The eating-related behaviours, expectations, and experiences of individuals before and after undergoing bariatric surgery.

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Thesis submitted for the degree of
Doctor of Philosophy
October 2017

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Acknowledgements

I would firstly like to thank my supervisors, Professors Anna Chur-Hansen and Gary Wittert.

Anna, thank you so much for your never-ending support, guidance, and encouragement throughout these years. Your positivity and unwavering belief that everything would work out has been more valuable than I can express.

Gary, thank you for being so generous with your knowledge, for your confidence in my abilities, and for challenging me to grow and improve. Your wise guidance has helped me to become a much better researcher.

Further, to my amazing family members and friends, thank you all for your love and for always being there for me. I am so grateful to each and every one of you. A special shout out to my mum, whose belief that I can do anything never seems to falter.

Finally, to Luke, thank you for being who you are, for being my partner in everything, and for your steadfast love, encouragement, and care. And now, on to new adventures!

Personal statement

The motivation for this thesis stemmed from my work with pre- and post-surgery bariatric patients, initially as a trainee psychologist, and now as a registered health psychologist. As part of my first placement as a provisional psychologist almost ten years ago, I began working one-on-one with clients who had undergone gastric banding and co-facilitating a monthly post-banding patient support group at a private bariatric clinic in Adelaide, South Australia. I so enjoyed this work that after obtaining my registration I continued seeing bariatric patients and facilitating the support group while working as a psychologist in private practice.

In this work, I quickly became aware that the bariatric patients I saw before surgery often had worryingly high hopes and expectations about how surgery would change their often-longstanding disordered eating behaviours. Similarly, I saw patients in the years after surgery who were distressed and frustrated that they had been unable to change, or maintain changes related to, their eating behaviours. Working with these patients taught me that while bariatric surgery was a tool that could help patients change their eating, many felt unable to ever make significant changes after surgery, or found that changes they had been able to make soon after surgery incredibly difficult to maintain long-term. However, my exposure primarily to banding patients and generally seeing only those patients who were experiencing difficulties meant that my understanding of these issues was very limited.

I wanted to choose a dissertation topic that would hopefully enhance my own and other clinicians' clinical practice, helping us to better assist clients before and after bariatric surgery. As such, this thesis aims to further our understanding of the eating-related behaviours, expectations, and experiences of individuals who undergo bariatric surgery.

Thesis declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any other university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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I acknowledge the support I have received for my research through the provision of an Australian Government Research Training Program Scholarship.

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Thesis abstract

While a variety of disordered eating behaviours can play significant roles in the development and maintenance of obesity, little is known about their prevalence and implications in individuals who undergo bariatric (weight loss) surgery. Patients' expectations and experiences of eating behaviour change after surgery, and their reasons for undergoing one particular bariatric procedure rather than another, are also not well-understood. This thesis investigated these topics in two reviews and an original research study, with the results presented in four papers.

Paper 1 reviewed the literature on eating-related behaviours, disorders, and expectations in pre-bariatric surgery candidates. A variety of disordered eating behaviours appear more common in bariatric candidates than in non-obese populations, with evidence that 4-45% of candidates have binge eating disorder (BED), 20-60% graze, 2-42% have night eating syndrome (NES), 38-59% emotionally eat, and 17-54% fit the criteria for food addiction. Expectations are high, with candidates believing their procedure will almost guarantee significantly improved eating behaviours.

Paper 2 systematically reviewed the literature on pre- to post-surgery changes in eating disorders and disordered eating behaviours after Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), or vertical sleeve gastrectomy (VSG). Short- to medium-term reductions in BED and related behaviours were common after RYGB. Short- to medium-term reductions in emotional eating and short to long-term reductions in bulimic symptoms were reported after RYGB. Reoccurrences and new occurrences of disordered eating, especially BED and binge episodes, were apparent after RYGB and AGB. Limited and low-quality evidence hindered conclusions and comparisons. The literature was unclear on whether any bariatric procedure leads to long-term improvement in disordered eating.

Using content analysis and quantitative analyses, paper 3 examined patients' reasons for undergoing their particular bariatric procedure rather than another procedure. RYGB was most often chosen because of its *evidence base and success rate*, VSG due to a *medical practitioner's recommendation,*

preference, or choice, and AGB because of *characteristics of the procedure* including its reversibility. A desire to avoid *post-surgical complications and risks* such as leaks or malabsorption was the most commonly cited reason against both RYGB and VSG, while *information and evidence* from failure rates and others' unsuccessful experiences was most common against AGB.

In Paper 4, content analysis and quantitative analyses were utilised to investigate patients' expectations and experiences of eating-related behaviour change after bariatric procedures. The most common pre-surgical expectations were of *eating less and feeling increased satiety* (47.0%) and *reduced hunger* (30.4%). After surgery, patients more often reported positive (84.9%; most often *eating less*) than negative eating-related experiences (43.7%; most often co*ntinued or new problematic/disordered eating behaviours*). Disordered eating behaviours *persisted or emerged* in 17.1% and *improved or resolved* in 18.1%. Negative experiences were more frequently reported at ≥ 18 months than ≤ 1 year. Reporting any negative eating-related experience was related to poorer outcomes after VSG and AGB, but not RYGB. Relationships between negative eating-related experiences and poorer outcomes, and positive experiences and improved outcomes, were significant almost exclusively from ≥ 18 months post-surgery.

The findings of this thesis show that the prevalence and consequences of disordered eating behaviours, eating disorders, and negative eating-related experiences are substantial for pre- and post-surgical bariatric patients. These issues are not always cured or even improved by bariatric surgery, and can continue, worsen, or begin de novo after surgery. Eating-related difficulties may be especially likely to begin or re-emerge at one to two years post-surgery. Patients are likely to benefit from the incorporation of eating-related education, assessment, and provision of therapeutic strategies by bariatric practices from prior to surgery to well beyond two years post-surgery. It is also recommended that surgeons be aware of the different reasons why patients undergo one bariatric procedure rather than another, and ensure that patients receive accurate, unbiased, and individualised information regarding the different procedures.

List of publications contained in this thesis

Please note my surname change, from Opolski to Opozda, in 2016.

Peer-reviewed journal articles

Opolski, M., Chur-Hansen, A., & Wittert, G. (2015). The eating-related behaviours, disorders, and expectations of candidates for bariatric surgery. *Clinical Obesity, 5*(4), 165-197. https://doi.org/10.1111/cob.12104

Opozda, M., Chur-Hansen, A., & Wittert, G. (2016). Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy: A systematic review of pre-post studies. *Obesity Reviews, 17*(8), 770-792. https://doi.org/10.1111/obr.12425

Opozda, M., Wittert, G., & Chur-Hansen, A. (in press). Patients' reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy. *Surgery for Obesity and Related Diseases.* https://doi.org/10.1016/j.soard.2017.07.013

Conference presentations

Opolski, M., Chur-Hansen, A., & Wittert, G. (2015). Problematic eating behaviours and disordered eating before bariatric surgery (oral presentation, M. Opolski). *Australian Psychological Society Health Psychology Conference*, Sydney, Australia, 10-11 April.

Wittert, G., **Opozda, M.**, & Chur-Hansen, A. (2016). Nutrition and eating behaviours in people undergoing bariatric surgery (symposium presentation, G. Wittert). *Obesity Society of Australia and New Zealand (OSSANZ) Conference*, Sydney, Australia, 27-29 October.

Thesis overview

This thesis is an interdisciplinary PhD across psychology and medicine. In 2010, I completed a Master of Psychology (Health), followed by a year of supervised practice to become a health psychologist. During this period and in my subsequent employment as a registered health psychologist, I have worked primarily in behavioural medicine, with a particular focus on overweight, obesity, and bariatric surgery. This research has developed from my interest in this area of practice.

This thesis is presented in the format of a thesis by publication. Four related research articles were written, each of which is presented as published (Papers 1-3) or in manuscript format (Paper 4), and comprises a separate chapter. These research chapters are preceded by introductory and research aims chapters. The final chapter discusses the implications and potential applications of the research findings.

Key abbreviations

AGB	adjustable gastric banding (a.k.a. “lap band” or “banding”)
BED	binge eating disorder
BMI	body mass index
BPD	biliopancreatic diversion
EBMIL	excess BMI loss (%)
EWL	excess weight loss (%)
GLP-1	glucagon-like peptide-1
NES	night eating syndrome
PYY	peptide YY
RYGB	Roux-en-Y gastric bypass (a.k.a. “bypass”)
VSG	vertical sleeve gastrectomy (a.k.a. “sleeve”)

Chapter 1. Literature review

1.1 Obesity

While at a basic level, weight gain occurs when an individual's energy intake exceeds the energy used up through their body's physical processes and activity, obesity is related to a more complex interaction of biological, behavioural, neurological, genetic, environmental, psychological, endocrine, metabolic, cultural, perinatal, developmental, and socioeconomic influences (Karasu, 2012; Mun, Blackburn, & Matthews, 2001). Over 600 million adults, or 13% of the worldwide adult population (11% of men and 15% of women) are obese (World Health Organisation, 2016). In low income countries, obesity mostly affects middle-aged adults, especially women, from wealthy, urban environments. In high income countries, it affects both sexes and all ages, but is disproportionately greater in disadvantaged groups (Swinburn et al., 2011). The worldwide prevalence of obesity is increasing, and no country has reported a significant obesity rate decrease in over 30 years (Ng et al., 2014).

1.1.1 Measuring obesity

Obesity is most commonly determined using body mass index (BMI), a simple ratio calculated by dividing body weight in kilograms by the square of the individual's height in metres. Within the World Health Organisation international BMI classifications for Caucasian adults, a BMI of 25 to < 30 is considered overweight and ≥ 30 is obese (World Health Organisation, 2016). Waist circumference is another valuable measure for identifying increased risk of obesity-related illness related to abdominal fat. Caucasian adults with a waist circumference of ≥ 94cm in males and ≥ 80cm in females are considered at risk of metabolic complications, with that risk viewed as substantially increased at ≥ 102cm and ≥ 88cm respectively (World Health Organisation, 2008).

While BMI continues to be the most often utilised measure of obesity, its inability to account for wide variations in obesity between individuals and population is problematic. Appropriate cut-offs may differ by ethnic group, and BMI does not distinguish between weight from muscle and weight from fat. Accordingly, relationships between BMI and body fat vary according to body build and proportion, and BMI may not correspond to the same degree of fatness across populations (Centres for Disease Control and Prevention, 2011; World Health Organisation, 2000).

1.1.2 Morbidity, mortality, and psychosocial consequences

O'Brien, Brown, and Dixon (2005) call obesity "the consummate pathogen" (p. 310) because of the wide range of other diseases and conditions it can cause or make worse, including Type 2 diabetes, cardiovascular diseases, gallstones, musculoskeletal disorders, and colorectal cancer, endometrial cancer, and cancers of the kidney, breast, pancreas, liver, and gallbladder (Hu, 2008; World Health Organisation, 2016). Some obesity-related conditions can be a primary cause of death, others lead to reduced life expectancy, many involve inconvenience, pain, or reduced mobility, require medication or treatment, and almost all have a negative impact on quality of life (Colquitt, Picot, Loveman, & Frampton, 2014; O'Brien et al., 2005; World Health Organisation, 2016).

Obesity is also related to negative social and psychological consequences (World Health Organisation, 2000). Meta-analyses have reported significant links between obesity and anxiety disorders (Gariepy, Nitka, & Schmitz, 2010) and depression (de Wit et al., 2010). Luppino et al. (2010) found reciprocal links between depression and obesity, with baseline obesity increasing the risk of onset depression by 55%, and baseline depression increasing the risk of developing obesity by 58%. Meta-analyses have also linked poorer quality of life (Ul-Haq, Mackay, Fenwick, & Pell, 2013) and self-esteem (Miller & Downey, 1999) to obesity.

1.2 Obesity, eating disorders, and disordered eating behaviours

Although there are many different causes of obesity, there is substantial evidence that disordered and problematic patterns of eating can be significant contributors to its development and maintenance (Marcus & Wildes, 2014; Tanofsky-Kraff & Yanovski, 2004). Obesity can both result in, and be a result of, these eating behaviours (Fairburn et al., 1998; Stice, Cameron, Killen, Hayward, & Taylor, 2002; Stice, Hayward, Cameron, Killen, & Taylor, 2000; Vogeltanz-Holm et al., 2000; Yanovski, 2003).

In examining links between eating behaviours and obesity, researchers (Conceição, Utzinger, & Pisetsky, 2015; Saunders, 2004; Tanofsky-Kraff & Yanovski, 2004) have noted the importance of investigating both diagnosable eating disorders and "problematic" or "disordered" eating behaviours (henceforth, these terms are used interchangeably). These eating behaviours include both sub-threshold symptoms and other seemingly atypical eating behaviours – generally, "eating that does not meet strict diagnostic criteria but still has a significant impact on daily functioning" (Saunders, 2004, p. 99). Although these eating behaviours do not always involve the distress or impairment intrinsic to eating disorders, they may still play important roles in obesity development or maintenance (Tanofsky-Kraff & Yanovski, 2004).

While there is no consensus on the full range of eating disorders and problematic eating behaviours involved in obesity that should be considered in its treatment (Carter & Jansen, 2012), a number have been implicated as potentially important. They are outlined below.

1.2.1 Binge eating disorder

Binge eating disorder (BED) is an eating disorder characterised by the consumption of an objectively large amount of food in a brief period of time (less than two hours), during which the individual feels they have lost control over their eating and experiences related distress (American Psychiatric Association, 2013). Individuals may eat rapidly, eat until uncomfortably full, eat when not hungry, eat

alone due to embarrassment about their eating behaviours, and feel disgusted, down, or guilty after bingeing (Marcus & Wildes, 2014).

Although BED does occur in normal weight individuals, it is strongly associated with obesity (Marcus & Wildes, 2014). A population-based study (Kessler et al., 2013) of 24000 persons in 14 mostly upper-middle and high-income countries found a higher 12-month prevalence of BED in obese (41.7%) than in normal weight individuals (25.0%). A US study of over 9000 nationally-representative adults (Hudson, Hiripi, Pope Jr, & Kessler, 2007) reported a greater prevalence of severe obesity (BMI $\geq$ 40) in individuals with BED than in those without any eating disorder. The comorbidity of obesity and BED has been associated with increased impairment, with greater psychiatric disorders, psychological symptoms, and distress, and poorer quality of life, appearance dissatisfaction, and lower self-esteem having been reported in obese patients with BED than those without (Bulik, Sullivan, & Kendler, 2002; Herbozo, Schaefer, & Thompson, 2015; Kolotkin et al., 2004; Perez & Warren, 2012; Wadden, Foster, Letizia, & Wilk, 1993; Yanovski, Nelson, Dubbert, & Spitzer, 1993).

1.2.2 Bulimia nervosa

Bulimia is an eating disorder that involves recurrent episodes of binge eating, as per BED, but with inappropriate compensatory behaviours such as self-induced vomiting, laxative or other medication misuse, fasting, or excessive exercise. To diagnose bulimia, the individual's self-evaluation must also be strongly affected by their body shape or weight (American Psychiatric Association, 2013).

The same large studies (Hudson et al., 2007; Kessler et al., 2013) that investigated the prevalence of BED in obese individuals also reported on the prevalence of bulimia. While Kessler et al. (2013) found higher obesity rates in individuals with bulimia nervosa than in those without bulimia and a higher twelve-month prevalence of bulimia in obese (38.1%) than normal weight (26.6%) individuals, Hudson et al. (2007) found no difference in bulimia prevalence related to BMI.

1.2.3 Grazing

Grazing is a potentially problematic eating behaviour involving repetitive, unplanned consumption of small amounts of food eaten continuously over an extended period, resulting in subjective overconsumption (Colles, Dixon, & O'Brien, 2008a). It is differentiated from binge eating by its lack of discrete time limits, the slow way in which the overeating occurs, and the relatively small amounts of food consumed each time the individual eats (Lane & Szabó, 2013). With division amongst researchers and clinicians as to whether grazing requires or generally involves loss of control over eating (Carter & Jansen, 2012; Fairburn, 2008; Saunders, 2004), Conceição et al. (2014a) recently proposed two subtypes: one "compulsive", in which the person feels they cannot resist eating, returning to snack even if not intending to, the other "non-compulsive", characterised by distracted snacking.

While often described as a potential high-risk behaviour for weight gain (Carter & Jansen, 2012; Saunders, 2004), Conceição et al. (2014a) report that grazing "has only rarely been reported and frequently neglected in clinical assessments and research, and little is known about its prevalence and impact on treatment outcomes" (p. 974).

