant population (Patel, Doku, Tennakoon, 2003) although such a response rate is rare. Therefore, steps were taken to assess the sample's representativeness, by comparing preoperative characteristics of the sample to those of the eligible sample and the UK WLS population. This assessment identified that the recruited and eligible sample was overrepresented in terms of patients who had undergone RYGB type procedure, compared to the wider population and that the recruited sample were approximately 10 kilograms lighter than the wider population. Thus, these comparisons show there is likely to be bias in the data. Also, there is extensive research showing that certain types of people are more likely to take part in research, such as those who have an interest in the subject matter (see Sarre, 2008, review of the current literature) and this appears relevant to the study's sample given that most had undergone WLS approximately four years ago. Therefore, taking these factors into account and the small sample, caution should be exercised when generalizing these study findings to the wider WLS UK population.

5.5.4 Reliability of preoperative weight

For preoperative weight, taken from the medical records was thought to be more reliable than patients self-reports (Connor, Tremblay, Moher & Gorber, 2007; Christian, King, Yanovski, Courcoulas & Belle, 2013). Nevertheless, in the current study preoperative weight recorded in the medical records was relied on and a problem with the date that the preoperative weight was recorded on the hospital system was identified. This date ranged from 17 days to 1 year before surgery, with an average recording date of three months prior to surgery ($M = 106.15$ months, $SD = 30.5$). The concern with this variability in reported preoperative weight is that in order to calculate participants' preoperative BMI and change in weight postoperatively, a reliable preoperative recorded weight is required. Also, given that similar studies in this field had not reported on variations in when preoperative weight was taken it is unclear whether this range is unusual. This recording issue has implications for future studies into WLS and some consensus in terms of what is an acceptable period for recording preoperative weight is required (Beck et al., 2012; Brunault et al., 2012; Livhits et al., 2010).

5.5.5 Reliability of self-report

All of the questionnaires were self-reports and this can lead to validity problems such as patients either exaggerating their symptoms in order to make their situation seem worse, or under-estimating the severity of their symptoms in order to reduce the appearance of their problems. Also, given that the questionnaires were completed in a private room with the CI, this might have affected these validity issues. Instead what the CI recalls as being more apparent in the research appointments were difficulties with participants completing the TFEQ-R18. This standardised questionnaire was developed with an obese population, not with a bariatric surgery population for whom some of the questions were inappropriate. For instance, participants had difficulty in answering questions about the volume of food they consume. For example, question 2, “I deliberately take small helpings as a means of controlling my weight”. Some participants’ responses to this question suggested that they took small helpings of food for a combination of reasons including preventing side effects related to overeating and because they physically could not eat more due to the restrictions of having had WLS. Additionally, the clinical cut off points used to assess participants’ level of concern in the IWQOL-Lite questionnaire were derived from a non-obese sample, not seeking weight loss treatment (Crosby et al., 2004). Therefore, it is unclear what the usual profile would be for bariatric patients and the level of rating which would indicate that the patient requires appropriate professional support.

There is also the issue of patients’ self-reported postoperative weight. Other studies consider that patients self-reports are less reliable than researchers recordings (Connor et al., 2007; Christian, King, Yanovski, Courcoulas & Belle, 2013). To increase the reliability of patients’ postoperative weight, the CI prompted participants before the research appointment to weigh themselves on the day of the appointment and the CI also checked whether they had done this during the appointment. Moreover, the lowest postoperative weight recorded from the medical records was similar to the patients’ self-reported weight at the research appointment and therefore, this implies some consistency in patients’ self-reported postoperative weight.

5.6 Implications for future clinical practice in bariatric surgery

Further aims of the current study were to use the findings to inform clinical practice in bariatric surgery. The first aim was to make recommendations regarding the psychological factors that should be assessed preoperatively, in order to evaluate suitability for surgery and to better align patient characteristics with treatment options. This aim, however, was not addressed because of issues with using the medical records to retrieve preoperative psychological factors, in the current study (see section 5.6.2). Therefore, it still remains unclear whether specific preoperative psychological factors could determine which patients might benefit most from WLS in terms of reducing obesity and improving psychological health. However, given that NICE (2014) does not state what psychological factors should be included in the comprehensive psychological assessment of patients before bariatric surgery and that the literature has not identified consistent psychological characteristics that impact on WL or psychological outcomes after WLS, this might not be an easily achievable aim. Additionally, there are likely to be a number of factors which account for WLS outcomes (e.g. physiological and surgery related factors) and each might contribute differently to WL. Therefore, the presence of any psychological difficulties should not exclude patients from WLS, especially, when current evidence is based on correlational analysis rather than causation (section 1.5). It would also be unethical to deny obese people access to WLS given that it is a cost effective and successful procedure for reducing adult obesity, long term (Picot et al., 2009). Ultimately, the concept of screening patients before surgery should not exclude patients who might benefit from the procedure. Instead screening should focus on preparing patients for the procedure by highlighting psychological risk factors, facilitating time for patients to access support and information, and to be prepared for the changes to their body that may occur (e.g. excess skin post WLS).

The second aim was to make recommendations on psychological factors that should be assessed postoperatively, in order to identify those WLS patients who might benefit from further intervention, ultimately, to facilitate long term WL maintenance as well as reduce the incidences of postoperative psychological/behavioural problems e.g. self-introduced vomiting, substance misuse. Similarly, this aim was not addressed

because of significant limitations in the research study. In particular, missing preoperative data prevented conclusions being drawn as to whether the presence of psychological difficulties after surgery could be attributed to WLS, or if they were evident before surgery. Additionally, the data was captured at one time point (i.e. on average four years after WLS) from a small and likely biased sample. Therefore, before considering changes to clinical practice, further research, addressing the current study's limitations is warranted. This information may give health professionals who are supporting bariatric surgery patients, a better understanding of patients' postoperative difficulties and the predictors of WLS success.