1.2.4 Night eating syndrome

Night eating syndrome (NES) was newly included in the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as recurrent episodes of night eating, after waking from sleep during the night or after dinner, which the individual is aware of and can recall, and which causes significant distress and impairment (American Psychiatric Association, 2013).

Night eating syndrome (NES) has been extensively investigated for its relationship to and implications for obesity. However, NES research is often difficult to interpret due to the variety of assessment criteria used to assess this pattern of behaviour (Cleator, Abbott, Judd, Sutton, & Wilding, 2012). For example, a population-based Swedish twin study (Tholin et al., 2009) reported that night

eating (defined as ≥ 25% of food intake after the evening meal and/or episodes of night time awakening with eating at least once per week) was 2.5 and 2.8 times more common in obese men and women than in normal weight men and women. In a representative German population sample (N = 2456), using the Night Eating Questionnaire to assess NES behavioural and psychological symptoms, NES and BMI were positively associated (de Zwaan, Müller, Allison, Brähler, & Hilbert, 2014). A Danish age- and sex-stratified random sample of over 1000 middle-aged persons (Andersen, Stunkard, Sørensen, Petersen, & Heitmann, 2004) assessed night eating as "getting up at night to eat", and found that obese women with night eating had significantly greater six-year weight gain (5.2kg) than those without (0.9kg). Conversely, a study by Striegel-Moore, Franko, Thompson, Affenito, and Kraemer (2006) of 24-hour dietary intake recalls from over 28000 US-representative individuals found little association between night eating and BMI. Gallant, Lundgren, and Drapeau (2012) suggest that symptoms associated with NES such as night time eating, depression, and sleep-related difficulties, are likely to present a challenge to weight control.

1.2.5 Emotional eating

Links between obesity and emotional eating, "a tendency to overeat in response to negative emotions" (van Strien, Herman, & Verheijden, 2012, p. 782), are not well-understood. While emotional eating theory assumes that negative emotions increase motivation to eat and that the eating reduces the intensity of negative emotions (Canetti, Bachar, & Berry, 2002; Macht & Simons, 2011), emotions may increase food intake in some individuals (e.g. restrained eaters) but decrease intake in others (e.g. non-restrained eaters), and different emotions may increase or decrease eating in the same group of individuals (Macht, 2008).

Emotional eating is associated both with obesity and undesirable effects in obese populations. In a UK study (Blair, Lewis, & Booth, 1990) of 493 individuals with BMIs approximating the general population, baseline BMI was positively associated with emotional eating, and participants with higher baseline emotional eating who had reduced their emotional eating one year later lost

significantly more weight than those with continued high levels of emotional eating. Sung, Lee, and Song (2009) investigated over 1500 Korean twins aged 30+ years, finding that emotional eating was positively associated with weight gain since age 20 and current BMI. Van Strien et al. (2012) reported that emotional eating moderated the effect between overweight and BMI change over a two-year period in a Dutch population representative sample.

1.2.6 Food cravings

A food craving is an intense, difficult to resist desire to consume a particular food or food type (Weingarten & Elston, 1990). Nijs, Franken, and Muris (2007) describe cravings as "an omnipresent phenomenon that is not necessarily pathological or maladaptive" (p. 38). Food cravings are common, with several studies of young adults finding that all females and 70% of males had experienced them in the past year (Pelchat, 1997; Weingarten & Elston, 1991). Cravings are typically for high calorie foods, and may be specific to particular classes of foods, especially sweets, carbohydrates, and high-fat foods (Chao, Grilo, White, & Sinha, 2014; Christensen & Pettijohn, 2001; Greeno, Wing, & Shiffman, 2000; Pelchat, 1997).

Though most people experience them (Hill & Heaton-Brown, 1994; Lafay et al., 2001), obese individuals experience food cravings more frequently than normal weight individuals (Chao et al., 2014; Franken & Muris, 2005; Lafay et al., 2001). Laboratory evidence and questionnaires suggest that cravings for specific high calorie foods are related to their intake in overweight and obese individuals (Chao et al., 2014; Martin, O'Neil, Tollefson, Greenway, & White, 2008). Little is known about the implications of food cravings in obesity, though several studies have linked food cravings and binge eating behaviours (Chao, Grilo, & Sinha, 2016; Schlundt, Virts, Sbrocco, Pope-Cordle, & Hill, 1993).

1.2.7 Food addiction

Food addiction is a controversial concept. There is currently no consensus whether food addiction is a clinical disorder, and it has no universally accepted definition (Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014). Critics argue that human evidence for food addiction is limited and inconsistent, cite substantial differences in the brain mechanisms of food and drug reward, and note disagreements and difficulties in defining and measuring food addiction (Benton, 2010; Meule & Kübler, 2012; Ziauddeen, Faroogi, & Fletcher, 2012; Ziauddeen & Fletcher, 2013). Conversely, its supporters have stated that the degree of overlap between consumption of highly palatable foods and addictive drugs is "significant and compelling" (Gearhardt, Davis, Kuschner, & Brownell, 2011, p. 144).

Assessment of food addiction has relied largely on the Yale Food Addiction Scale (YFAS; Gearhardt, Corbin, & Brownell, 2009), which adapted the DSM-IV diagnostic criteria for substance dependence to eating behaviours. A systematic review of 25 studies using the YFAS (Pursey et al., 2014) found a weighted mean food addiction prevalence of 24.9% in overweight and obese individuals, compared to 11.1% in normal weight persons. In a further review of 40 YFAS studies, Long, Blundell, and Finlayson (2015) reported 4-5 times greater food addiction prevalence in overweight and obese versus general population samples, with consistent evidence that overweight and obese individuals meeting food addiction criteria were more likely to report binge eating behaviours or fit BED criteria.

1.3 Surgical interventions for obesity

At the individual level, weight reduction strategies based on diet, medication, psychological therapies, and exercise have demonstrated, at best, only moderate success in achieving long-term weight reduction in obesity (Avenell et al., 2004). Even those that are more often effective for individuals with lower BMIs, at least in the short-term, are usually ineffective for those with more severe obesity (Mann et al., 2007; Sarwer et al., 2004). With the limited impact of these approaches to weight loss, surgical interventions have increased in popularity (Zimmerman et al., 2007). Bariatric surgery is the

most effective treatment currently available for obesity (Buchwald, 2005; Colquitt et al., 2014; National Health and Medical Research Council, 2004).

1.3.1 Common bariatric procedures

The most common bariatric operations are currently Roux-en-Y gastric bypass (RYGB; 45% of all worldwide procedures), vertical sleeve gastrectomy (VSG; 37%), and adjustable gastric banding (AGB; 10%). Preferred procedures differ by region, with VSG the most frequently performed procedure in North America and the Asia-Pacific region (including in Australia), and RYGB the most common procedure in Europe and Latin and South America. While VSG has risen rapidly from 0% of procedures in 2003, AGB has fallen sharply from its 2008 peak of 68% of all worldwide procedures (Angrisani et al., 2015).

1.3.1.1 Roux-en-Y gastric bypass

RYGB (Figure 1.1) combines restrictive and malabsorptive techniques, creating both a small gastric pouch and a bypass that prevents individuals from absorbing all they have ingested. The gastric pouch (15-30ml) is created by stapling across the upper stomach, partitioning the two portions. The small intestine is divided below the lower stomach outlet and is reconfigured into a Y arrangement, enabling outflow of food from the upper stomach pouch via a Roux limb, which is constructed from 75-150cm of small intestine. The remaining intestine is preserved to absorb nutrients. Gastric, pancreatic, and biliary secretions continue to be produced and flow from the lower stomach portion, mixing with food at the jejuno-jejunum connection. RYGB is reversible (Colquitt et al., 2014).

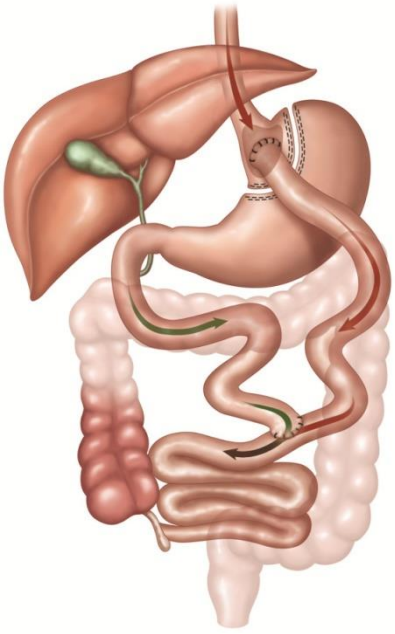

Figure 1.1. Roux-en-Y gastric bypass (RYGB).[1]

1.3.1.2 Vertical sleeve gastrectomy

VSG (Figure 1.2) was initially carried out as the first stage of the biliopancreatic diversion with duodenal switch, but gained significant popularity (Regan, Inabnet, & Gagner, 2003) after being approved a standalone primary procedure in 2009 (Clinical Issues Committee of the American Society for Metabolic and Bariatric Surgery, 2010). The operation is relatively simple, involving removal of the greater curvature of the stomach, reducing it to around 20-30% of its original size and resulting in a sleeve-like or tubular stomach. The pyloric valve at the bottom of the stomach is left intact, resulting in unaltered stomach function and digestion. The procedure is not reversible (Colquitt et al., 2014; Miras & le Roux, 2013), though RYGB may be added later in cases of inadequate restriction or failed weight loss (Colquitt et al., 2014).

[1] Images in Figures 1.1, 1.2, and 1.3 used with permission from Can Stock Photo.

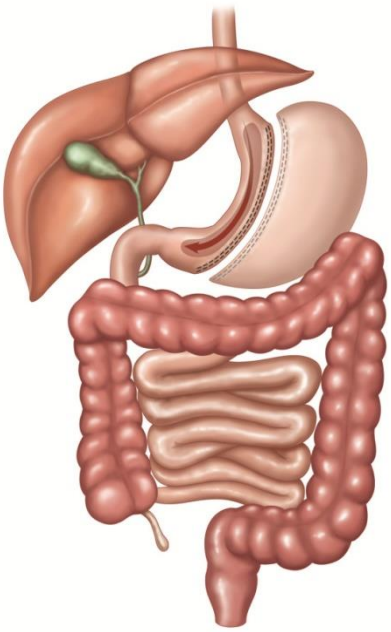

Figure 1.2. Vertical sleeve gastrectomy (VSG).

1.3.1.3 Adjustable gastric banding

AGB (Figure 1.3) is considered the least invasive surgery (Abeles, Tari, & Shikora, 2010). It is a restrictive procedure in which a constricting plastic and silicone band is placed around the uppermost portion of the stomach to create a small upper gastric pouch. An inflatable balloon within the band's lining, to which saline is added or removed via injection into a subcutaneous port, allows adjustment to the restriction size in order to regulate possible food intake and the degree of induced satiety (Colquitt et al., 2014; O'Brien et al., 2005; O'Brien, Dixon, & Brown, 2004).

While historically grouped with VSG as 'restrictive' procedures, the mechanisms of these two surgeries are very different. Stefater et al. (2012) report that behavioural and physiological changes after RYGB and VSG suggest that both cause alterations to the "defended level of body weight, preventing normal responses to food restriction that make maintaining significant non-surgical weight loss so difficult", while "many of the behavioural changes and the much less dramatic changes in gut hormone secretion indicate that physical restriction may play a much more important role to produce effects of AGB" (p. 612).

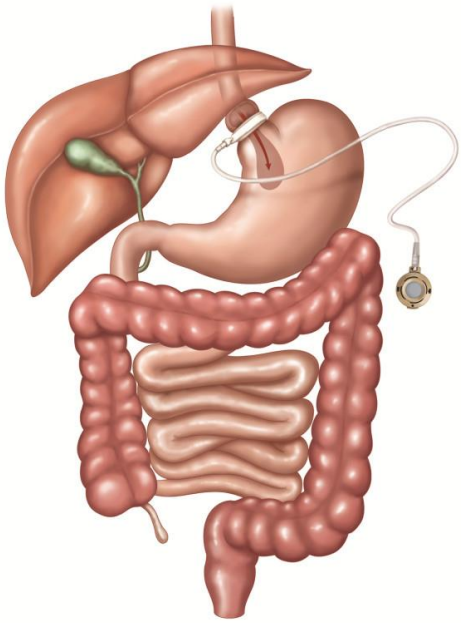

Figure 1.3. Adjustable gastric banding (AGB).

1.3.2 Weight loss, lack of loss, and regain by procedure

Weight changes are the most commonly evaluated outcome of bariatric surgery. All currently-used bariatric procedures can result in significantly greater, longer-term weight loss than conventional treatment such as diets, exercise, and pharmacological measures (Colquitt et al., 2014). However, a Cochrane review of 22 studies noted that while weight loss and changes in obesity-related comorbidities were similar in RYGB and VSG, both procedures had better outcomes than AGB (Colquitt et al., 2014).

A substantial minority of patients do not lose a significant amount of weight after bariatric surgery, with rates appearing to vary by procedure. Sjöström et al. (2004) found that at 10 years post-surgery, 8.8% of RYGB patients and 25.0% of AGB patients had lost less than five percent of their initial weight. Similarly, Caiazzo and Pattou (2013) noted weight loss failure rates (< 50% EWL) of 50% after AGB, 33% in VSG, and 23% in RYGB. Weight regain after an initial loss is a further issue. The prospective Swedish Obese Subjects study (Sjöström et al., 2007) found maximum weight loss

(RYGB 32%, AGB 20%) at 1-2 years post-surgery, with significant average regain in both procedures (RYGB 7% and AGB 6% increase from maximum loss) at 10 years post-surgery. Similarly, in a prospective longitudinal study (Magro et al., 2008), excess BMI loss was statistically significant up to 18 months after RYGB, but was no longer significant after 24 months, and weight regain was significant within 48 months of surgery.

1.3.3 Surgical criteria, evaluation, and contraindications

Clinical guidelines in countries including the United States, the United Kingdom, and Australia recommend considering surgical interventions for the treatment of obesity in individuals with a BMI ≥ 40, or 35 to < 40 with serious medical comorbidities, for whom appropriate non-surgical measures have not resulted in adequate, sustained weight loss (National Health and Medical Research Council, 2004; National Institute for Health and Care Excellence, 2006; National Institutes of Health Consensus Development Conference Panel, 1992). The UK National Institute for Health and Care Excellence guidelines also recommend bariatric surgery as the first-line option for adults with a BMI > 50 (National Institute for Health and Care Excellence, 2006). However, given variations in adiposity and risk of obesity-related comorbidities, ethnic-specific differences should also be considered when determining an individual's suitability for bariatric surgery (Dixon, 2011).

As recommended by the Surgical Review Corporation and American College of Surgeons (Huberman, 2008), many bariatric programs include psychological evaluation as part of the pre-operative screening procedure. Factors often considered important for evaluation include disordered eating such as binge eating, night eating, and grazing, current and past psychiatric disorders and substance abuse or dependence, unrealistic expectations of surgery and life after surgery, previous treatment non-compliance, current life stressors, and knowledge of and preparedness for life after bariatric surgery (Dziurowicz-Kozlowska, Wierzbicki, Lisik, Wasiak, & Kosieradzki, 2006; Fabricatore, Crerand, Wadden, Sarwer, & Krasucki, 2006; Sarwer et al., 2004; Wadden & Sarwer, 2006; Zimmerman et al., 2007). However, there is little consensus as to what constitutes an

appropriate screening process, and what factors should result in postponement, or contraindicate bariatric surgery (Zimmerman et al., 2007). In a study of almost 200 mental health professionals who conducted pre-bariatric evaluations, Fabricatore et al. (2006) found that no single specific factor was endorsed as a contraindication for surgery by more than 50% of the sample.

1.3.4 Patient reasons for undergoing bariatric surgery

Patient reasons for undergoing bariatric surgery often relate to medical issues, health concerns, pain, mobility, psychological well-being and quality of life, appearance and self-esteem, relationships, and family or social functioning (Kaly et al., 2008; Libeton, Dixon, Laurie, & O'Brien, 2004; Munoz et al., 2007). One psychologist (Huberman, 2008) reported that a primary motivation cited by "an overwhelming number of patients" is "to end the psychological exhaustion from dieting and chronic feelings of failure for their inability to lose weight." He noted that while the majority of candidates presenting for surgery have successfully lost weight before, "most patients believe that maintaining such weight loss with diet and exercise is commonplace […] although virtually all clinical research suggests this is hardly the case" (p. 45).

1.3.5 Choosing a bariatric procedure

Selecting the most appropriate bariatric procedure is often an unclear process. Needleman (2008) notes that "in experienced hands, most operations have the ability to be successful in providing a given patient meaningful weight loss and impart better health through loss of adiposity, amelioration of comorbidities, and improvement of overall quality of life" (p. 1005). However, a patient's characteristics and circumstances may mean that they are more likely to achieve a more successful outcome with one procedure than another. For example, a nationwide French study found that the best profile for a successful outcome (EWL > 50%) at two years after AGB was a patient who was < 40 years old, with an initial BMI < 50, who changed their eating habits and was physically active after surgery (Chevallier et al., 2007).

With no consensus on one "best" bariatric procedure for everyone and no simple flow chart available to indicate which surgery best suits each patient, a thorough understanding of the patient's medical history, their expectations of surgery, and information from the dietitian and psychologist on the patient's dietary habits, psychosocial history, and behavioural patterns may assist the bariatric team to guide the patient toward the procedure that best fits their needs (Khan, Madan, & Tichansky, 2008; Needleman & Happel, 2008). Little is understood about why bariatric patients choose to undergo one particular procedure over other potential options. Research suggests that procedures are often selected based on either the surgeon's preference or the patient's choice (Khan et al., 2008), and Ren, Cabrera, Rajaram, and Fielding (2005) found that Australian patients primarily chose AGB for its "safety", while US patients most often cited its reputation as the "least invasive" operation. RYGB was preferred by US patients because of its "lack of a foreign body" and "inability to cheat". For Australians, a desire for "dumping" was the most common reason for preferring RYGB. Dumping syndrome is an adverse event most often linked with RYGB. Caused by eating refined sugar, it involves symptoms such as nausea, shaking, feeling faint, diarrhoea, and rapid heart rate, and is believed to aid weight loss by conditioning individuals to limit their consumption of triggering foods (Colquitt et al., 2014; Miras & le Roux, 2013; Stefater et al., 2012). No studies have investigated patients' wider repertoires of reasons for and against bariatric procedures, or have compared these in the three most common current procedures.

1.4 Pre- and post-bariatric eating expectations, behaviours, and experiences

A number of issues related to the incidence and impact of problematic and disordered eating behaviours before and after bariatric surgery have been under-explored in the literature to date. These include: (1) the prevalence of problematic and disordered eating behaviours in pre-surgical candidates and candidates' expectations of how their eating will change after surgery, (2) post-surgical occurrences, reoccurrences, remission, and changes in disordered eating behaviours and eating disorders from pre- to post-surgery and over time after surgery, (3) whether pre- to post-surgical

changes in eating disorders and disordered eating behaviours vary by bariatric procedure, and (4) patients' experiences of eating behaviour change since surgery.

1.4.1 Pre-surgery eating-related behaviours and expectations

While there is substantial evidence that particular eating disorders and disordered eating behaviours are common and often associated with problematic outcomes in obese individuals, the commonality and implications of these behaviours for bariatric candidates (individuals who are in process to undergo bariatric surgery) require investigation. Although studies have examined the prevalence of a variety of eating disorders and disordered eating behaviours in pre-surgical candidates, those findings have not yet been systematically summarised and their implications assessed. Similarly, there has been no systematic examination of the literature on how pre-surgical bariatric patients believe their eating will change after surgery.

1.4.2 Changes pre- to post-surgery and over time after surgery

1.4.2.1 Remissions, reductions, occurrences, and reoccurrences

While decreases in disordered eating behaviours and eating disorders appear common after bariatric surgery, for some patients, unhealthy eating behaviours appear to persist, or new ones develop (Dodsworth, Warren-Forward, & Baines, 2010; Zunker, Karr, Saunders, & Mitchell, 2012). Colles, Dixon, and O'Brien (2008a) examined 129 patients before and one year after AGB (80.0% female; mean BMI 44.3), finding continued or new cases of binge eating disorder (3.1% vs. 14% pre-surgery), uncontrolled eating (22.5% vs. 31%), and night eating syndrome (7.8% vs. 17.1%), and a post-surgical increase in grazing (38.0% vs. 26.3%). Similarly, in a systematic review of 14 studies, Dodsworth, Warren-Forward, and Baines (2010) found significant reductions in binge eating behaviours at one and five years after AGB, but noted their continuation or reoccurrence in 11-33% of patients.

1.4.2.2 Changes in patterns of behaviours

Patterns of disordered eating may change from pre-surgery due to limitations imposed by the procedure. For example, though binge eating might decline because of new physical limitations and increased negative consequences of bingeing after surgery (e.g., food blockages, regurgitation), uncontrolled eating may remain problematic, manifesting instead as frequent grazing or as a subjective sense of loss of control over eating despite eating smaller amounts than prior to surgery (Colles et al., 2008a). Patients may also continue to eat in response to emotions, or as a coping mechanism (Fischer et al., 2007). Franks and Kaiser (2008) warn that if patients "are not prepared to cope with a return of hunger cues or a tendency to eat despite a lack of hunger cues, the efficacy of the surgery as a weight loss tool may be diminished" (p.81). All of these behaviours may reflect a post-surgical continuation of disordered eating (Colles et al., 2008a; Dodsworth et al., 2010; van Hout, 2005).

1.4.2.3 One to two years post-surgery: Return of hunger, cravings, and disordered eating?

One to two years post-surgery may be a significant time for the occurrence or reoccurrence of eating disorders, disordered eating behaviours, hunger, and cravings. Several explanations for this have been suggested. Hsu, Sullivan, and Benotti (1997) hypothesised that in the initial post-surgery period many patients experience a reduction or extinction of their pre-surgical eating disturbances, likely due to a forced temporary restriction caused by their surgery, during which the individual loses weight. However, as time passes, patients learn how to work with and around their restrictions, subsequently experiencing a reoccurrence of their disordered eating and beginning to regain weight. Larsen et al. (2004) suggested that a decrease in positive reinforcement experienced by patients when their weight stabilises or re-increases at around two years post-surgery may lead to difficulties maintaining helpful eating behaviours. Further investigation is needed into this pattern.

1.4.3 Differences in problematic eating by surgical procedure

Significant attention has focused on whether eating behaviours are changed by bariatric surgery overall. However, despite their significantly differing physiological changes, mechanisms, and outcomes, much less research has examined whether the varying "anatomical realities" of different bariatric surgeries "lead to differing consequences for eating behaviours" (Herpertz et al., 2003, p. 1308). Just one review has compared eating behaviours after different procedures. Herpertz et al. (2003) examined studies with at least one year of follow-up to investigate changes in BED and related behaviours, eating disorder scores, general eating behaviours, and the acceptability and variability of foods after restrictive procedures (9 studies), RYGB (5 studies), or biliopancreatic diversion (BPD; 7 studies). The authors concluded that "exclusively restrictive surgery procedures such as gastric banding or gastroplasty have a different impact on eating behaviour compared with bypass procedures such as gastric bypass or biliopancreatic diversion' (p.1310–1311). In spite of this, more recent reviews of eating behaviour change after bariatric surgeries have either focused on a single procedure (Dodsworth et al., 2010) or examined multiple procedures under a single 'bariatric surgery' banner (Meany, Conceição, & Mitchell, 2014; Niego, Kofman, Weiss, & Geliebter, 2007; Wimmelmann, Dela, & Mortensen, 2014).

1.4.4 Patient experiences of post-surgical eating behaviour change

While studies have reported on patients' experiences of eating behaviour change after bariatric surgery, the wider qualitative data have not been synthesised, and little has been reported on the expectations and experiences of patients undergoing different procedures. Ogden, Clementi, and Aylwin (2006) found that post-surgical (8 AGB, 5 RYGB, 1 VSG, 1 vertical stapled bypass; 4-33 months post-surgery; 93.3% female) patients saw surgery as having changed their eating by "forcing" reduced food intake via smaller stomach capacity and the negative effects (e.g. regurgitation) of eating certain types or too-large portions of food. The inability to eat large amounts was believed to cause reduced food focus and less hunger. Zijlstra, Boeije, Larsen, van Ramshorst, and Geenen (2009)

interviewed 11 patients with unsuccessful weight loss (current BMI ≥ 40 and < 10 BMI points loss two years post-surgery and at interview) 2-5 years after AGB. All interviewees initially lost weight and could eat only small amounts. However, as time passed most again felt hungry soon after eating, reported finding solid food difficult to eat, and experienced pain and regurgitation after eating too much or too quickly. During negative emotional states, they felt especially tempted to eat sweet and high-fat snacks that passed easily through their band. Ogden, Avenell, and Ellis (2011) interviewed 10 patients up to 10 years after AGB (n = 7) or RYGB (n = 3) whose outcomes were unsuccessful (regain, loss deemed insufficient by the participant, or loss small enough to warrant subsequent surgery). These individuals attributed failure to factors including surgery not having provided the desired restriction over their eating, "cheating", finding ways to eat more than they knew they should, and comfort eating.

1.5 Eating-related changes after bariatric surgery

1.5.1 How are eating behaviours 'supposed' to change after surgery?

Clinicians and researchers commonly frame bariatric surgery as a 'tool', highlighting that the changes and assistance provided by surgery need to be accompanied by patient-driven behaviour change (Natvik, Gjenedal, Moltu, & Råheim, 2014). While bariatric surgeries generally make dietary changes necessary, especially regarding amounts of food eaten and the speed at which individuals can eat, they do not force patients into a single new way of healthful and helpful eating. Vigilance, planning, and effort are generally required to achieve positive eating-related changes (Hillersdal, Christensen, & Holm, 2016).

Patients are often required to complete a two to three-week course of a very low calorie diet (VLCD) in the lead up to their surgery (Gerber, Anderin, & Thorell, 2014). In the first five to eight weeks after surgery, patients are also required to initially implement a restrictive liquid diet, generally followed by the introduction of soft foods, and progressively introducing more solid foods until returning to a diet

of ‘normal’ consistency (Conceição, Vaz, Pinto Bastos, Ramos, & Machado, 2013a; Shannon, Gervasoni, & Williams, 2013). There are a number of further eating-related guidelines for patients to follow after surgery. These usually include guidance to always eat very small meals, maintain a much-reduced caloric intake, avoid snacking, avoid carbonated and high-calorie drinks, increase water intake, take vitamins, eat protein, avoid high fat and high sugar foods, and avoid binge eating and grazing (Colles et al., 2008a; Elkins et al., 2005; Hsu et al., 1997; Saunders, 2004). While patients are advised that lifetime compliance is essential for sustained health improvement and weight loss (Elkins et al., 2005), there is a great degree of variance in post-surgical compliance (Hillersdal et al., 2016).

1.5.2 Physiological effects of bariatric procedures on food intake, hunger, and satiety

Originally conceived to reduce weight and maintain weight loss primarily by restricting food intake and/or causing food malabsorption (Colquitt et al., 2014; Dixon & Waters, 2003), the physiological effects of bariatric procedures on eating, hunger, and satiety are now known to be much more complex than first believed (Madura & Di Baise, 2012). They also vary widely by procedure.

RYGB is thought to result in eating-related changes including restriction of food intake, malabsorption of ingested food and drink, and increased satiation. Changes to various hunger and satiety hormones, including increased postprandial glucagon-like peptide-1 (GLP-1) independent of weight loss, increased postprandial peptide YY (PYY), and reduced total ghrelin also occur. Additional RYGB mechanisms include altered changed food preferences leading to decreased fat and sugar intake, reduced food reward, increased diet-induced energy expenditure, and conditioning against eating sugar-containing foods related to dumping syndrome (Colquitt et al., 2014; Miras & le Roux, 2013; Stefater et al., 2012).

VSG appears to involve many changes similar to RYGB. It leads to reduced food intake and increased gastric emptying, and involves hormonal changes including decreases in ghrelin, weight loss-independent increases in GLP-1, increased post-meal levels of PYY, and increased plasma bile acid

levels. Circulating leptin levels are lower in patients after VSG than expected based on their weight. However, there is mixed evidence regarding changes to post-VSG consumption of fat and sugar and changes in food reward (Miras & le Roux, 2013; Stefater et al., 2012).

AGB is believed to cause weight loss via decreased food intake, decreased leptin, and reduction of hunger, with limited evidence suggesting that vagal signalling changes are probably the most likely mechanism through which AGB reduces food intake and induces weight loss (Miras & le Roux, 2013). Unlike after RYGB and VSG, circulating ghrelin increases after AGB, and the increase in circulating GLP-1 after AGB is much lower than after the two other surgeries. AGB is associated with unchanged or increased consumption of fat and sugar, increased caloric liquids, and consumption of fewer fruits and vegetables than after RYGB. Food reward is unchanged or increased (Miras & le Roux, 2013; Stefater et al., 2012).

1.5.3 Differentiating disordered eating after surgery

Engel et al. (2012) note that despite expectations for patient post-operative behaviour, "what constitutes 'typical' or 'normal' eating behaviour after bariatric surgery is unclear". As patients may engage in restrictive or compensatory behaviours to reduce or avoid post-surgical symptoms, post-surgical diets "may mimic eating disordered behaviours or symptoms" (p. 91). Some relatively common post-surgical behaviours, such as eating too fast or too much, leading the patient to vomit either spontaneously or in a self-induced manner to relieve discomfort (de Zwaan et al., 2010), appear to mimic the symptoms of an eating disorder (Natvik et al., 2014). Patients are also often instructed to carry out eating behaviours that may appear disordered, such as eating small meals frequently, chewing food very thoroughly, avoiding certain foods or foods cooked using certain methods, and even in some cases, to spit out food after chewing it (Engel et al., 2012). It is important to consider the motivation behind these behaviours, including whether they are driven by weight or shape concern or are "merely a way of accommodating the considerable changes in the digestive tract that result from the surgery" (Engel et al., 2012, p. 91), in determining whether they are disordered.

Chapter 2. Research aims and outline

2.1 Aims

The overarching aim of this thesis is to study patients' eating-related behaviours, expectations, and experiences before and after the three most common current bariatric surgery procedures.

The following specific research questions are addressed:

1. How prevalent are eating disorders and disordered eating behaviours in pre-bariatric patients?
2. How does bariatric surgery affect eating disorders and disordered eating behaviours from pre- to post-surgery and over time after surgery?
3. Do pre- to post-surgical changes in eating disorders and disordered eating behaviours vary by bariatric procedure?
4. Why do patients undergo one particular bariatric procedure rather than another?
5. What are patients' pre-surgical expectations and post-surgical experiences of eating behaviour change after bariatric surgery?
6. Do patients' eating-related expectations and experiences vary by bariatric procedure?

2.2 Research outline

Four research papers, from three studies, were produced to investigate the research questions. The first two papers utilised review methodologies. The final two, stemming from an original study, both utilised content and quantitative analyses. Figure 1.4 outlines the research sequence and resulting publications.

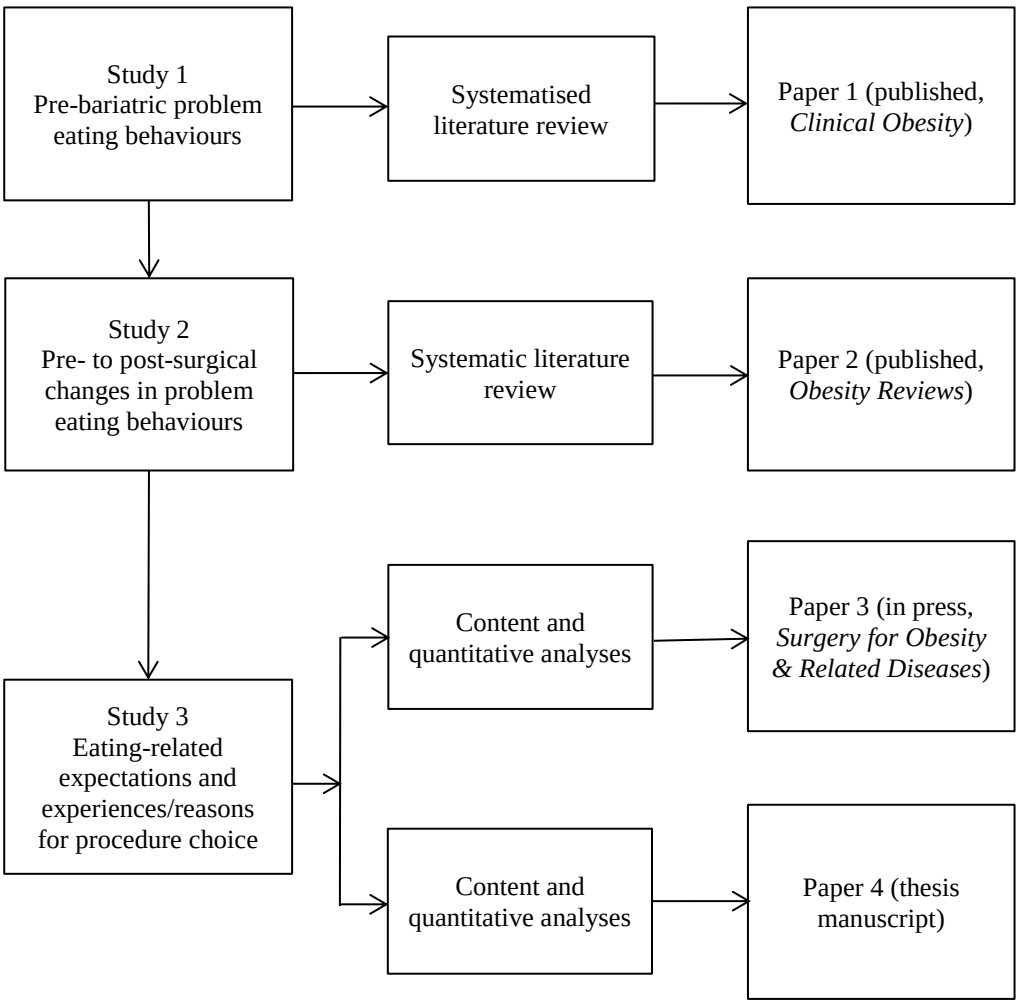

Figure 1.4. Research sequence and resulting publications.