In the interim, the study findings could inform existing postoperative care delivered by health professionals within Mid Yorkshire NHS Trust. In particular, given that NICE already recommends bariatric surgery patients are offered support up to two years after WLS, health professionals might consider screening for evidence of hazardous drinking, problematic anxiety, and weight related quality of life concerns in sexual functioning and self-esteem. Appropriate measures used to assess these psychological and eating related behaviours could include the same clinical questionnaires used in the current study. There is also the possibility of postoperative screening of disordered eating symptoms, given its potential relationship with postoperative %WL. Professionals might consider using validated measures such as the Eating Disorder Examination-Questionnaire (EDE-Q, Fairburn & Beglin, 1994). This is a 28 item self-report questionnaire that measures the frequencies of eating disorder behaviours and can assess binge eating among the obese which might be more appropriate than the 'Symptoms of disordered eating' questionnaire (Kalarchian et al, 2000; Grilo et al, 2013). Ultimately, this assessment might identify patients who require support to maintain successful WL and psychological health.

Given the numerous issues in extracting and using existing medical data contained on the current hospital system, improvements need to be made in the way information is recorded in the Mid Yorkshire NHS Trust and national records systems. Specifically, it is recommended that the Trust consider ensuring that patients' preoperative weight is recorded on the day of their WLS and that any psychology reports or psychological measures are uploaded onto the system so that patients' psychological health can be considered in future studies, with consenting participants. This is especially important

since recruiting patients for this type of research, might prove particularly challenging, as was found in the current study.

5.7 Research recommendations

As this is the first UK study to attempt to follow-up bariatric surgery patients over a longer time frame, using clinically relevant measures, a clear research recommendation would be to replicate this study protocol and to improve the identified limitations. Specifically, to strengthen the reliability of any statistical findings, patients' preoperative and postoperative psychological functioning must be assessed systemically (e.g. using the same standardised questionnaires, clinical interviews). Additionally, a larger UK sample of patients needs to be recruited from multiple NHS sites to increase the representativeness of the sample. This would also increase the scope of statistical testing so that several covariates and predictors could be entered into the final statistical model. This may also include multiple follow-up points which might address cohort effects. Moreover, a recommendation is to consider whether validating the disordered eating questionnaire against standardised measures would be preferable over current questionnaires measuring eating pathology. Finally, objective measures of psychological difficulties such as liver functioning tests carried out before and after surgery, for identifying alcohol misuse, would further strengthen the reliability of the long term outcome analysis.

5.8 Conclusions

This study is thought to be the first UK based study to follow up bariatric surgery patients over a longer period (2-10 years), using clinically relevant objective measures of psychological factors and specific criteria for defining successful WL. These aims were only partly achieved because of the inadequacy of the current medical records preventing data on preoperative assessments being extracted and analysed.

While WLS for these 24 patients had been successful at significantly reducing their level of obesity, it is unclear whether the presence of psychological difficulties (e.g. alcohol misuse, anxiety disorder, quality of life issues and support from a mental health professional) and obesity co-morbidities postoperatively are related to WLS. Additionally, obesity co-morbidities, psychological factors and disordered were able

to discriminate between patients with successful WL, from those with less WL. Disordered eating symptoms were able to explain a small amount of the variance in %WL, even when years since surgery were accounted for ($F(2,16) = 5.77, p < 0.013.$). However, replication of this study with a larger sample, including preoperative psychological measures and utilizing multiple follow-up time points, is required before changes to clinical care for NHS WLS patients can be recommended.

CHAPTER 6: REFERENCES

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CHAPTER 7: APPENDICES

Appendix 1 Personal communication with Arnold van de Laar

From : arnold van de laar <arnoldvandelaar@usa.net> To: Ann Lanham;
Sun 5/3/2015 1:42 PM Re: Validating the alterable weight loss (AWL)

A cut-off of 10% total weight loss is way too low for bariatric surgery outcome. Average % total weight loss after gastric bypass is 33% and about 75% loose more than 25% body weight in the first two year. I would suggest to compare the less successfull 25% of your patients in terms of % total weight loss to the rest (percentile p25)(if they all had the same bariatric procedure).

KR, A van de Laar

Received: Sat, 02 May 2015 05:16:26 PM CEST Subject: Re: Validating the alterable weight loss (AWL)

From: Ann Lanham <umacl@leeds.ac.uk>

To: Arnold van de Laar <arnoldvandelaar@usa.net>

Thank you Mr van de Laar ?for responding to my email so quickly. I am afraid the article does not seem to be attached? Having calculated the % total weight loss for all of my participants, everyone seems to have had successful weight loss, following surgery (% total weight loss = 10%+). Best regards, Ann

From: Arnold van de Laar <arnoldvandelaar@usa.net> To: Ann Lanham

Sent: Saturday, May 2, 2015 2:24 PM

Subject: Re: Validating the alterable weight loss (AWL)

Mrs Lanham,

If you are comparing (groups of) patients with clearly different baseline BMI than it is best to use AWL, as these differences in baseline BMI influence EWL-outcome very strongly. In general however, that effect is weak enough to use % total weight loss instead of AWL. Especially for your study on psychological factors, the common % total weight loss metric should be preferred. It is good that you avoid the EWL metric. You can refer to my articles on the right choice of metrics. I'll attach the copy you request. % total weight loss: $\%WL = 100\% \times (\text{baseline weight} - \text{final weight}) / \text{baseline weight}$.

Kind Regards, A van de Laar

Dear van de Laar AW,

I am contacting you because I was wondering if you would be able to forward me a copy of your paper:

Obes Surg. <<http://www.ncbi.nlm.nih.gov/pubmed/24563106#>> 2014 Jul;24(7):1085-9. doi: 10.1007/s11695-014-1203-4. Validating the alterable weight loss (AWL) metric with 2-year weight loss outcome of 500 patients after gastric bypass. van de Laar AW Dollé MH de Brauw LM, Bruin SC, Acherman YI.

I am a third year, trainee clinical psychologist, who is investigating the psychological factors associated with weight loss in patients who have undergone bariatric surgery. I had planned to use excess body weight as a baseline but after reading some of your papers abstracts I thought I should also use your AWL as well.