A short introduction to the aims and methodology of each study and paper is provided below. Significant additional detail is presented in each of the full-text articles presented as Chapters 3-6.

2.2.1 Study 1: Systematised review

The first study (Chapter 3) reviews and critically evaluates the literature on a wide range of eating-related issues (BED and related behaviours, grazing, NES, emotional eating, food cravings and addiction, and pre-surgical expectations of post-surgical eating) in pre-bariatric populations. This

paper focuses on the prevalence of particular eating behaviours in this population, and reviews the literature on the eating-related expectations of candidates before surgery. A systematised review methodology, which includes one or more elements of the process of conducting a systematic review, but stops short of being a systematic review (Grant & Booth, 2009), was used. For this study, literature was identified using a systematic strategy, with a narrative form of review undertaken to summarise qualitative, quantitative, and mixed-methods research related to eating-related issues in pre-bariatric surgery populations.

2.2.2 Study 2: Systematic review

The second study (Chapter 4) builds on the first by systematically reviewing the literature on pre- to post-surgery changes in a narrower field of pre-surgically common and problematic eating disorders and disordered eating behaviours (BED and related behaviours, bulimia and related behaviours, NES, emotional eating, and grazing) after RYGB, AGB, and VSG. A traditional systematic review process was followed and only studies of the three most common bariatric surgery procedures were reviewed. Predefined and transparent procedures were used to ensure that the methodology was clear and replicable, and that where possible, bias was minimised. This research informed the development of Study 3 by identifying gaps and limitations in the current literature on changes in eating behaviours after the three bariatric procedures of interest.

2.2.3 Study 3: Original research study

The final study is an investigation of the procedure choice and eating-related expectations, experiences, and behaviours of adult Australians who had undergone Roux-en-Y gastric bypass, adjustable gastric banding, or vertical sleeve gastrectomy within Australia. Participants were recruited online, via the media, by clinicians, in clinics, and by bariatric organisations (Appendices A-D) completed a single online questionnaire collecting current and pre-surgical (retrospective) quantitative and qualitative data. On visiting the study website, patients could download information and a list of

support services (Appendices E-F), consent to participate and undergo screening, before completing the questionnaire (Appendix G). No tangible participation incentive was offered. The two papers from this study utilised content analysis and quantitative analyses to examine (a) why patients chose to undergo their particular bariatric procedure (Paper 3; Chapter 5), and (b) patients' eating-related pre-surgical expectations and post-surgical experiences (Paper 4; Chapter 6).

Only a small proportion of the collected data is presented in the two papers produced to date. Further articles are planned.

Chapter 3. The eating-related behaviours, disorders, and experiences of candidates for bariatric surgery

Please note: The published article is included as Appendix H.

Statement of authorship

Title of paper	The eating-related behaviours, disorders, and experience of candidates for bariatric surgery.
Publication status	Published (submitted 25 November 2014; revised 13 May 2015; accepted 21 May 2015)
Publication details	Opolski, M., Chur-Hansen, A., & Wittert, G. (2015). The eating-related behaviours, disorders, and expectations of candidates for bariatric surgery. *Clinical Obesity, 5*(4), 165-197. https://doi.org/10.1111/cob.12104

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Principal author name	Melissa Opozda (née Opolski)
Contribution to paper	Developed study protocol, conducted searches and retrieved papers, appraised and extracted data, acted as corresponding author, wrote and revised manuscript based on supervisor and reviewer feedback.
Overall percentage	85%
Certification	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signed and dated _____ _____

CO-AUTHORS

By signing the Statement of Authorship, each co-author certifies that:
- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100%, less the candidate's stated contribution.

Co-author name	Anna Chur-Hansen
Contribution to paper	Provided guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

Co-author name	Gary Wittert
Contribution to paper	Provided guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

3.1 Abstract

It is important that clinicians and researchers understand the possible eating-related difficulties experienced by pre-bariatric surgery candidates, as well as their expectations of how their eating and hunger will change after surgery. This review examines English-language publications related to the eating-related behaviours, disorders and expectations of bariatric candidates. Seventy-five articles related to binge eating disorder, grazing, night eating syndrome, emotional eating, food cravings and addiction, and pre-surgical expectations of post-surgical eating in this population were critically reviewed. A variety of often problematic eating behaviours appear more common in bariatric candidates than in non-obese populations. The literature suggests that 4-45% of candidates may have binge eating disorder, 20-60% may graze, 2-42% may have night eating syndrome, 38-59% may engage in emotional eating and 17-54% may fit criteria for food addiction. Binge eating may also be more prevalent in bariatric candidates than in similarly obese non-surgical individuals. Expectations of surgery are high, with pre-surgical candidates believing their bariatric procedure will virtually guarantee significantly improved eating behaviours. Study replications are needed, and further investigation into prevalence, impacts and candidate characteristics related to disordered eating behaviours, as well as candidates' expectations of eating after surgery, will be important. Further comparisons of bariatric candidates to similarly obese non-bariatric populations will be important to understand eating-related characteristics of candidates beyond those related to their weight. Future research may be improved by the use of validated measures, replicable methodologies, minimisation of data collected in circumstances where respondents may be motivated to 'fake good', use of prospective data and consistent definitions of key terminology.

Keywords: bariatric surgery, candidates, eating, eating disorder.

3.2 Introduction

Bariatric surgery is the most effective long-term treatment currently available for severe obesity, resulting in significantly greater, longer-term weight loss than non-surgical interventions such as diets, exercise and pharmacological measures (Colquitt et al., 2014). It is recommended for well-informed individuals with a body mass index (BMI) ≥ 40, or 35 to < 40 with serious obesity-related comorbidities (National Institutes of Health Consensus Development Conference Panel, 1992), for whom non-surgical measures have failed to result in significant, sustained weight loss, and as a first-line treatment for adults with a BMI > 50 (National Institute for Health and Care Excellence, 2006).

The most common current bariatric operations are Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB) and vertical sleeve gastrectomy (VSG). These surgeries either reduce the volume of the stomach to restrict food intake and induce earlier satiety (AGB, VSG, RYGB) or combine this restriction with malabsorption, altering the digestive processes to reduce the body's absorption of calories and nutrients (Colquitt et al., 2014). However, the full mechanisms may be much more complex, also potentially involving hormonal, inflammatory, central nervous system and gut microbial factors (Sandoval, 2011). After bariatric surgery, patients are expected to develop and maintain various recommended eating-related behaviours including eating small portions, chewing food slowly and thoroughly, avoiding carbonated, alcoholic and high-calorie drinks, high-fat, high-sugar and other poorly tolerated foods, increasing their water intake, taking vitamins and avoiding binge eating, grazing or snacking (Elkins et al., 2005; Parkes, 2006).

To provide optimal care and education, and improve well-being, it is important that researchers and clinicians understand the potentially distressing and problematic eating-related issues commonly experienced before surgery and bariatric candidates' expectations about how surgery will affect their eating and hunger. The aim of this review is to provide a critical evaluation of current literature on eating-related issues in pre-surgical bariatric candidates.

3.3 Method

Relevant English-language research papers, published between January 1960 and October 2014, were identified in PubMed using the string *bariatric* and *eating*, *hunger*, *disorder*, *expectation*, *binge*, '*night eating*', '*emotional eating*', *appetite*, *craving*, *addiction* or *experience*. This initial search found 3238 matches, which decreased to 1541 matches after filtering those results to include only articles from 1960 onwards, English-language publications and adult, human studies. The abstract of each of the 1541 articles was manually checked, with full-text downloaded for appraisal if articles appeared potentially relevant. Articles were included in this review if they reported primary data in a peer-reviewed journal related to bariatric candidates' pre-surgical binge eating, night eating, emotional eating, grazing, food cravings and addiction or pre-surgical eating-related expectations, were English-language publications of human adult participants and presented standalone pre-surgical data (studies including pre-surgical data which could not be interpreted without the context of post-surgical data were not included). Qualitative, quantitative and mixed-method studies were included, and review articles, theoretical papers, meta-analyses, unpublished data, dissertations, studies of post-surgical eating and articles not relevant to the research topic were excluded. Nine articles which appeared relevant based on their abstracts were unable to be retrieved as full-text publications, and therefore were not included. Furthermore, manual searches were performed on article reference lists, journal websites and relevant authors to identify additional articles suitable for inclusion.

A total of 75 articles fitting these criteria were identified and are reviewed in this paper. They are presented in six sections: binge eating disorder (BED), grazing, night eating syndrome, emotional eating, food cravings and addiction, and pre-surgical expectations of post-surgical eating. The tables present information on each article to summarise them and to inform critical analysis, focusing on key methodological issues including sample characteristics, methodology and measures utilised, implications of the study design, and potential biases and generalisability, as well as noting key findings including prevalence, demographic findings and associations with other traits.

3.4 Results

3.4.1 Binge eating disorder

A total of 47 articles investigating pre-surgical BED were identified and are presented in Table 3.1. According to the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), a diagnosis of BED requires recurrent (at least once a week for 3 months) episodes of eating, during discrete periods of time, amounts of food definitely larger than most people would eat under similar circumstances and within that amount of time, plus three or more of the following: eating much more quickly than usual, until uncomfortably full, eating large amounts of food when not physically hungry, eating alone because of embarrassment about the amount of food being eaten and feeling disgusted, depressed or very guilty after a binge. The individual must also feel a lack of control over the eating during binges and experience significant related distress. In comparison with prevalence estimates of 1 and 3% in European and US adults (Hudson et al., 2007; Preti et al., 2009), current BED rates of 4.2 to 44.5% have been reported in pre-bariatric surgery candidates (Abiles et al., 2013; Allison et al., 2006; Castellini et al., 2014a; Castellini et al., 2014b; Colles, Dixon, & O'Brien, 2007; Colles et al., 2008a; Colles, Dixon, & O'Brien, 2008b; Crowley et al., 2012; de Man Lapidoth, Ghaderi, & Norring, 2008; de Zwaan et al., 2003; Diaz, Arzola, Folgueras, Herrera, & Sosa, 2013; Dymek-Valentine, Rienecke-Hoste, & Alverdy, 2004; Elder et al., 2006; Friedman, Ashmore, & Applegate, 2008; Hayden, Murphy, Brown, & O'Brien, 2014; Jones-Corneille et al., 2012; Kalarchian et al., 2007; Kalarchian, Wilson, Brolin, & Bradley, 1998; Lent & Swencionis, 2012; Lier, Biringer, Stubhaug, & Tangen, 2013; Lin et al., 2013; Marek, Ben-Porath, Ashton, & Heinberg, 2014a; Marek et al., 2013; Mauri et al., 2008; Mitchell et al., 2014; Mitchell et al., 2012; Mühlhans, Horbach, & de Zwaan, 2009; Noli et al., 2010; Sansome, Schumacher, Wiederman, & Routsong-Weichers, 2008; Sarwer et al., 2004; Spitzer et al., 1993). Colles et al. (2007, 2008a) reported higher rates of binge eating and BED in candidates than in a general community sample of individuals who were not trying to lose weight.

Investigations of BED and binge eating symptoms in bariatric candidates have reported on potential differences related to a variety of demographic characteristics, with mixed findings related to gender (Adami, Gandolfo, Bauer, & Scopinaro, 1995; Lavender et al., 2014; Mauri et al., 2008; Mazzeo, Saunders, & Mitchell, 2006; Mitchell et al., 2014; Mitchell et al., 2012; Mühlhans et al., 2009; Müller et al., 2012; Sallet et al., 2007; Sarwer et al., 2004) and BMI (Adami et al., 1995; Brunault et al., 2012; Kalarchian et al., 1998; Mauri et al., 2008; Mitchell et al., 2014; Müller et al., 2012; Sallet et al., 2007; White, Masheb, Rothschild, Burke-Martindale, & Grilo, 2006). However, studies reporting on age (Adami et al., 1995; Kalarchian et al., 1998; Lavender et al., 2014; Mitchell et al., 2014; Müller et al., 2012; Sallet et al., 2007) and ethnicity (Azarbad, Corsica, Hall, & Hood, 2010; Hood, Corsica, & Azarbad, 2011; Mazzeo, Saunders, & Mitchell, 2005; Mitchell et al., 2014) have consistently found no differences related to binge eating, and a single study by Lavender et al. (2014) also found no difference by candidate education level. One investigation found that candidates with BED were more likely to be married or in a de facto relationship (Azarbad et al., 2010; Hood et al., 2011; Mazzeo et al., 2005; Mitchell et al., 2014).

A majority of studies comparing BED in bariatric candidates with other population groups have found that bariatric candidates are more likely to have a diagnosis of BED or more severe binge eating symptoms than similarly obese non-surgical individuals. Castellini et al. (2014b) reported that bariatric surgery candidates had more objective and subjective binge eating episodes per month than non-surgical weight loss patients, Colles et al. (2007, 2008b) found greater proportions of binge eaters in bariatric candidates than in non-surgical weight loss support group members and Stout et al. (2007) found that pre-surgical candidates reported significantly more severe binge eating symptoms than individuals in a residential therapy-based weight loss programme. Furthermore, Gradaschi et al. (2013) noted that surgical candidates were significantly more likely than individuals in a non-surgical weight loss programme to have BED and Lin et al. (2013) reported significantly higher rates of BED in bariatric candidates than in obese non-bariatric treatment seekers. However, two further comparisons of surgical candidates and non-surgical weight loss patients found no differences in the proportions of those with binge eating symptoms (de Man Lapidoth et al., 2008) and those who

reported engaging in binge eating behaviours at least once a week (Rutledge, Adler, & Friedman, 2011).

Many studies have linked BED in pre-bariatric populations with other eating, psychosocial and mental health difficulties. For example, Jones-Corneille et al. (2012) reported that candidates with BED were more likely to have a mood or anxiety disorder and lower self-esteem than those without BED, and Colles et al. (2008a) found that those with BED had more problematic issues including depressive symptoms, appearance dissatisfaction, subjective hunger and had a higher energy intake than those without BED. Dymek-Valentine et al. (2004) reported that candidates with BED more often viewed themselves as being 'extremely' fat (although their average BMI did not differ from those without BED), had a lower desired weight and also had greater eating, shape and weight-related concern, and greater dietary disinhibition and hunger. However, there were no differences related to self-esteem or depressive symptoms. Similarly, Adami et al. (1995) found that those with BED reported greater disinhibition and hunger, perfectionism, drive for thinness and body dissatisfaction, and White et al. (2006) reported that candidates who were 'regular bingers' (at least one bingeing episode per week) had more severe depressive symptoms, lower body satisfaction and felt more concern about their own eating, shape and weight.