Many thanks, Ann Lanham, Psychologist in Clinical Training, University of Leeds

Appendix 2 Pre-operative data capture sheet

Bariatric Surgery Outcome Audit

Pre-operative Information

If data unknown mark with 'X'

Patient ID						
Gender	Male			Female		
DOB						
Age (y/m)						
Weight (kg)						
BMI		O	MO	SMO		
MHP/Alc./Drug	Y	N	Specify:			
MH History	Anxiety	Depression	Self Harm	P/S Abuse	Suicide Attempts	Other
ED History	Y	N	Specify:			
Contact with CP services	Past	Current	Specify:			
Employment Status	FT	PT	UE	S	Other	
Co-Morbidities	Y	N	Specify:			
Medications						
Family Support	Y	N	Specify:			
Risk Evaluation	No Sig. Risks	CP Req'd	Ongoing CP Req'd	Not Rec at Present	Surgery Not Advised	
Exercise History	Y	N	Specify:			
Attendance at WL Group	Y	N	Specify:			
Type of Procedure						
Date of Surgery						
Time in Hospital (d)						
Complications	Y	N	Specify:			

Appendix 3 Postoperative data capture sheet

Bariatric Surgery Outcome Audit

Post-operative Information

If data unknown mark with 'X'

Patient ID						
Gender	Male			Female		
DOB						
Age (y/m)						
Current Weight (kg)						
Lowest Weight (kg)				Date:		
BMI		O		MO		SMO
MHP/Alc./Drug	Y	N		Specify:		
MH Post Surgery	Anxiety	Depression	Self Harm	P/S Abuse	Suicide Attempts	Other
ED Post Surgery	Y	N		Specify:		
Contact with CP services	Past		Current		Specify:	
Employment Status	FT	PT		UE	S	Other
Co-Morbidities	Y	N		Specify:		
Medications						
Family Support	Y	N		Specify:		
Exercise	Y	N		Specify:		
Would you do it again?	Y	N		Comments:		
Would you recommend?	Y	N		Comments:		
Improvements to service?	Y	N		Comments:		

Appendix 4 Recruitment Information sheet (RIS)

<u>RECRUITMENT INFORMATION SHEET</u>

Date of contact: ____ / ____ / ____	Researcher:
-------------------------------------	-------------

First name(s):			
Surname:			
Address:.....			
.....			
Telephone number:			
.....			
Mobile number:			
.....			
Email Address:			
.....			
Date of Birth: / /		Age:	
Female / Male			
Occupation: Employed	Unemployed	Student	
Retired	Housewife/Househusband	Other	
Hours of work - Full time/ Part time			
Night shifts: Yes/No Details.....			
Highest level of education:			
None	GCSE	GCE O Level	AS/A Level
Diploma Degree	Masters	PhD/Doctorate	
What is your current marital status?			
Civil partnership	Co-habiting	Divorced	
Married	Separated	single Widowed	

HEALTH

Height: _____ feet _____ inches Circle: Self-report Measured Notes/ date
 Weight: _____ (stone/kgs) Circle: Self-report Measured Notes/ date
 How would you rate your health? Circle: Self-report Measured Notes/ date
 Not very healthy 1 2 3 4 5 6 7 8 9 10 Extremely healthy Have
 you ever been told you have? (*specify yes, no or unsure in the columns below*)
Before WLS **After WLS** **Current**

Heart Disease			
Stroke			
Transient Ischaemic Attack			
Atherosclerosis			
Vascular disease			
Heart Attack			
Left Ventricular Hypertrophy			
Dyslipidemia			
Hypercholesterolemia (high cholesterol)			
Type 2 Diabetes Mellitus			
Hypertension (high blood pressure)			
Metabolic Syndrome			
Chronic Inflammation			
Hypothyroidism (underactive thyroid)			
Non-alcoholic fatty liver disease			
Sleep Apnoea (abnormal breathing in sleep)			
Asthmas			
Cancer			
Arthritis			
Infertility			
Gall stones/bladder discomfort			

LIFESTYLE

Do you have or have you had any other medical conditions not listed above?

What was this?

When?

How was this treated?

Do you still have it now?

Are you currently taking any medications?

.....
.....

Have you ever smoked? **No, never smoked** **Yes** **Given up**

 If given up, how long ago?

 If you are a current smoker, how many cigarettes do you smoke per day?

How many years have you smoked?.....

How often do you drink alcohol?

Never (*skip to exercise questions*) **monthly or less**

2-4 times a month

2-3 times per week

4 or more times per week

How often do you have six or more drinks on one occasion?

Never (*skip to exercise questions*) **less than monthly**

2-4 times a month

2-3 times per week

4 or more times per week

Do you do regular exercise? **Yes / No**

If yes, how many times a week do you exercise?

One to two

Three to four

More than four

What type of exercise do you do?

.....

About your weight loss surgery

In the last 2-8 years, how many weight loss surgery procedures have you had? _____

Type of weight loss surgery _____

Approximate date of surgery _____

After your weight loss surgery, what advice & support were you given for **weight control**?

	Advised to	still attend/ do
Post-surgery check-ups		
Dietician /nutritionist		
Take nutritional supplements (details_____)		
Attend weight loss support groups (details_____)		
Regular exercise with myself or with a friend		
Physiotherapy		
Psychology / counsellor / mental health professional		
Other _____		

Do you self-monitor your food intake? YES/NO

Do you self-monitor your exercise? YES/NO

Do you self-monitor your weight? YES/NO

Do you crave sugary foods? YES/NO

Before surgery did you crave sugary foods? YES/NO

Is there anything else you want to tell me about your experience since surgery?

Appendix 5 Hospital Anxiety and Depression Scale

HAD Scale

Name: _____

Date: _____

We are aware that emotions play an important part in most illnesses. If we know about these feelings then we will be able to help you more.

This questionnaire is designed to help us know how you feel. Read each item and place a firm tick in the box opposite the reply which come closest to how you have been feeling in the past week.

Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought-out response.

Tick only one box per question

I feel tense or 'wound up':

Most of the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A lot of the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time to time, Occasionally.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I feel as if I am slowed down:

Nearly all the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sometimes.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I still enjoy the things I used to enjoy:

Definitely as much.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not quite so much.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Only a little.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hardly at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I get a sort of frightened feeling like butterflies in the stomach:

Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Occasionally.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quite often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I get a sort of a frightened feeling as if something awful is about to happen:

Very definitely and quite badly.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes, but not too badly.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A little, but it doesn't worry me.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I have lost interest in my appearance:

Definitely.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I don't take so much care as I should.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I may not take quite as much care....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I take just as much care as ever.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I can laugh and see the funny side of things:

As much as I always could.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not quite so much now.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Definitely not so much now.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I feel restless as if I have to be on the move:

Very much indeed.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quite a lot.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not very much.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Worrying thoughts go through my mind:

A great deal of the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A lot of the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
From time to time but not too often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Only occasionally.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I look forward with enjoyment to things:

As much as I ever did.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rather less than I used to.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Definitely less than I used to.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hardly at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I feel cheerful:

Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sometimes.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Most of the time.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I get sudden feelings of panic

Very often indeed.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quite often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not very often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I can sit at ease and feel relaxed:

Definitely.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Usually.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not at all.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I can enjoy a good book or radio or TV programme:

Often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sometimes.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not often.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very seldom.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do not write below this line

Appendix 6 Social Readjustment Rating Scale

Here is a list of 41 life events. Please tick and put the approximate date this occurred to you since having weight loss surgery. If a particular event has happened to you more than once please state that.

Life Event	Since WLS (Yes/No)	When? Year/Months (e.g. June 2011)
1 Death of Spouse		
2 Divorce		
3 Marital separation		
4 Jail term		
5 Death of close family member		
6 Personal injury or illness		
7 Marriage		
8 Fired at work		
9 Marital reconciliation		
10 Retirement		
11 Change in health of family member		
12 Pregnancy		
13 Sex difficulties		
14 Gain of new family member		
15 Business readjustment		
16 Change in financial state		
17 Death of close friend		
18 Change to a different line of work		
19 Change in number of arguments with spouse		
20 Large mortgage		
21 Foreclosure of mortgage or loan		
22 Change in responsibilities at work		
23 Son or daughter leaving home		
24 Trouble with in-laws		
25 Outstanding personal achievement		
26 Spouse begins or stops work		
27 Begin or end school		
28 Change in living conditions		
29 Revision of personal habits		
30 Trouble with boss		
31 Change in work hours or conditions		
32 Change in residence		
33 Change in schools		
34 Change in recreation		
35 Change in church activities		
36 Change in social activities		
37 Loan or debts		
38 Change in sleeping habits		
39 Change in the number of family get-togethers		
40 Change in eating habits		
41 Vacation (trip/holiday)		
42 Christmas		
43 Minor violation of the law		
44 Any other life event or stress since WLS that you		

think impacted on your weight loss or stress

Scoring Sheet for SRRS (researchers use only)

Add values to the right of each item to obtain the total score. The likelihood of stress levels leading to illness and mental health problems: Low < 149, Mild 150-200, Moderate 200-299 and Major >300

Life Event	Value	Life Event	Value
1	100	33	20
2	73	34	19
3	65	35	19
4	63	36	18
5	63	37	17
6	53	38	15
7	50	39	15
8	47	40	15
9	45	41	_____ Person grades themselves
10	45	42	_____
11	44	43	_____
12	40		
13	39		
14	39		
15	39		
16	38		
17	37		
18	36		
19	35		
20	31		
21	30		
22	29		
23	29		
24	29		
25	28		
26	26		
27	26		
28	25		
29	24		
30	23		
31	20		
32	20		
			Total _____

Appendix 7 Impact of Weight on Quality of Life-Lite (IWQOL-Lite)

Impact of Weight on Quality of Life (IWQOL-Lite)

Please answer the following statements by circling the number that best applies to you in the past week. Be as honest as possible. There are no right or wrong answers.

Physical Function		ALWAYS TRUE	OFTEN TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I have trouble picking up objects.	5	4	3	2	1
2.	Because of my weight I have trouble tying my shoelaces.	5	4	3	2	1
3.	Because of my weight I have difficulty getting up from chairs.	5	4	3	2	1
4.	Because of my weight I have trouble using stairs.	5	4	3	2	1
5.	Because of my weight I have difficulty putting on or taking off my clothes.	5	4	3	2	1
6.	Because of my weight I have trouble with mobility (getting around).	5	4	3	2	1
7.	Because of my weight I have trouble crossing my legs.	5	4	3	2	1
8.	I feel short of breath with only mild exertion.	5	4	3	2	1
9.	I am troubled by painful or stiff joints.	5	4	3	2	1
10.	My ankles and lower legs are swollen at the end of the day.	5	4	3	2	1
11.	I am worried about my health.	5	4	3	2	1
Self-esteem		ALWAYS TRUE	OFTEN TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I am self-conscious.	5	4	3	2	1
2.	Because of my weight my self-esteem is not what it could be.	5	4	3	2	1
3.	Because of my weight I feel unsure of myself.	5	4	3	2	1
4.	Because of my weight I don't like myself.	5	4	3	2	1
5.	Because of my weight I am afraid of being rejected.	5	4	3	2	1
6.	Because of my weight I avoid looking in mirrors or seeing myself in photographs.	5	4	3	2	1
7.	Because of my weight I am embarrassed to be seen in public places.	5	4	3	2	1

Sexual Life		ALWAYS TRUE	OFTEN TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I do not enjoy sexual activity.	5	4	3	2	1
2.	Because of my weight I have little or no sexual desire.	5	4	3	2	1
3.	Because of my weight I experience physical difficulties during sexual activity.	5	4	3	2	1
4.	Because of my weight I avoid sexual encounters whenever possible.	5	4	3	2	1