Mitchell et al. (2014) also found that candidates with current BED were more likely to report problematic eating behaviours, including non-hungry eating, night eating and eating more fast-food meals, were more likely to have undergone recent counselling or medication for an emotional problem, felt they had less interpersonal support, reported more severe depressive symptoms and had worse quality of life. Binge eating has also been linked to more problematic food cravings, including feeling less control over eating, greater bodily hunger and more negative craving-related emotion in a study by Crowley et al. (2012), while Kalarchian et al. (1998) also reported more problematic symptoms, including greater disinhibition, hunger, fear of losing control over eating and weight and shape dissatisfaction, in binge eaters, but found no difference in depressive symptoms. In contrast, Mazzeo et al. (2005) found that depression and lower self-esteem each accounted for significant

variance in binge eating severity. Lavender et al. (2014) found that candidates with a lifetime history of BED were more likely to also have a history of depression, but after controlling for depression found no difference in attention, executive function or language functioning related to lifetime BED status. Friedman et al. (2008) linked current BED diagnosis with recent experiences of weight stigmatisation in bariatric candidates.

Sandberg et al. (2013) found that mental health-related quality of life, but not physical health-related quality of life, was worse in candidates with BED. Müller et al. (2012) again found that candidates with BED had greater depression symptoms, as well as greater eating, weight and shape concerns, but found no differences related to adult ADHD, anxiety, impulsivity or restraint eating. Similarly, Sallet et al. (2007) also noted that bariatric candidates with BED had more severe depression and anxiety symptoms than those without BED, but found no difference in body image distress. Two studies by Marek et al. (2014b; 2013) linked BED and greater BED severity with a variety of undesirable personality variables including emotional/internalising dysfunction, antisocial behaviours, self-doubt and family problems and Lent and Swencionis (2012) noted that candidates with BED 'displayed addictive personality scores comparable to individuals addicted to substances' (p. 67).

While validated questionnaires and interview schedules such as the self-report Questionnaire on Eating and Weight Patterns – Revised (QEWP-R; Spitzer et al., 1992) and Structured Clinical Interview for DSM Disorders (SCID; First, Williams, Karg, & Spitzer, 2015) are available for use in research and practice, tools using the same diagnostic criteria may yield differing results. Dymek-Valentine et al. (2004) found much higher rates of BED diagnoses using the QEWP-R than the SCID, which the researchers suggested was due to overestimation by the QEWP-R, while Elder et al. (2006) noted that agreement between the Eating Disorder Examination – Questionnaire and QEWP-R was 'modest' when identifying those engaging at least one binge eating episode per week, but 'poor' when identifying those with two or more episodes per week. Interpretation of the BED literature is also made more difficult due to the varying criteria previous researchers have used to examine binge eating in candidates. The DSM-IV BED criteria required two binge eating episodes per week in the

preceding 6 months for diagnosis (along with additional other diagnostic criteria such as loss of control and marked related distress continued in the DSM-5), rather than the DSM-5 criteria of one per week over the preceding 3 months. Even prior to publication of the DSM-5, a number of researchers had suggested that once a week binge episode frequency was a more clinically significant cut-off, questioning the twice weekly frequency criterion (Elder et al., 2006; Friedman et al., 2008).

Accordingly, researchers have used various methods and criteria to assess BED and binge eating symptoms in candidates (see Table 3.1). Some used a cut-off of one binge episode per week, others diagnosed BED at two or more binges per week and a number compared both cut-offs. Other researchers compared 'full' BED with concepts such as 'binge eating syndrome' described by Adami et al. (1995) as 'frequent binge eating episodes plus at least two behavioural indicators or loss of control' (p. 46) or 'subdiagnostic BED' (Sandberg et al., 2013), which required participant endorsement of one less criterion than required for diagnosis under the DSM-IV criteria – either reduced binge frequency, endorsing only two behavioural criteria, or not feeling depressed or guilty about binges. Marek et al. (2014a) investigated the potential impact of the differing DSM-IV and DSM-5 criteria on BED diagnostic rates, finding that an additional 3.4% of candidates in their sample would have received a BED diagnosis using DSM-5 criteria. Utilising multiple methods to assess BED, including a standardised clinical interview to confirm diagnosis, may be advisable (Colles et al., 2008a). Future research will also be improved with consistent use of replicable, validated, consistent methods. For example, while Adami et al. (1999) used existing criteria to diagnose BED, their questions were 'asked with the most appropriate methodology according to the subject's personal background and the clinical sensitivity and experience of the interviewer' (p. 366). Assessment protocol standardisation is important.

Attention should also be paid to ensuring that blinded, appropriately trained assessors assess candidates and all attempts should also be made to minimise candidates 'faking good'. If questioned as part of their pre-surgical eligibility assessment, candidates may feel the need to downplay their symptoms to appear a better candidate for surgery. This bias may be able to be minimised via

methodologies such as those used by Mühlhans et al. (2009) and Kalarchian et al. (2007), who, among other researchers listed in Table 3.1, collected their data separate to candidates' pre-surgical assessments and emphasised that their answers would not influence their eligibility for surgery, or Colles et al. (2008a), who invited candidates who had already been assessed and accepted for bariatric surgery to participate in their study. Additionally, the particular mode of questioning may also have an influence on whether or how much candidates underreport symptoms and should be considered, with Dymek-Valentine et al. (2004) suggesting that candidates may feel more pressure to appear 'psychologically healthy' during a face-to-face interview with a psychologist than when filling in questionnaires by themselves, even if both are used to assess a candidate's suitability for surgery. Studies utilising pre-surgical assessment data may need to account for these potential sources of bias.

Table 3.1. Summary of characteristics of included studies on binge eating.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Abiles et al. (2013)	110	70.0	41 (9)	49.1 (9.0)	Prospective observational study of consecutive surgery candidates in one hospital, participants underwent psychosocial assessment, before 12 two-hour group CBT sessions (participants had to lose 10% of their initial weight and complete CBT to be accepted for surgery), then additional individual assessment to detect current problematic behaviours/symptoms and 12 months of weekly hour-long sessions and caloric restriction; at this stage suitability for surgery was assessed	CEDD44-B (stress measure), Abbreviated Scale of Anxiety and Depression, RSE, Quality of Life Index, Family APGAR scale, FCQ-T, EDE-Q	Pre-CBT 44.5% had BED, post-CBT 31.8% had BED; at baseline, candidates with BED had higher BMIs ($p = 0.002$); pre-CBT, those with BED reported greater concern with weight, shape, and food than those without BED ($p < 0.005$), post-CBT no differences were found between the groups on any EDE-Q subscale; both before and after CBT, BED candidates made more plans to consume food, were more concerned about food, felt more physiological hunger, fear, and guilt, and experienced more eating-related cues compared to non-BED candidates ($p < 0.005$), post-CBT, improvement in all subscales was seen in the overall sample versus pre-CBT ($p < 0.005$); at baseline, BED patients had greater depression and anxiety and lower self-esteem and quality of life than non-BED patients ($p < 0.05$), differences regarding depression and self-esteem were not seen post-CBT due to improvements among the BED patients, but persisted in anxiety and quality of life
Adami et al. (1995)	43 with BED 20 with binge eating	74.4 60.0	38 (2) 38 (2)	46.3 (1.9) 47.6 (1.9)	Participants bariatric surgery candidates interviewed by trained	Semi-structured clinical interview designed to Spitzer et	No group age or sex differences; binge groups had higher BMI than non-binge eaters ($p < 0.04$); binge eating syndrome

	syndrome 29 non-binge eaters	75.9	36 (2)	41.0 (1.8)	investigator, completed questionnaires; categorised by binge eating status after assessment	al. (1993) criteria for binge eating syndrome and BED, TFEQ, EDI, questions on body weight changes over lifetime	and BED patients had greater history of dieting/weight changes than non-binge eaters ($p < 0.03$, $p < 0.04$); non-bingers had lower disinhibition and hunger than B binge eating syndrome ($p < 0.009$, $p < 0.002$) and BED ($p < 0.002$, $p < 0.001$) patients; binge eating syndrome and BED also had higher bulimia-related traits ($p < 0.03$, $p < 0.003$), interoceptive awareness ($p < 0.02$, $p < 0.03$), ineffectiveness ($p < 0.005$, $p < 0.05$), and maturity fears ($p < 0.04$, $p < 0.008$), drive for thinness, body dissatisfaction, perfectionism, and interpersonal distrust (statistics not reported for these items)
Adami et al. (1999)	63	76.2	37.6 (19-61)	46.9 (not reported)	Structured interview designed by the researchers, administered pre-surgery and at 1, 2, and 3-year follow-ups	BED assessed according to Spitzer et al (1993) criteria	42.8% met diagnostic criteria for BED
Allison et al. (2006)	210	81.9	44.4 (10.7)	50.4 (8.1)	Measures as part of pre-surgical assessment; those who reported overeating, loss of control, and distress underwent a supplemental semi-structured clinical interview by psychologist or psychiatric nurse to ensure participants consumed objectively large amounts of	Self-report WALI, which contains the QEWP-R; participants endorsing binge eating symptoms interviewed to establish diagnosis	By self-report, 16.7% fit criteria for BED; just 4.2% fit criteria when assessed by semi-structured clinical interview

					food, met diagnostic frequency criteria, and assessed compensatory behaviours; diagnoses confirmed by case review		
Azarbad et al. (2010)	137 Caucasian candidates 212 African American candidates 35 Hispanic candidates	100.0 100.0 100.0	44.6 (10.8) 40.1 (9.9) 39.3 (8.8)	49.0 (8.6) 51.7 (9.7) 47.6 (7.2)	Measures and interview completed as part of pre-surgical psychosocial evaluation	BES to measure severity (severe at score ≥ 27), plus psychosocial interview including evaluation of binge eating behaviours to establish diagnosis	Caucasian participants were older and average African American BMI was higher than the other two groups; Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV diagnostic criteria met by 15.7% of Caucasians, 11.5% of African Americans, 11.8% of Hispanic women; no group differences found in past ($p = 0.61$) or current BED diagnosis ($p = 0.53$); three groups did not differ in binge eating symptomatology ($p = 0.63$), though Caucasians exhibited more binge eating symptoms than African Americans ($p = 0.045$); no differences (Caucasians: 9.5%, African Americans: 7.5%, Hispanic: 5.7%) in the proportions of severe binge eaters ($p = 0.70$)
Brunault et al. (2012)	34	79.4	38.5 (11.0)	55.3 (10.2)	Patients assessed at pre-surgical visit and at 12 months post-surgery	BITE	Pre-operative BMI was not associated with binge eating ($p = 0.69$)
Castellini et al. (2014a)	27 AGB candidates 30 RYGB candidates 26 biliopancreatic	83.2 93.3 92.3	43.9 (11.4) 43.6 (9.8) 48.8 (8.4)	44.8 (5.3) 49.5 (6.8) 50.6 (6.6)	Patients interviewed pre-surgery as part of routine clinical assessment, and again at 12 months post-surgery	BES	26.5% had BED; no difference in binge eating severity by forthcoming type of bariatric surgery

	diversion (BPD) candidates						
Castellini et al. (2014b)	394 surgical candidates 683 non-surgical weight loss treatment clinic patients	73.4 80.1	44.9 (11.4) 46.7 (13.8)	44.6 (8.3) 37.8 (6.9)	Diagnosis and clinical assessments were part of routine clinical assessments; patients interviewed by clinician using the SCID to assess lifetime BED and Axis I disorders and number of weekly objective and subjective binge episodes using questions from EDE-I and DSM-5; BED diagnosis made using DSM-5 criteria	SCID, EDE-Q, BES	31.8% of surgical candidates, 25.5% of non-surgical weight loss patients had BED ($p < 0.05$); surgical candidates had more objective and subjective binge eating episodes per month than non-surgical patients (both $p < 0.01$); subjective binge eating associated with higher emotional eating in the surgical ($p < 0.01$) and non-surgical groups ($p < 0.001$); even after adjusting for BMI, subjective binge eating episodes associated with emotional eating in the overall sample
Colles et al. (2007)	180 surgical candidates 93 members of a non-surgical weight loss group 158 community respondents	78.3 91.4 78.5	44.8 (11.2) 55.1 (12.4) 41.3 (13.5)	44.5 (6.8) 32.7 (7.3) 24.8 (5.1)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group, and bariatric surgery candidates; candidates screened for binge and night eating behaviours, then interviewed by non-blinded clinician if behaviours detected;	NES measure constructed using Stunkard et al. (1996) criteria, QEWP-R to assess BED, semi-structured interview for all surgical candidates and those other respondents reporting binge or night eating characteristics	After confirmatory interview, 24.4% of surgical candidates were binge eaters, 5.4% in the support group, 1.9% in the community sample; rates significantly different between all groups ($p < 0.001$); 4.4% had comorbid NES and binge eating

					binge eating classified if ≥ 1 binge per week plus distress related to loss of control		
Colles et al. (2008b)	180 surgical candidates 93 members of a non-surgical weight loss group 158 community respondents	78.3 91.4 78.5	44.8 (11.2) 55.1 (12.4) 41.3 (13.5)	44.5 (6.8) 32.7 (7.3) 24.8 (5.1)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group, and bariatric surgery candidates; candidates screened for binge eating behaviours and then interviewed by non-blinded clinician if behaviours detected; BED diagnosed at ≥ 2 objectives binges per week plus significant distress related to loss of control	QEWP-R plus semistructured interview using DSM-IV criteria to confirm diagnosis	Highest proportion with BED in surgical group (17.8%), followed by support group members (3.2%), and community respondents (1.9%; $p < 0.001$)
Colles et al. (2008a)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into bariatric surgery program invited to participate; prospective observational data collected pre- and 12 months post-surgery	QEWP-R plus semi-structured clinical interviews for confirmation, TFEQ, CCV FFQ, BDI, MBSRQ	BED diagnosed in 14.0% of candidates; those with BED had higher depressive symptoms ($p = 0.033$), appearance dissatisfaction ($p = 0.05$), dietary disinhibition ($p < 0.001$), hunger ($p < 0.001$), more frequent eating ($p = 0.001$), greater energy intake ($p = 0.023$), higher proportion of fat in their diet ($p = 0.006$)
Crowley et al. (2012)	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluation for bariatric surgery	FCQ-T; interviewed about past and	12.3% engaged in binge eating behaviours; binge eaters had more intentions/plans to

					including semi-structured clinical interview and questionnaires; also assessed by dietitian	present binge eating behaviours – "specific questions differed according to clinician but generally included questions like, […] 'Has there ever been a time when you've eaten a large quantity of food in a short period of time with a sense of loss of control?'" (p. 368)	eat craved foods (p = 0.01), felt less control over their eating (p = 0.003), experienced more physiological hunger (p = 0.03), felt greater emotion before or during cravings or eating (p = 0.005), felt more guilt related to having/giving into cravings (p = 0.008); no group differences in cues triggering food cravings, food preoccupation, or anticipation of positive or relief from negative states/feelings from eating
de Man Lapidoth et al. (2008)	54 surgical candidates 46 non-surgical weight loss patients	75.9 67.4	40.3 (9.1) 45.3 (12.9)	46.7 (5.9) 39.3 (6.5)	Participants informed about study at last pretreatment assessment, asked to complete and return questionnaires before treatment; participants classified as having BED if ≥ 1 objective binge episode per week during the previous 3 months	EDO questionnaire, SF-36, CPRS S-A	Surgical patients were younger (p = 0.032) and heavier (p < 0.001) than non-surgical patients; no difference in proportion of binge eating in surgical (13.0%) vs. non-surgical (26.1%) patients
de Zwaan et al. (2003)	110	87.3	39.6 (19-62)	48.4 (35.4-86.9)	Consecutive candidates for RYGB were sent questionnaires before being scheduled for a pre-surgery evaluation	Eating Disorders Questionnaire, EDE-Q, QEWP-R, TFEQ, RSE, Inventory of Depressive Symptoms, IWQOL-Lite	17.3% fit criteria for BED, none were male; candidates with BED did not differ from those without BED on BMI, but more saw themselves as "extremely" fat (90 vs. 54%; p = 0.04) and had a lower desired weight (p = 0.001); those with BED had greater eating (p < 0.001), shape (p = 0.01), and weight (p = 0.03) concern and disinhibition and hunger (both p < 0.001),