Public Distress		ALWAYS TRUE	OFTEN TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I experience ridicule, teasing, or unwanted attention.	5	4	3	2	1
2.	Because of my weight I worry about fitting into seats in public places (e.g. theatres, cinemas, restaurants, buses, or aeroplanes).	5	4	3	2	1
3.	Because of my weight I worry about fitting through aisles or turnstiles.	5	4	3	2	1
4.	Because of my weight I worry about finding chairs that are strong enough to hold my weight.	5	4	3	2	1
5.	Because of my weight I experience discrimination by others.	5	4	3	2	1

Work (Note: For those not in paid employment, answer with respect to your daily activities.)		ALWAYS TRUE	USUALLY TRUE	SOMETIMES TRUE	RARELY TRUE	NEVER TRUE
1.	Because of my weight I have trouble getting things done or carrying out my responsibilities.	5	4	3	2	1
2.	Because of my weight I am less productive than I could be.	5	4	3	2	1
3.	Because of my weight I feel that I don't receive appropriate pay raises, promotions or recognition at work.	5	4	3	2	1
4.	Because of my weight I am afraid to go for job interviews.	5	4	3	2	1

Appendix 8 Alcohol use disorder identification test (AUDIT) and drug use

This next set of questions asks about alcohol use in the past 12 months?

How often do you have a drink containing alcohol?

- 0. Never Skip to next page
- 1. Monthly or less
- 2. Two to four times a month
- 3. Two to three times per week
- 4. Four or more times a week

How many drinks containing alcohol do you have on a typical day when you are drinking?

- 1 or 2 drinks 3 or 4 drinks 5 or 6 drinks 7 to 9 drinks 10 or more drinks

How often do you have six or more drinks on one occasion?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

How often during the **past 12 months** have you found that you were not able to stop drinking once you had started?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

How often during the **past 12 months** have you failed to do what was normally expected from you because of drinking?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

How often during the **past 12 months** have you needed a first drink in the morning to get yourself going after a heavy drinking session?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

How often during the **past 12 months** have you had a feeling of guilt or remorse after drinking?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

How often during the **past 12 months** have you been unable to remember what happened the night before because you had been drinking?

- Never less than monthly monthly 2 to 3 times/week 4 or more times a week

Have you or someone else been injured as a result of your drinking?

- No Yes, but not in the last year Yes, during the past 12 months

Has a relative or friend or doctor or other health worker been concerned about your drinking or suggested you cut down?

- No Yes, but not in the last year Yes, during the past 12 months

The next set of questions asks about substance use in the past 12 months.

Directions: Indicate your use of any of the substances listed below. *Note: All of your responses will remain confidential.* If you did not use a particular substance, mark “no” and go to the next item. 1.

In the **past 12 months**, other than as prescribed by a physician, have you used any of the following:

Opiates (such as codeine, morphine, heroin, etc.)? No Yes

Amphetamines (such as white crosses, speed, “meth”)? No Yes

Hallucinogens (such as LSD, mescaline)? No Yes

Inhalants (such as sniffing glue)? No Yes

Marijuana/hashish/pot? No Yes

Cocaine/crack? No Yes

PCP/Angel dust? No Yes

Appendix 9 Symptoms of disordered eating questionnaire

1. Do you ever fast for a whole day?
Never Rarely Sometimes Often Very often
2. Do you ever take diet pills to help you lose weight?
Never Rarely Sometimes Often Very often
3. Do you ever take laxatives to help you lose weight?
Never Rarely Sometimes Often Very often
4. Do you ever make yourself vomit to help you lose weight?
Never Rarely Sometimes Often Very often
5. Do you ever exercise to help you lose weight?
Never Rarely Sometimes Often Very often
6. Do you ever experience overwhelming urges to eat and eat and eat?
Never Rarely Sometimes Often Very often
7. Do you ever binge on large amounts of food?
Never Rarely Sometimes Often Very often
8. If you overeat, do you feel very guilty?
Never Rarely Sometimes Often Very often

Appendix 10 Three Factor Eating Questionnaire R18

The following questions ask about your eating behaviours. Please circle the item that best describes your own behaviour over the past seven days.

1. When I smell a sizzling steak or juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
2. When I deliberately take small helpings as a means of controlling my weight.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
3. When I feel anxious, I find myself eating.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
4. Sometimes when I start eating, I just can't seem to stop.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
5. Being with someone who is eating often makes me hungry enough to eat also.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
6. When I feel blue, I often overeat.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
7. When I see a real delicacy, I often get so hungry that I have to eat right away.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
8. I get so hungry that my stomach often seems like a bottomless pit.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
9. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE
10. When I feel lonely, I console myself by eating.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE

11. I consciously hold back at meals in order not to gain weight.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE				
12. I do not eat some foods because they make me fat.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE				
13. I am always hungry enough to eat at any time.	DEFINITELY TRUE	MOSTLY TRUE	MOSTLY FALSE	DEFINITELY FALSE				
14. How often do you feel hungry?	ONLY AT MEAL TIMES	SOMETIMES BETWEEN MEALS	OFTEN BETWEEN MEALS	ALMOST ALWAYS				
15. How frequently do you avoid "stocking up" on tempting foods?	ALMOST NEVER	SELDOM	USUALLY	ALMOST ALWAYS				
16. How likely are you to consciously eat less than you want?	UNLIKELY	SLIGHTLY LIKELY	MODERATELY LIKELY	VERY LIKELY				
17. Do you go on eating binges though you are not hungry?	NEVER	RARELY	SOMETIMES	AT LEAST ONCE A WEEK				
	NO RESTRAINT			TOTAL RESTRAINT				
18. Using the scale to the right, what number would you give yourself?	1	2	3	4	5	6	7	8
1= NO RESTRAINT (eat whatever I want, whenever I want it)								
8= TOTAL RESTRAINT (constantly limit food intake, never 'giving in')								

Appendix 11 Cover letter to bariatric surgery patients

Evaluating the psychological predictors of long term weight loss, following bariatric surgery



Hello, my name is Ann Lanham.