							but were no different in dietary or cognitive restraint, self-esteem, and depressive symptoms
Diaz et al. (2013)	45	71.4	40 (11)	44.4 (4.6)	Patients underwent routine pre-surgical assessment and were assessed for BED during their post-surgical hospital stay; patients classified as no binge eating if they had no BED or < 1 binge episode/week, or as having BED if they had at least one binge/week; patients reassessed at 6, 12, 18, and 12 months post-surgery	Participants completed the QEWP-R on their third day after surgery	21.4% (n = 9) were identified as having BED; 5 patients binge ate twice a week, 4 reported binge eating once a week
Dymek-Valentine et al. (2004)	168	85.9	39.5 (9.3)	50.8 (9.2)	Measures administered within psychological portion of pre-surgical evaluation	QEWP-R, eating disorders module of the SCID administered by clinical psychologist	BED diagnosed in 26.8% of candidates using the QEWP-R and 14.3% using the SCID; 56.0% denied binge eating behaviours with the QEWP-R, 67.9% denied this with the SCID
Elder et al. (2006)	249	82.7	43.5 (10.6)	51.4 (10.6)	Study comparing QEWP-R and EDE-Q for assessing binge eating in bariatric candidates; measures completed within routine pre-surgery assessment; "recurrent" binge eating classified at ≥ 1	QEWP-R, EDE-Q, BSQ, BDI, RSE	Measures identified similar number of patients with recurrent binge eating: EDE-Q: 20.7%, QEWP-R: 23.2%, but agreement was modest (k = .26); at ≥ 2 binges/week, agreement was poor (k = .05, EDE-Q: 8.9%, QEWP-R: 13.9%); those identified on either or both measures as recurrent binge eaters reported greater psychopathology; recurrent binge eaters on the EDE-Q but not QEWP-R reported

					objective binge/week		greater eating, weight, and shape concern and global disordered eating, body dissatisfaction, and depression; QEWP-R only recurrent binge eater group found greater eating and weight concern and global disordered eating only
Friedman et al. (2008)	94	73.4	47.8 (11.8)	47.8 (8.0)	Completed measures and interview as part of pre-surgical evaluation; diagnoses made after interview based on DSM-IV criteria	Stigmatising Situations Inventory, BDI, RSE, BES, SCL-90-R, BSQ, plus semi-structured clinical interview by psychologists or interns	25% met criteria for current BED; weight stigmatisation associated with a current diagnosis of BED (p = 0.027)
Gradaschi et al. (2013)	75 surgical candidates 75 non-surgical treatment seekers	60.0 66.7	42.7 (11.3) 50.9 (14.5)	40.2 (4.1) 40.2 (4.6)	Comparison of bariatric surgery candidates and non-surgical (weight loss programme) treatment seekers; no group differences in mean weight and BMI	"Each patient was regarded as having a binge eating disorder when clinically meeting the standard diagnostic criteria (Spitzer et al., 1993)"; "subjects were requested to state whether they have emotional eating or tend to lose control over food intake" (p. 35)	Surgical candidates (22.7%) more likely than those beginning a non-surgical weight loss program (6.7%) to have BED (p = 0.004)
Hayden et al. (2014)	204	82.4	45.2 (11.5)	42.7 (6.1)	Consecutive eligible bariatric candidates invited to take part, emphasised this would not affect their medical	SCID for DSM-IV	13.7% had a lifetime history of BED, 13.6% fit criteria for current BED diagnosis

					treatment/surgery; attended face to face interview assessment with trained researcher or psychologist an average 4.6 weeks before surgery and 101.2 weeks post-surgery		
Hood et al. (2011)	142 RYGB candidates 130 AGB candidates	83.1 88.5	44.0 (11.4) 44.7 (10.2)	50.1 (8.9) 47.1 (6.6)	Patients assessed during routine pre-surgical evaluation by a psychologist	BES, BDI	RYGB candidates had higher BMI and fewer years of education than AGB candidates ($p < 0.05$); RYGB candidates had more binge eating symptoms than AGB candidates, and African American RYGB candidates reported more binge eating symptoms than African American AGB candidates (no differences in Caucasian candidates), but differences were not significant after controlling for higher BMI and lower education in RYGB candidates
Jones-Corneille et al. (2012)	44 with BED 61 without BED	78.7 77.3	44.7 (9.9) 47.9 (10.0)	50.4 (7.2) 49.1 (7.4)	Comparison of candidates with and without BED, recruited by QEWP pre-surgery assessment result	QEWP, EDE-I administered by blinded assessors to assess BED, then SCID by telephone to assess Axis I disorders	34.4% (62/180 who completed the EDE) had BED; candidates with BED more likely than those without BED to have a current (27.3% vs. 4.9%, $p = 0.002$) or lifetime (52.3% vs. 23.0%, $p = 0.003$) mood disorder, or current (27.3% vs. 8.2%, $p = 0.014$) or lifetime (36.4% vs. 16.4%, $p = 0.019$) anxiety disorder; also had greater depressive symptoms and lower self-esteem
Kalarchian et al.	64	76.6	Not reported for	52.0 (36.6-73.7)	Measures completed within initial pre-	BDI, TFEQ, EDE	39.1% of candidates classified as binge eaters, no significant differences were seen

(1998)			overall sample		surgical appointment; binge eating classified using a cut-off of ≥ 1 binge/week		in age, current BMI, or depressive symptoms (all p > 0.05); binge eaters reported greater pre-surgical disinhibition (p < 0.003) and hunger (p < 0.004) than non-binge eaters; on the EDE, binge eaters reported less eating restraint (p < 0.005), greater food/eating preoccupation (p < 0.04), fear of losing control (p < 0.002), weight dissatisfaction (p < 0.02), desire to lose weight (p < 0.003), and shape dissatisfaction (p < 0.01), and more social eating (p < 0.002); using cut-off of ≥ 2 binges/week, 25.0% were binge eaters
Kalarchian et al. (2007)	288	83.3	46.2 (9.4)	52.2 (9.7)	Data collected pre-surgery, independent of pre-operative screening/approval	Interviews by psychologists using the SCID	Current BED in 16.0% of candidates, lifetime BED diagnosis in 27.1%
Larsen et al. (2004)	93	82.8	39 (22-59)	46.5 (37-67)	Cross-sectional comparison of patients pre-surgery (n = 93), and less (n = 48) and greater than (n = 109) two years after AGB; participants completed questionnaires	BES (patients scoring > 17 considered to have binge eating, researchers found moderate [k=.59] agreement with diagnoses based on EDE-I in pilot interviews)	55.9% of pre-surgical patients “manifested binge eating”
Lavender et al. (2014)	68	89.7	42.9 (10.7)	46.5 (6.1)	Participants recruited from those in a previous related study; completed self-report measures and computerised cognitive battery test	SCID, tests of cognitive function (IntegNeuro cognitive test battery), attention/executive function (digit span	29.4% had a lifetime diagnosis of BED; no significant differences between those with and without a history of BED in age (p = 0.89), gender (p = 0.07), education (p = 0.28), hypertension (p = 0.68), type 2 diabetes (p = 0.71), sleep apnoea (p = 0.14), hyperlipidaemia (p = 0.22), and

					≤ 30 days of surgery and 12 months post-surgery; medical characteristics gathered via self-report and medical record review	total, attention switching on computerised Trail Making Test, verbal interference, computerised Austin Maze), memory (verbal list learning), and language (letter/animal fluency)	COPD (p = 0.35); participants with history of BED were more likely to have a history of depression (p = 0.01); controlling for depression, no difference found between BED and no BED history participants in attention (p = 0.80), executive function (p = 0.83), memory (p = 0.64), or language (p = 0.99)
Lent and Swencionis (2012)	97 (52 considering surgery, 29 met with doctor/surgeon about surgery, 16 scheduled for surgery)	85.6	41.0 (11.3)	45.2 (8.0)	Participants recruited through advertisements on social networking sites and a web site for bariatric surgery candidates, completed questionnaires online	EPQ-R Addiction Scale, Overeating Questionnaire, QEWP-R, Eating Behaviours and Attitudes Questionnaire	22.7% met criteria for BED; participants with BED "displayed addictive personality scores comparable to individuals addicted to substances" (p. 67)
Lier et al. (2013)	127	74.0	41.3 (10.3)	45.3 (5.2)	Assessed within pre-surgical psychiatric evaluation and again at one-year post-surgery	MINI, SCID-II	10.2% had pre-surgical BED
Lin et al. (2013)	455 surgical 386 non-surgical	70.5 67.1	34.1 (10.8) 37.2 (12.4)	39.5 (8.3) 31.2 (7.3)	Comparison of surgical and non-surgical treatment seekers at an obesity treatment centre, review of pretreatment screening data	Psychiatrist interview using the SCID if above cut-off on Taiwanese Depression Questionnaire or Chinese Health Questionnaire	BED diagnosed in 10.3% of candidates; surgical candidates more likely than non-surgical treatment seekers (4.4%) to have BED (p = 0.001)
Marek et al.	982	67.0	46.0 (11.6)	49.2 (11.3)	Retrospective review of	MMPI-2-RF plus	22.1% met criteria for BED; BED diagnosis

(2013)					data collected within routine pre-surgical assessments	eating measures including those of BED diagnosis, subjective binges per week, BES, and the presence of NES "using research-based criteria" (p. 1866)	and more severe binge eating associated with greater emotional/internalising dysfunction, thought dysfunction, demoralisation, low positive emotions, antisocial behaviour, ideas of persecution, dysfunctional negative emotions, aberrant experiences, self-doubt, inefficacy, stress/worry , family problems (all $p < 0.001$), behavioural/externalising dysfunction, malaise, suicidal/death ideation, substance abuse ($p < 0.05$, $p < 0.001$); more severe binge eating only associated with somatic complaints, cynicism (both $p < 0.001$), hypomanic activation ($p < 0.05$)
Marek et al. (2014b)	297 with BED 289 BMI-matched controls without BED	71.7 73.4	45.2 (11.7) 45.5 (11.1)	51.1 (11.9) 51.1 (11.6)	Retrospective review of data collected as part of standard pre-surgical procedures; BED diagnosis based on DSM-IV criteria	MMPI-2-RF, BES	Those with BED had greater emotional/ internalising dysfunction ($p < 0.001$), behavioural/externalising dysfunction ($p < 0.05$), demoralisation ($p < 0.001$), low positive emotions ($p < 0.001$), antisocial behaviours ($p < 0.001$), dysfunctional negative emotions ($p < 0.01$), malaise ($p < 0.05$), cognitive complaints ($p < 0.001$), self-doubt, inefficacy, stress/worry, anxiety (all $p < 0.01$), anger-proneness ($p < 0.05$), juvenile conduct problems ($p < 0.001$), substance abuse ($p < 0.01$), family problems ($p < 0.001$), social avoidance, shyness, negative emotionality/neuroticism (all $p < 0.01$), introversion/low positive emotionality, and binge eating severity (both $p < 0.001$)
Marek et al. (2014a)	341	71.6	45.4 (11.8)	50.9 (11.7)	Review of data collected during pre-surgical psychiatric	MMPI-2-R, BES	23.2% had BED based on DSM-IV criteria; an additional 3.4% of candidates met diagnostic threshold for BED when using

					evaluation; every patient reporting a binge eating episode but not diagnosed with BED was coded to determine whether they met DSM-5 diagnostic criteria		the DSM-5 criteria, overall BED rate increased to 26.6% ($p < 0.001$); DSM-5 diagnosed had more years of education than DSM-IV diagnosed, but did not differ on any other demographic variables; both groups had greater binge eating severity scores and had "similar" MMPI-2-RF profiles
Mauri et al. (2008)	282	79.8	42.1 (11.4)	43.5 (7.0)	Data collected during pre-surgical psychiatric assessment	SCID, BITE	11.0% had a lifetime BED diagnosis, 6.7% had a current diagnosis; BED prevalence did not differ by gender ($p = 0.49$) or BMI class ($p = 0.66$)
Mazzeo et al. (2005)	148 African American women 240 Caucasian women	100.0 100.0	37.2 (9.5) 41.5 (11.3)	48.9 (7.6) 47.2 (8.0)	Review of archival data from patient pre-surgical assessments	QEWP, BDI, BES, RSE	33.3% of African American women, 38.6% of Caucasian women, met criteria for BED ($p > 0.05$); no difference in likelihood of having severe binge eating symptoms ($p > 0.05$); depression and self-esteem accounted for significant total and unique variance in BES (binge severity) scores for both groups (both $p < 0.05$); no racial differences found in relationships among depression, self-esteem, and binge eating ($p > 0.05$)
Mazzeo et al. (2006)	487	84.0	39.9 (11.2)	48.3 (8.2)	Review of archival data from patient pre-surgical assessments	QEWP, BES	No difference in male and female BED rates, assessed by QEWP (26.4% vs. 25.4%, $p > 0.05$); equal likelihood of being classified as severe binge eaters based on BES scores > 27 ($p > 0.05$)
Mitchell et al. (2012)	199	46.0 (37.5-53.0)	44.9 (median; SD not reported)		Participants from a previous related study were invited to take part; interviewed independent of normal pre-surgical	EDE-BSV, IWQOL-Lite, SF-36, BDI	10.1% had current BED (10.3% of females, 8.8% of males), 13.1% had a lifetime BED diagnosis (13.3% of females, 11.8% of males)

					assessments and told data would not be shared with their surgical team		
Mitchell et al. (2014)	2266	78.6	46 (18-78)	45.9 (median; 33.0-94.3)	Participants in a large multicentre study of bariatric surgery (LABS-2); patients had already been cleared for surgery; baseline data collection ≤ 30 days before surgery, independent of surgical care; study formulated before DSM-5 finalised, so prior 6 months instead of 3 months assessed as per DSM-IV, but DSM-5 cut-off of one binge/week used; NES diagnosed if evening hyperphagia or nocturnal eating reported	Items in larger survey used to determine BED and NES, BDI, SF-36, IWQOL-Lite, Psychiatric and Emotional Test Survey and Medication Form	15.7% fit criteria for BED; no difference in BED status by sex ($p = 0.36$), age ($p = 0.22$), race/ethnicity ($p = 0.29$), BMI ($p = 0.44$), or smoking status ($p = 0.29$), but those with BED more likely to be married/defacto ($p < 0.01$); participants with BED were more likely to eat when not hungry or when full (both $p < 0.001$), eat more restaurant ($p < 0.001$) and fast food ($p < 0.01$) meals per week, more likely to have had counselling for emotional/psychiatric problems in past year ($p < 0.001$), to be currently taking medication for emotional/psychiatric problems ($p < 0.001$), and to be treated for depression ($p < 0.001$); those with BED also reported receiving less interpersonal support ($p < 0.001$), had more depressive symptoms ($p < 0.001$) and worse physical ($p < 0.01$) and emotional ($p < 0.001$) quality of life; participants with BED were more than twice as likely to have NES symptoms (31.1% vs. 14.7%, $p < 0.001$)
Mühlhans et al. (2009)	146	71.9	38.7 (10.0)	49.3 (7.8)	Psychological assessments up to 6 months before surgery, independent of surgical eligibility assessment	Interviews conducted by psychologists using the SCID and EDE	Current BED in 23.3% of candidates; no significant difference between female (29.5%) and male (7.3%) rates
Müller et al.	22 with BED	77.3	35.8 (11.2)	48.4 (7.8)	Participants asked to	EDE-Q, BIS/BAS,	No differences regarding BMI, age, gender,