I am a psychologist in clinical training at the University of Leeds.

I am writing to tell you about my research project, which is a requirement of my clinical training. You have been approached as you fit the criteria for this study. The project is investigating what psychological factors are common in patients 2-8 years post-surgery. If you are interested in reading more about this study please read the Participant Information Sheet attached.

If you would like to take part in this study or have any questions please contact me by:

Telephone - 0777 58 36 023 /Dewsbury Hospital 01924 816032

Email- umacl@leeds.ac.uk,

Or return the opt in form

You do not have to respond if you are not interested in this study.

This is your decision and you do not have to participate or give a reason if you do not want to take part. Please do not feel that an enquiry would commit you to anything in any way. If you do not respond, no one will contact you, but you may receive another letter in the mail which you can simply disregard.

Thank you for taking the time to read this,

Ann

OPT-IN FORM

Evaluating the psychological predictors of long term weight loss, following bariatric surgery

Please complete this form and return it to: Ann Lanham, Clinical Psychology Training Programme, University of Leeds, Charles Thackrah Building, 101 Clarendon Road, Leeds, LS2 9LJ

I am interested in learning more about this study. Please contact me using the following information:

Name: _____

Telephone(s): _____

Best time and day to call: _____

Email: _____@_____

Appendix 12 Information sheet and consent form for Bariatric Surgery Patients

Evaluating the psychological predictors of long term weight loss, following bariatric surgery.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully and talk to others about the study if you wish. One of our team is available to go through the information sheet with you and answer any questions you have. Please take your time to decide whether or not you wish to take part.

What is the research about?

This study is evaluating what psychological characteristics can predict long term psychological and weight loss outcomes following bariatric surgery. We want to follow-up patients who have had surgery two to eight years ago and will be collecting information from patients about their physical health, eating habits and mental health. The study will be carried out under the supervision of Professor Louise Dye, Dr Clare Lawton (University of Leeds) and Dr Jo Quinn (Dewsbury and District Hospital). The results from this study will be used by a member of the research team (Ms Ann Lanham) towards her Doctorate in Clinical Psychology (DClin) training qualification.

Why have I been asked to take part?

You have been invited to take part because you have had weight loss surgery at Dewsbury & District Hospital, at least two years ago. We are looking for men and women aged 18 or over, who can understand English.

Do I have to take part?

No, it is up to you to decide whether or not to take part. Your decision will not affect your care at the hospital in any way. If you do decide to take part you will be given a copy of this information sheet to keep and asked to sign a consent form. Even if you decide to take part you are still free to withdraw at any time without having to give a reason. If you do decide to withdraw we will ask you if we can include all data collected from you up to that point.

What will I have to do?

There is one study session (less than one hour) and this can be arranged in a private room at Dewsbury & District Hospital, before or after your next routine hospital appointment, if convenient. Alternatively if you attend the WLS service user support groups, we can arrange a private room, for you to use there.

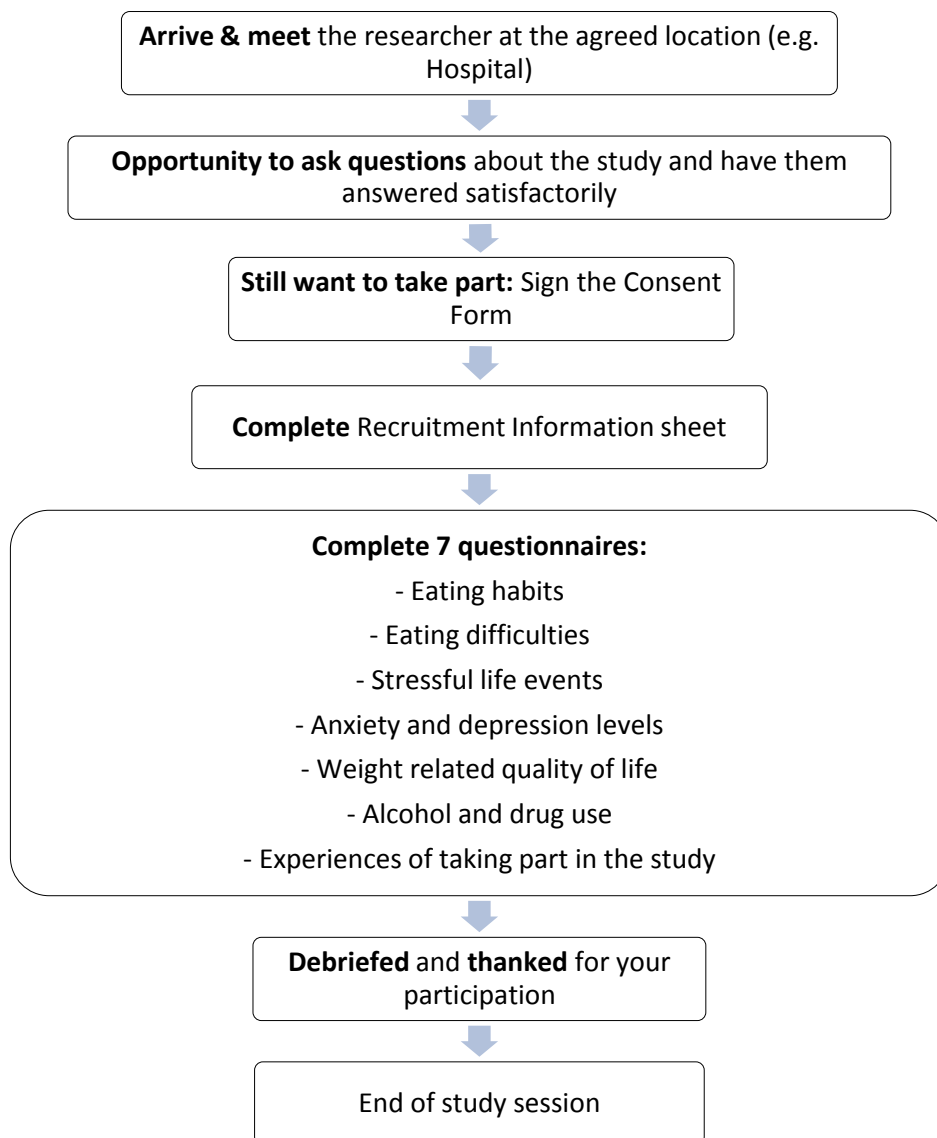
On arrival you will be free to ask any questions you may have about any aspect of the study. If you are still willing to participate in the study, you will be asked to sign a consent form (giving your consent to take part in the study) and to complete a recruitment information sheet. This will ask you various details about yourself (e.g. contact details, age, employment, marital status, physical health and lifestyle) and about your weight loss surgery procedure. I will obtain other information relevant to the study from your medical records with your permission.