(2012)	68 without BED	70.6	38.6 (11.2)	50.1 (10.3)	participate during routine pre-surgical assessment, assured responses would not influence their surgical candidacy	Effortful Control Scale, PHQ depression scale, Wender Utah Rating Scale for Attention Deficit Hyperactivity Disorder (ADHD)	adult ADHD, anxiety and impulsivity, and restraint eating ($p > 0.05$); candidates with BED had greater eating ($p < 0.01$), weight ($p < 0.05$), and shape ($p < 0.05$) concerns, depression symptoms ($p < 0.01$), and lower levels of effortful control ($p < 0.01$)
Noli et al. (2010)	150	64.7	42 (11)	46.6 (10.4)	Comparison of candidates and post-surgical patients; all underwent an eating and behaviour interview by a trained investigator	Patients classified as having BED if they fit Spitzer et al. (1992) criteria (> 2 episodes of binge eating/week for the past 6 months with marked related distress and no purging)	16.0% had BED
Rutledge et al. (2011)	70 non-surgical weight loss patients 25 bariatric surgery candidates	16.0 25.7	51.3 (8.7) 53.6 (10.9)	42.0 (6.0) 42.0 (6.0)	Participants were 95 consecutive veterans completing an intake class required for entry into weight control clinic (surgical and non-surgical) services	Single item on binge frequency in MOVE! Questionnaire: "On average, how often have you eaten extremely large amounts of food at one time and felt that your eating was out of control at that one time?"	88.0% of surgical candidates vs. 82.3% of non-surgical patients engaged in binge eating at least once a week ($p > 0.05$)
Sallet et al. (2007)	216	82.4	36.3 (9.6)	45.9 (6.0)	Prospective, longitudinal cohort study; pre-surgical candidates invited to	BED assessed via semi-structured interview using SCID for DSM-IV,	20.4% had lifetime history (current or past episodes) of BED; no difference in lifetime BED by sex ($p = 0.21$), age ($p = 0.20$), BMI ($p = 098$), or body image

					take part in program of clinical, psychological, physical training, and dietary assistance; classified according to lifetime BED: no binge eating, subclinical binge eating (< 2 binge episodes/week), BED (≥ 2 binges/week)	participants also completed the BSQ, BDI, HAM-A	distress (p = 0.34); BED and subclinical BED groups had significantly higher depression (p = 0.002, p = 0.012) and anxiety (p = 0.001, p = 0.042) than the no BED group; BED group had higher anxiety than the subclinical BED group (p = 0.038), no difference in depression (p = 0.20)
Sandberg et al. (2013)	18 with BED 20 with 'sub-diagnostic' BED 99 without any eating disorder	Not reported	39.8 (8.4) 35.5 (10.1) 42.1 (10.2)	47.2 (6.2) 48.3 (6.2) 47.8 (5.9)	Pre-surgical patients mailed questionnaires; classified BED according to DSM-IV criteria, either no eating disorder, 'subthreshold BED' (not fulfilling one required DSM-IV criterion, either by reduced binge frequency, only having two required additional features, or not feeling related depression/guilt), or BED	EDO questionnaire, SF-12	Mental health-related quality of life significantly lower in those with BED (p = 0.027) or subthreshold BED (p = 0.016) than those without an eating disorder; no difference between mental health-related quality of life in those with BED and subthreshold BED; no group differences related to physical health-related quality of life
Sansome et al. (2008)	121	86.0	44.6 (11.8)	47.2 (9.7)	Participants recruited to project by surgical program social worker (convenience sampling); study data	BED-related items from QEWP-R, "included a list of exclusionary purging behaviours"	6.5% prevalence of BED (6/92 who completed the QEWP-R)

					collected separate to surgical assessment	(p. 199)	
Sarwer et al. (2004)	90	82.2	43.4 (10.5)	54.9 (11.7)	Review of data from patient pre-surgical psychological evaluations	QEWP	BED in 26.7% of candidates; males (50.0% BED) more likely than females (21.6%) to have BED ($p = 0.013$); an additional 15.6% met subthreshold BED criteria (binge ate < 2 times/week)
Stout et al. (2007)	76 in a weight loss surgery program 101 in a residential cognitive-behavioural weight loss program	84% 67%	43.5 (9.1) 48.3 (13.0)	47.6 (6.9) 45.8 (9.0)	All individuals seeking obesity treatment from a therapy-based weight loss program or a surgical weight loss program (only those with BMI ≥ 35) within a specified time period were included	BES	Non-surgical group was significantly older than surgical group ($p < 0.01$); surgical group had significantly more binge eating symptoms ($p < 0.01$)
White et al. (2006)	139	89.2	42.4 (10.2)	51.7 (7.9)	Participants invited to participate in research study, completed questionnaires; informed participation would not influence provided care	EDE-Q, BSQ, BDI, RSE	60.4% did not binge eat, 15.8% binged < 1 time/week, 13.7% binged 1 to < 2 times/week, 10.1% binged ≥ 2 times/week; no difference in BMI by binge frequency; regular bingers (≥ 1/week) had greater depression ($p < 0.001$) and lower self-esteem ($p = 0.001$) than non-bingers (no difference between infrequent and non-bingers); infrequent (< 1/week) and regular binge eaters had more body dissatisfaction ($p < 0.001$, $p = 0.003$) and higher eating concern (both $p < 0.001$), shape concern ($p = 0.004$, $p < 0.001$), and weight concern ($p = 0.003$, $p = 0.002$) than non-binge eaters; no differences between infrequent vs. regular bingers on any variables

BDI, beck depression inventory; BES, binge eating scale; BIS/BAS, behavioural inhibition system and behavioural activation system; BITE, bulimic inventory test, edinburgh; BMI, body mass index; BSQ, body shape questionnaire; CBT, cognitive behavioural therapy; COPD, chronic obstructive pulmonary disease; CPRS-S-A, comprehensive psychopathological rating scale self-rating scales for affective syndromes; EDE-BSV, eating disorders examination – bariatric surgery version; EDE-I, eating disorders examination – interview; CCV-FFQ, cancer council victoria food frequency questionnaire; EDE-Q, eating disorder examination – questionnaire; EPQ-R, eysenck personality questionnaire – revised; FCQ-T, food craving questionnaire – trait; HAM-A, hamilton rating scale for anxiety; IWQOL-Lite, impact of weight on quality of life questionnaire – lite; AGB, adjustable gastric banding; MBSRQ, multidimensional body self-relations questionnaire; MINI, mini international neuropsychiatric interview; MMPI-2-RF, minnesota multiphasic personality inventory-2 restructured form; NES, night eating syndrome; PHQ, patient health questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; RSE, rosenberg self-esteem scale; RYGB, Roux-en-Y gastric bypass; SD, standard deviation.; SCID, structured clinical interview for DSM-IV; SCL-90-R, symptom checklist-90-revised; SF-12, short form health survey; SF-36, short form 36 health survey; TFEQ, three-factor eating questionnaire.

3.4.2 Grazing

As shown in Table 3.2, seven publications were identified that had investigated grazing (defined by Colles et al. (2008a) as continuous consumption of small amounts of food over an extended period of time, resulting in subjective overconsumption) in bariatric candidates. Grazing has received minimal research attention to date and little is known about its incidence and impact (Conceição et al., 2014b). The literature suggests that 19.5 to 59.8% of bariatric candidates may graze (Burgmer et al., 2005; Busetto et al., 2002; Colles et al., 2008a; Conceição et al., 2014b; Saunders, 1999), although no studies were found to have compared grazing in candidates to grazing in other populations. Mazzeo et al. (2006) found no difference in the proportion of male and female candidates who grazed, while Colles et al. (2008a) noted that pre-surgical grazing was associated with lower dietary restraint, greater disinhibition and hunger, and Saunders et al. (1999; 1998) linked grazing to severe binge eating behaviours.

Interestingly, Conceição et al. (2014b) have suggested that grazing may not actually be a disordered eating issue, noting that 'the evidence points to this being a rather common eating behaviour that tends to interfere with weight control in specific populations, but there are no clear data to suggest that it should be considered a psychopathological behaviour' (p. 980). Further investigation into prevalence, patterns and impacts of pre-bariatric grazing will be an important step to understand the potential importance of this eating behaviour.

Grazing is not listed in the DSM, and until recently, the only identified published assessment measures were the Eating Disorder Examination (Fairburn, 2008), which contains one item about 'picking' or 'nibbling' between meals and snacks, and the Structured Interview for Anorexia and Bulimia (Fichter et al., 1991), containing items assessing grazing as a form of binge eating, labelled 'atypical binges extending over a larger period of time' (Lane & Szabó, 2015). The assessment methods used to date in bariatric candidate grazing research can be seen in Table 3.2, and have often comprised single items composed by the researchers, added to existing measures of disordered eating.

This lack of consensus in definition and assessment of grazing to date has been problematic for understanding this behaviour and may have contributed to the limited research attention to date (Conceição et al., 2014a; Lane & Szabó, 2015). However, two research teams have recently developed new measures of grazing with both aiming to assess multiple aspects of grazing identified as important in the literature. The measures differ slightly, with Lane and Szabó (2015) including a sense of loss of control and Conceição et al. (2014a) proposing two distinct grazing subtypes: one compulsive, characterised by a lack of control over the eating, and one non-compulsive, involving more distracted eating. These measures will require further investigation, comparison and validation in populations including bariatric patients, but are likely to play a vital role in better understanding of grazing in bariatric candidates.

Table 3.2. Summary of characteristics of included studies on grazing.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Burgmer et al. (2005)	149	68.5	38.8 (10.3)	50.9 (8.1)	Assessments before surgery, after admission to hospital, and 12 months post-surgery	SIAB, short version, administered by trained, monitored professionals	Current grazing rate of 19.5%, lifetime prevalence 24.2%
Busetto et al. (2002)	260	72.3	37.6 (10.8)	46.6 (7.1)	Eating behaviours assessed in pre-surgical suitability assessment; patients followed up (eating not reassessed) to 3 years post-surgery	Evaluated by internist or psychologist, classified nibbling if patient "ate small quantities of foods repetitively between meals, typically triggered by inactivity and/or loneliness" (p. 84)	Current "nibbling" rate of 42.7%
Colles et al. (2008a)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into bariatric surgery program invited to participate; prospective observational data collected pre- and 12 months post-surgery	QEWP-R, one item on grazing based on Saunders (1999, 2004) definition, plus semi-structured clinical interviews for confirmation of behaviours, CCV FFQ, TFEQ, BDI, MBSRQ	26.4% grazed; grazing related to lower dietary restraint ($p = 0.025$) and greater dietary disinhibition ($p < 0.001$) and hunger ($p = 0.034$)
Conceição et al. (2014b)	61 (pre-surgical sample)	Not reported	Not reported	44.5 (5.3)	Cross-sectional study of AGB and RYGB candidates pre-	Diagnostic items in the EDE-BSV, administered by	29.5% had "picking or nibbling" behaviours

					surgery, and 6, 12, and 24 months post-surgery	trained therapists	
Mazzeo et al. (2006)	487	84.0	39.9 (11.2)	48.3 (8.2)	Review of data from pre-surgical assessments	QEWP and BES; unspecified measure of grazing	No sex difference in grazing ($p > 0.05$)
Saunders et al. (1999; 1998)	125	88.8	39.4 (10.4)	49.3 (7.8)	Self-report measures completed at initial pre-surgery appointment	One item on grazing was added to the QEWP by the researchers, BES	59.8% grazed in previous six months; grazing related to severe binge eating ($p < 0.01$) as assessed by the BES; 49.3% grazed 2-3 days per week

BDI, beck depression inventory; BES, binge eating disorder; BMI, body mass index; CCV FFQ, cancer council victoria food frequency questionnaire; EDE-BSV, eating disorder examination – bariatric surgery version; AGB, adjustable gastric banding; MBSRQ, multidimensional body-self relations questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, Roux-en-Y gastric bypass; SD, standard deviation; SIAB, structured interview for anorexia and bulimia nervosa; TFEQ, three factor eating questionnaire.

3.4.3 Night eating syndrome

Twelve studies examining night eating syndrome (NES) in bariatric candidates were identified and are summarised in Table 3.3. NES was newly included in the DSM-5 under the category of 'other specified feeding or eating disorder' and is described as recurrent episodes of night eating, either after waking from sleep during the night or excessive food consumption after dinner, which the individual is aware of and can recall, and which cause significant distress or impairment (American Psychiatric Association, 2013). In comparison with general population prevalence estimates of 1.5% (Rand, Macgregor, & Stunkard, 1997), studies have found that between 1.9 and 41.7% of bariatric candidates have current NES (Adami et al., 1999; Allison et al., 2008a; Allison et al., 2008b; Allison et al., 2006; Colles et al., 2007, 2008a; Hsu, Betancourt, & Sullivan, 1996; Hsu et al., 1997; Marek et al., 2013; Mitchell et al., 2014; Powers, Perez, Boyd, & Rosemurgy, 1999). It is unclear whether NES rates differ between bariatric candidates and other populations, with Colles et al. (2007) finding higher NES rates in bariatric candidates than in a weight loss support group and a community sample, while Ronchi et al. (2008) noted no difference between the night eating traits of bariatric candidates and non-surgical (behavioural) weight loss patients.

The comorbidity of NES and BED in bariatric candidates has been highlighted in several investigations. Colles et al. (2008a) reported a significant positive correlation between these eating patterns, Adami et al. (1999) found that all of the 7.9% of candidates in their study who had NES also had BED, Colles et al. (2007) noted 4.4% comorbidity of the two issues and Mitchell et al. (2014) reported that those with BED were more than twice as likely to have NES symptoms. Investigation into potential implications of this comorbidity is needed. Attention should also be paid to studying demographic characteristics related to NES in candidates, as only Colles et al. (2008a) have done so to date, noting that male candidates were more likely than female candidates to have NES. Just one study was found to have investigated relationships between NES and personality, with Marek et al. (2013) finding that NES diagnosis was associated with increased dysfunctional thinking, somatic complaints and aberrant experiences. Additional research links with other psychological and eating-

related issues and traits will be an important step in understanding NES and its comorbidities and impacts in bariatric candidates.

Understanding of NES in candidates has also been impeded by problematic variations in definition, assessment and non-replicable methodologies. As noted, retrospective ratings of pre-surgical eating may be subject to recall bias, and the two studies, both by Hsu et al. (1996; 1997), which used candidates' post-surgical recollections of their own pre-surgical night eating symptoms for diagnosis, found the highest rates of pre-surgical NES (33.3% and 41.7%). However, these publications also did not specify their particular methods used to assess NES. In addition, a number of studies (Allison et al., 2008b; Allison et al., 2006; Marek et al., 2013; Powers et al., 1999) used data collected as part of pre-surgical psychological assessments, which may be influenced by candidates' conscious or unconscious attempts to appear 'psychologically well' in the hope of qualifying for surgery. All of these potential biases make interpretation and comparison within the literature difficult. In addition, there were small actual numbers of candidates with NES in all of the identified studies, and although potentially challenging, future studies containing larger samples of individuals with NES will be important for better understanding this issue.

A further difficulty in interpreting the existing literature lies in the fact that definitions of NES have varied by researcher and over time, with little consensus. NES was not included in the DSM prior to the recent DSM-5. As Table 3.3 shows, the majority of researchers in the pre-surgical literature to date either constructed their own unspecified measures of NES based on the Stunkard *et al*. (1996) criteria (Adami et al., 1999; Colles et al., 2007, 2008a) or used other unspecified questions (Hsu et al., 1996; Hsu et al., 1997) or unreferenced questionnaires (Powers et al., 1999).

However, two recent developments are likely to assist consistent assessment of NES. First is the publication of the Night Eating Questionnaire (NEQ), a measure developed and evaluated by Allison et al. (2008a; 2008b) in populations including bariatric candidates to measure the severity of NES symptoms. However, the authors note that assessments of actual food intake (24-h recall and/or use of

food diaries) may be a necessary adjunct to improve the validity of symptom assessment when using the NEQ (Allison et al., 2008a; Allison et al., 2008b). Second is the recent publication of a consensus paper (Allison et al., 2010) outlining core diagnostic criteria for NES: consumption of > 25% of daily food intake after the evening meal in the evening and/or night-time, at least twice a week, with awareness and recall of the eating episodes and distress or impairment of functioning, plus at least three of the following: lack of desire to eat in the morning > 4 times per week, the strong urge to eat between dinner and sleep onset and/or during the night, sleep onset and/or maintenance insomnia > 4 nights per week and a belief that the individual must eat to initiate or return to sleep. Symptoms must be present for at least 3 months. This set of criteria will be invaluable for standardising definition and improving assessment in research into NES in pre-bariatric populations.

Table 3.3. Summary of characteristics of included studies on night eating syndrome.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Adami et al. (1999)	63	76.2	37.6 (19-61)	46.9 (not reported)	Structured interview designed by the researchers, administered pre-surgery and at 1, 2, and 3-year follow-ups	Assessed NES using Stunkard et al. (1996) criteria, BED assessed according to Spitzer et al. (1993) criteria	7.9% (n = 5) of candidates had NES; all with NES also had BED
Allison et al. (2006)	210	81.9	44.4 (10.7)	50.4 (8.1)	Part of pre-surgical assessment; those reporting consuming > 25% of calories after dinner or waking to eat in the night (on NEQ) interviewed in semi-structured interview by psychologist or psychiatric nurse about food intake/night eating and food diaries assessed; diagnoses confirmed by review	WALI containing the NEQ and QEWP-R; participants endorsing night eating or binge eating symptoms were further interviewed to establish diagnosis	Using the strictest criteria (interview, calculations confirming evening hyperphagia and night eating criteria), 1.9% fit criteria for NES and 8.9% "fell on the NES spectrum" (p. 80S)
Alison et al. (2008a)	147	70.1	43.6 (11.5)	50.5 (9.4)	Candidates completed measure within their pre-surgery psychological assessment	NEQ, within the WALI	7.5% (n = 11) met all three key criteria for NES identified in this study: nocturnal eating and/or evening hyperphagia, initial insomnia, and night awakenings

Allison et al/ (2008b)	194	82.5	44.0 (10.7)	50.4 (8.0)	Candidates undergoing routine pre-surgical evaluations completed measure	WALI, containing the NEQ; participants endorsing night eating symptoms interviewed with unpublished Night Eating Syndrome History and Inventory to establish diagnosis	9.8% (n = 19) were diagnosed with NES
Colles et al. (2007)	180 surgical candidates 93 members of a non-surgical weight loss group 158 community respondents	78.3 91.4 78.5	44.8 (11.2) 55.1 (12.4) 41.3 (13.5)	44.5 (6.8) 32.7 (7.3) 24.8 (5.1)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group, and bariatric surgery candidates; candidates screened for night and binge eating behaviours and then interviewed by non-blinded clinician if behaviours detected	NES measure constructed using Stunkard et al. (1996) criteria, QEWP-R, semi-structured interview for all participants reporting binge or night eating characteristics; TFEQ, BDI, MBSRQ, SF-36	After confirmatory interview, 19.4% of surgical candidates had NES, 4.3% in support group, 5.7% in the community sample; rates were significantly different between all groups ($p < 0.001$); 4.4% had comorbid NES and binge eating (classified as ≥ 1 binge per week plus distress related to loss of control)
Colles et al. (2008a)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into surgical program invited to participate; prospective observational data collected pre- and 12 months post-surgery	NES measure constructed using Stunkard et al. (1996) criteria, plus semi-structured clinical interviews for confirmation	17.1% (n = 22) had NES; NES was related to BED ($p = 0.048$), men were more likely than women to have NES ($p = 0.008$)
Hsu et al. (1996)	24	100.0	37.8 (8.5) at pre-surgery	48.8 (8.1) at pre-surgery	Retrospective reporting of pre-surgical and	EDE, plus unspecified questions about night	41.7% (n = 10) retrospectively reported having pre-operative NES; “frequency of

					current (past four weeks) behaviours by patients who had undergone vertical banded gastroplasty in previous 3.5 years	eating	night eating varied from several times a year to three times a night" (p. 28)
Hsu et al. (1997)	27	100.0	38.7 (10.1) at pre-surgery	48.8 (8.6) at pre-surgery	Retrospective reporting of pre-surgical and current behaviours at an average of 20.8 months post-bypass	EDE, with unspecified "supplemental questions" on NES	33.3% (n = 9) retrospectively reported having pre-surgical NES
Marek et al. (2013)	982	67.0	46.0 (11.6)	49.2 (11.3)	Retrospective review of data collected within routine pre-surgical assessments	MMPI-2-RF plus eating measures including items on NES "using research-based criteria" (p. 1866)	3.4% had NES; NES diagnosis was associated with thought dysfunction, somatic complaints, and aberrant experiences (all $p < 0.05$) but no other MMPI specific problem or clinical scales
Mitchell et al. (2014)	2266	78.6	46 (18-78)	45.9 (median; 33.0-94.3)	Participants in large multicentre study of bariatric surgery; patients had already been cleared for surgery; baseline data collection ≤ 30 days before surgery, independent of surgical care; study formulated before DSM-5 finalised, so BED criteria of prior 6 months assessed as per DSM-IV, but DSM-5 cut-off of ≥ 1 binge/week used	Items in larger survey used to determine BED as per DSM criteria, NES diagnosed if participant reported evening hyperphagia or nocturnal eating, BDI, SF-36, IWQOL-Lite, Psychiatric and Emotional Test Survey and Medication Form	17.7% considered to have NES; participants with BED were more than twice as likely to have NES symptoms (31.1% vs. 14.7%, $p < 0.001$)
Powers et al.	116	82.8	39.6 (9.3)	53.4 (10.9)	Evaluations pre-	"The Eating Disorder	10.3% (n = 12) met criteria for current NES

(1999)					surgery, followed-up periodically to an average 5.5 years post-surgery	Questionnaire" (not referenced), which "elicits epidemiological and clinical data including specific questions about symptoms of NES" (p. 295)	
Ronchi et al. (2008)	50 surgical candidates 50 behavioural weight loss program patients	76 70	42.6 (22-58) 40.8 (24-65)	44.5 (8.5) 40.7 (8.8)	Interviews by trained dietitian with surgical candidates and patients enrolling in behavioural weight loss program; "the interviewer carried out the interviews according to the patient's personal background and in a clinically sensitive manner" (p. 146)	Questions on eating including about night eating; participants considered night eaters "if they reported sleep disturbances – frequent waking in the night to eat – or consuming food after the evening meal" p. 146	No significant difference in night eating traits of surgical candidates and non-surgical weight loss patients

BED, binge eating disorder; BDI, beck depression inventory; BMI, body mass index; DSM, diagnostic and statistical manual of mental disorders; EDE, eating disorder examination; IWQOL-Lite, impact of weight on quality of life – lite questionnaire; MBSRQ, multidimensional body-self rating questionnaire; MMPI-2-RF, minnesota multiphasic personality inventory-2 restructured form; NES, night eating syndrome; NEQ, night eating questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; SD, standard deviation; SF-36, short form 36 health survey; TFEQ, three factor eating questionnaire; WALI, weight and lifestyle inventory.

3.4.4 Emotional eating

Fourteen studies were identified that had investigated the emotional eating behaviours of pre-bariatric patients (Table 3.4). Emotional eating, defined by van Strien et al. (2012) as 'a tendency to overeat in response to negative emotions such as anxiety or irritability' (p.782), is commonly viewed as being a risk factor for poorer post-surgical outcomes. This was demonstrated by Zimmerman et al. (2007), who found that their most common reason for exclusion from bariatric surgery was candidates 'overeating to cope with stress or emotional distress' (p. 1560). With prevalences of 38.1 to 58.7% (Crowley et al., 2012; Gradaschi et al., 2013; Guerdjikova et al., 2007; Miller-Matero et al., 2014; Noli et al., 2010; Walfish, 2004) reported in bariatric candidates, emotional eating appears common in this population.

Few studies have reported data related to emotional eating by population or demographic characteristics. Both Ronchi et al. (2008) and Gradaschi et al. (2013) found that bariatric candidates were no more likely than obese individuals beginning a non-surgical weight loss programme to emotionally eat; Castellini et al. (2014a) noted no difference in the emotional eating symptoms reported by candidates for AGB, RYGB and biliopancreatic diversion. Just one study reported any demographic characteristics related to emotional eating, with Gade et al. (2014) finding that female candidates reported significantly more emotional eating symptoms than male candidates.

However, several studies have reported links between emotional eating and other potentially problematic eating-related issues. Fischer et al. (2007) reported that candidates' emotional eating was associated with more frequent episodes of bingeing and other extreme weight control behaviours, depression and greater eating disinhibition and hunger. Castellini et al. (2014b) found that emotional eating was associated with greater subjective binge eating episodes, and Crowley et al. (2012) linked higher emotional eating to stronger food-related cravings, including greater intention to eat, anticipating more positive reinforcement and relief from negative states after eating and experiencing greater food preoccupation and less perceived control over eating.

Emotional eating has also been associated with undesirable personality traits and psychological difficulties in several studies. Claes et al. (2013) found that candidates with an emotionally dysregulated/undercontrolled personality reported more emotional eating symptoms than those with a resilient/high functioning personality. Gade et al. (2014) found that emotional eating was associated with higher levels of neuroticism, anxiety and depression and lower levels of conscientiousness, while Zijlstra et al. (2012) noted an association between emotional eating and negative affect. Further research is needed into the patterns, characteristics and clinical implications of emotional eating in bariatric candidates. If associated with significant distress or other negative impacts, consideration should be paid to the potential benefit of evidence-based therapeutic interventions for affected candidates.

Once again, the majority of studies (Castellini et al., 2014a; Castellini et al., 2014b; Claes et al., 2013; Crowley et al., 2012; Fischer et al., 2007; Gradaschi et al., 2013; Guerdjikova et al., 2007; Miller-Matero et al., 2014; Walfish, 2004) of emotional eating utilised pre-surgical assessment data which may be influenced by candidates 'faking good' for surgery. Furthermore, methods of assessing emotional eating have varied widely and use of unvalidated, non-replicable assessment methods and varying definitions of emotional eating makes interpreting some findings difficult. For example, Guerdjikova et al. (2007) asked their participants to define themselves as emotional eaters 'if they would eat for any reason other than true physical hunger, such as for situational triggers, or negative or positive emotions' (p.1092), a definition seemingly more appropriate for broader concepts of 'non-hungry eating' than emotional eating, while Noli et al. (2010) and Crowley et al. (2012) included positive and negative emotions in their definitions and Gradaschi et al. (2013) reported only that 'subjects were requested to state whether they have emotional eating . . .' (p. 35). Use of validated, replicable measures based on consistent definitions of emotional eating is vital. Miller-Matero et al. (2014), Fischer et al. (2007) and Castellini et al. (2014a) measured emotional eating with the Emotional Eating Scale (Arnow, Kenardy, & Agras, 1995), which asks respondents to indicate the extent to which each of a series of mainly negative emotions lead them to feel an urge to eat. Other widely used measures follow this pattern. The Dutch Eating Behaviour Questionnaire (DEBQ; van

Strien, Frijters, Bergers, & Defares, 1986) measures the desire to emotionally eat, while the Three-Factor Eating Questionnaire (Cappelleri et al., 2009) contains a combination of items about 'feeling the need' to eat and actually engaging in emotional eating. It is worth noting that feeling an urge to emotionally eat will not necessarily result in that individual actually emotionally eating. In comparison with those experiencing control conditions and self-identified non-emotional eaters, Evers et al. (2009) found that individuals who self-reported as emotional eaters on the DEBQ did not actually increase their food intake during emotional encounters in a laboratory setting. The researchers suggested cautious interpretation of results from emotional eating scales, hypothesising that self-reported emotional eating may be either a reflection of beliefs about emotional eating, rather than behaviour, or that answers may be influenced by difficulties recalling, assessing and reporting one's own motivations for eating and the links between emotional state and food intake. Questions of what is being assessed by various definitions and measures of emotional eating and the most appropriate ways to investigate emotional eating in bariatric candidates require further consideration.

Table 3.4. Summary of characteristics of included studies on emotional eating.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Castellini et al. (2014b)	394 surgical candidates 683 non-surgical weight loss treatment clinic patients	73.4 80.1	44.9 (11.4) 46.7 (13.8)	44.6 (8.3) 37.8 (6.9)	Assessed as part of routine clinical assessments; participants completed measures, interviewed by clinician using SCID to assess lifetime BED/Axis I disorders and number of weekly objective/subjective binges using to the EDE-I and DSM-5; BED diagnosis made with DSM-5 criteria	SCID for DSM-IV, EDE-Q, BES	Subjective binge eating was associated with higher emotional eating for both the surgical ($p < 0.01$) and non-surgical groups ($p < 0.001$); after adjusting for BMI, greater subjective binge eating episodes were still associated with higher levels of emotional eating in the whole sample
Castellini et al. (2014a)	27 AGB candidates 30 RYGB candidates 26 BPD candidates	83.2 93.3 92.3	43.9 (11.4) 43.6 (9.8) 48.8 (8.4)	44.8 (5.3) 49.5 (6.8) 50.6 (6.6)	Patients interviewed pre-surgery as part of routine clinical assessment and at 12 months post-surgery	EES	No difference in emotional eating by forthcoming type of bariatric surgery
Claes et al. (2013)	102	100.0	36.4 (10.9)	40.7 (4.2)	Screened within pre-surgical psychological assessment	DEBQ, NEO-FFI	Emotionally dysregulated/undercontrolled personality subtype ($n = 58$) reported greater emotional eating symptoms than resilient/high functioning type ($n = 44$; $p < 0.01$)

Crowley et al. (2012)	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluation for bariatric surgery conducted by psychologist, included semi-structured clinical interview and questionnaires; also assessed by dietitian	FCQ-T; interviewed about past and present emotional eating behaviours; "specific questions differed according to clinician but generally included questions like 'Do you ever find yourself eating when you're bored? Angry? Upset? Or some other emotion?'" (p. 368)	58.7% reported emotional eating; emotional eaters had more intentions/plans to eat craved foods ($p = 0.01$), more often anticipated positive reinforcement ($p = 0.01$) and relief from negative states and feelings ($p = 0.02$) as a result of eating craved foods, felt less control over their eating ($p = 0.01$), were more preoccupied with food ($p = 0.005$), felt greater emotion before or during cravings or eating ($p < 0.001$), and experienced more cues triggering food cravings ($p = 0.001$); no group differences in physiological hunger or guilt related to having/giving into cravings
Fischer et al. (2007)	144	80.6	40.3 (not reported)	54.2 (34.9-81.4)	Utilised data from pre-surgical assessments and follow-up assessments an average of 8 months post-surgery	EES, BDI, TFEQ, QEWP/QEWP-R	High emotional eaters (top EES quartile) had more frequent binge ($p < 0.001$) and extreme weight control episodes ($p < 0.05$), more depressive symptoms ($p < 0.001$), and greater eating disinhibition ($p < 0.001$) and hunger ($p < 0.001$) than low (bottom quartile) emotional eaters; no difference in BMI or cognitive restraint ($p > 0.05$)
Gade et al. (2014)	102	67.6	42.6 (9.8)	43.5 (4.9)	Data collected online during hospital visit four months prior to surgery	TFEQ-R, NEO-PI-R, HADS	Female candidates reported significantly more emotional eating symptoms than male candidates ($p < 0.001$); emotional eating positively correlated with neuroticism, anxiety, and depression, and negatively correlated with conscientiousness (all $p < 0.001$)
Gradaschi et al. (2013)	75 surgical candidates 75 non-	60.0 66.7	42.7 (11.3) 50.9 (14.5)	40.2 (4.1) 40.2 (4.6)	Comparison of bariatric surgery candidates and non-surgical	"Subjects were requested to state whether they have	38.7% reported emotional eating; no difference between rates in surgical candidates (38.7%) and non-surgical

	surgical treatment seekers				(weight loss program) treatment seekers; data collected within pre-surgical/pre-weight loss program evaluations; no group differences in mean weight/BMI	emotional eating or tend to lose control over food intake" (p. 35)	treatment seekers (33.3%)
Guerdjikova et al. (2007)	178	74.2	Not reported for total sample	Not reported for total sample	Reviewed pre-surgery psychological evaluations of consecutive patients and data from 6-month follow-up (emotional eating assessed pre-surgery only)	Patients asked in evaluation whether "they considered themselves 'emotional eaters,' e.g. if they would eat for any reason other than true physical hunger, such as for situational triggers, or negative or positive emotions" (p. 1092)	38.7% reported emotional eating
Miller-Matero et al. (2014)	142	81.0	46.3 (11.7)	49.1 (9.6)	Reviewed pre-surgery psychological evaluations (semi-structured interviews) of consecutive patients	EES	38.1% reported emotional eating; 25.4% ate in response to anger/frustration, 40.7% in response to anxiety, 38.4% in response to depression
Noli et al. (2010)	150	64.7	42 (11)	46.6 (10.4)	Study comparing candidates and post-surgical patients; all underwent an eating and behaviour interview by a trained investigator	Patients labelled emotional eaters "when being used to eat specifically in response to anxiety, boredom, and to positive and/or negative emotions" (p.	50.6% had pre-surgical emotional eating

				617)			
Ronchi et al. (2008)	50 surgical candidates 50 behavioural weight loss program patients	76 70	42.6 (22-58) 40.8 (24-65)	44.5 (8.5) 40.7 (8.8)	Interviews by trained dietitian with surgical candidates and patients enrolling in a behavioural weight loss program; "the interviewer carried out the interviews according to the patient's personal background and in a clinically sensitive manner" (p. 146)	Assessment of issues including emotional eating ("if they usually ate to cope with negative emotions or if they increased food intake in response to psychological distresses, such as depression or anxiety" (p. 146)	Surgical patients had higher BMI ($p < 0.003$) and body weight ($p < 0.009$); more behavioural program patients than surgical patients reported a "tendency toward" emotional eating, though no significant difference was found ($p \geq 0.05$)
Walfish (2004)	122	100.0	37.9 (21-59)	49.3 (30.8-97.9)	Pre-surgical psychological evaluations conducted by the author	WALI Section H - candidates rated how much eating in response to each of six emotions had contributed to their weight gain	40% "considered emotional eaters"; 22% said eating when tired contributed a "large" or "the greatest" amount to their weight gain, 29% said this for eating when anxious, 31% when angry, 44% when depressed/upset, 45% when bored, 49% when stressed; 38% said none of these emotions contributed in this way to their weight gain
Zijlstra et al. (2012)	102 bariatric candidates 102 matched general population controls	100.0 100.0	46 (10) 45 (11)	Not reported for each group	Patients already screened for surgery were sent invitation/ questionnaires; control group selected from sample of