You will then be asked to complete 7 short questionnaires about:

- eating habits

- eating difficulties
- stressful life events (e.g. relationships, employment, bereavements)
- anxiety and depression levels
- weight related quality of life
- alcohol and drug use
- your experience of taking part in this study

Once you have completed the last questionnaire, you will be free to ask any further questions about the study and have these questions answered. You will then be thanked for your participation and free to leave. Please see the flow chart, for a summary of what will happen during the study session.



What are the disadvantages of taking part?

Before deciding to take part you should consider the time required to complete the questionnaires. The time taken to complete the study has been kept to a minimum and should take no longer than one hour. We can arrange for your research appointment to be before or after your next routine health assessment, to minimise inconvenience to you. You will need to allow for this extra time on top of your normal visit time.

We will be asking you about your physical and mental health. You may find some of the questions sensitive. If you wish to skip any questions, or do not want to complete the questionnaires then you may do so without having to give a reason. In the event that your responses identify any serious risks or that you may have anxiety or depression we may arrange for you to see a Clinical Psychologist or another Health Professional.

What are the possible benefits of taking part?

We cannot promise the study will help you but the information we get from this study will contribute to the growing research into the long term outcomes of weight loss surgery. This information may help us to improve how we assess people for surgery as well as what advice and support they receive before and after surgery. We will provide you with a summary of the overall findings of the study and this might be helpful for you in managing your weight in the future. You will also be automatically entered into a £50 prize draw.

Will my taking part in the research be kept confidential?

Yes. We will follow the ethical guidelines set out by the British Psychological Society and the NHS. All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised.

If your responses identify thoughts of suicide and/or serious self-harm then the chief investigator will need to consider breaching confidentiality and sharing this information with other professionals. The researcher will be supervised by Dr Jo Quinn, who is the Principal Clinical Psychologist at Dewsbury and District Hospital and may discuss her concerns with her.

If your responses identify less risky issues such as non-adherence to treatment advice or symptoms of mental or physical health decline, we will first discuss these concerns with you and encourage you to contact your GP and will provide you with a list of numbers to get additional help and support.

What will happen to the results of the research study?

When the study is completed the anonymised results will be analysed and used in the write-up of academic research publications and in the Researcher's DCLin thesis. Remember that your own results are confidential and that your name will not be associated with any information published from this study. All of the data will be kept for at least 3 years and then destroyed.

Who has reviewed this study?

All research is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given a favourable opinion by the NHS Research Ethics Committee, [insert committee name here].

Who is organising and funding the research?

This research is funded by the Doctorate of Clinical Psychology programme, at the University of Leeds, where the researcher is training. It is collaboration between the University of Leeds and Dewsbury and District Hospital NHS Trust.

If I want to take part or get more information what do I do next?

If you have any questions or would like to volunteer to take part in this study, please contact:

Ann Lanham
DClin Student / Psychologist in Clinical Training / Chief Investigator
Clinical Psychology Training Programme, University of Leeds
Charles Thackrah Building, 101 Clarendon Road, Leeds, LS2 9LJ
0113 343 2732 or work mobile 0777 58 36 023
umacl@leeds.ac.uk

Other contacts:

Dr Jo Quinn
Principal Clinical Psychologist
Dewsbury District Hospital
01924 816032
Joanne.Quinn@midyorks.nhs.uk

Dr Clare Lawton
Associate Professor of Biopsychology
Institute of Psychological Sciences
University of Leeds
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LS2 9JT
01133435741
c.l.lawton@leeds.ac.uk

Prof Louise Dye
Professor of Nutrition and Behaviour
Institute of Psychological Sciences
University of Leeds
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LS2 9JT
01133435707
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Appendix 13 Consent form

Evaluating the psychological predictors of long term weight loss, following bariatric surgery.

	Please Initial
1. I confirm I have read and understood the Participant Information Sheet for weight loss surgery patients dated 12.09.14 (Version 5) for the above study.	
2. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.	
3. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.	
4. I understand that relevant sections of my medical notes and data collected during the study may be looked at by individuals from University of Leeds, from regulatory authorities or from the NHS Trust, where it is relevant to me taking part in this research. I give permission for these individuals to have access to my records.	
5. I understand that if during the study I disclose thoughts of suicide or serious self-harm, that the researcher may need to breach confidentiality and tell her clinical supervisor (Dr. Joanne Quinn).	
6. I agree to take part in the above study.	

Name of Participant (print name)	Signature	Date
Name of Chief Investigator	Signature	Date

Appendix 14 Recruitment poster displayed in WLS clinics



**We are recruiting
participants who have had
weight loss surgery between 2-8 years ago**

We are recruiting people who are:

- Over 18 years of age
- Adequate comprehension of English (written and verbal)
- Able to give informed consent
- Had bariatric surgery performed between 2 to 8 years ago

The study is ONE session lasting **one hour**.

You will be entered in a **free prize draw** for the chance to win a **£50 love2shop voucher** and will receive a summary of the study findings.

This study has received NHS Ethics Committee approval from NRES Committee South Central – Berkshire. Reference: 14/SC/1186. If you fit the above criteria and you would like to express your interest to participate or have any questions, please contact: **Ann Lanham**

ANN LANHAM
Bariatric surgery study
umac@leeds.ac.uk

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Appendix 15 Summary of the medical data extracted from the hospital records system

Table 1. *Summary of the medical data extracted from the hospital records system*

		Preoperative data	Postoperative data
		<i>n (%)</i>	<i>n (%)</i>
1	Ethnicity	NE	24(100)*
2	Employment status	7 (29)	7 (29)
3	Family support	7 (29)	5 (21)
4	Exercise	12 (50)	17 (71)
5	Attendance at WLS group	8 (33)	NE
6	Preoperative psychology assessment	11 (46)	n/a
7	Contact with mental health services	6 (25)	12 (50)*
8	Anxiety	3 (13)	3 (13)
9	Depression	9 (38)	10 (42)
10	Eating disorders	6 (25)	5 (21)
11	Alcohol/drug use	6 (25)	4 (17)
12	Other psychological difficulties (e.g. stress, bereavement and Bipolar Disorder)	1 (4)	2 (8)
13	Preoperative weight (kg)	20 (83)*	n/a
14	Types & date of surgery	24 (100)*	n/a
15	Complications	15 (63) *	n/a
16	Days in hospital	15 (63) *	n/a
17	Lowest weight postoperatively (kg)	n/a	24 (100)*

*Note: *Retained for analysis, NE Not extracted from the medical records by CI*

Appendix 16 SPSS outputs for testing the distribution of data for %WL

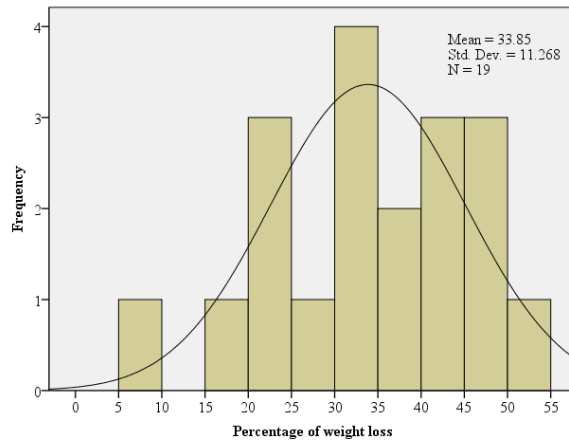


Figure 1 *Frequency histogram of percentage weight loss*

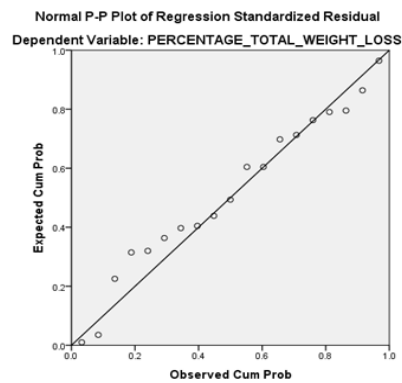


Figure 2 *P-Plot of the standardized residuals of percentage weight loss*

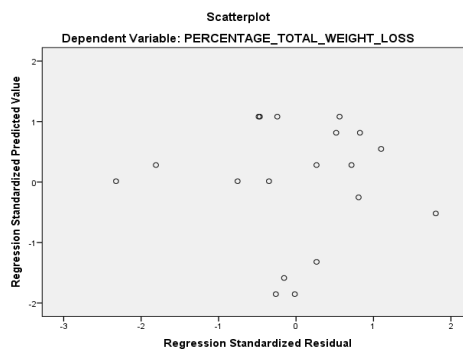


Figure 3 *Scatterplot of percentage weight loss*

Appendix 17 Multi-collinearity between measures

	Alcohol	Physical functioning	Self esteem	Sexual life	Public distress	Work functioning	Total quality of life score	Anxiety	Depression	Level of stress	Disordered eating	Cognitive restraint	Uncontrolled eating	Emotional eating
Alcohol	1	-.013	.243	.132	.179	-.063	.087	-.365	.072	.129	-.028	-.289	-.058	-.121
Physical functioning	-.013	1	.362	.403	.617**	.623**	.655**	.054	-.407	.341	-.107	.394	-.029	.299
Self esteem	.243	.362	1	.677**	.527*	.449	.847**	-.660**	-.630**	.347	-.211	-.295	-.274	-.237
Sexual life	.132	.403	.677**	1	.641**	.542*	.748**	-.452	-.694**	.052	-.078	-.097	-.500*	-.403
Public distress	.179	.617**	.527*	.641**	1	.717**	.791**	-.164	-.502*	-.006	.111	.193	-.103	.146
Work functioning	-.063	.623**	.449	.542*	.717**	1	.741**	-.203	-.761**	.072	-.114	.227	-.313	-.099
Total quality of life	.087	.655**	.847**	.748**	.791**	.741**	1	-.397	-.724**	.249	-.022	.016	-.172	-.068
Anxiety	-.365	.054	-.660**	-.452	-.164	-.203	-.397	1	.440	-.020	.490*	.260	.379	.519*
Depression	.072	-.407	-.630**	-.694**	-.502*	-.761**	-.724**	.440	1	-.038	.326	.013	.595**	.262
Level of stress	.129	.341	.347	.052	-.006	.072	.249	-.020	-.038	1	.032	.101	-.011	-.088
Disordered eating symptoms	-.028	-.107	-.211	-.078	.111	-.114	-.022	.490*	.326	.032	1	.192	.562*	.246
Cognitive restraint	-.289	.394	-.295	-.097	.193	.227	.016	.260	.013	.101	.192	1	.235	.391
Uncontrolled eating	-.058	-.029	-.274	-.500*	-.103	-.313	-.172	.379	.595**	-.011	.562*	.235	1	.516*
Emotional eating	-.121	.299	-.237	-.403	.146	-.099	-.068	.519*	.262	-.088	.246	.391	.516*	1

** . Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed).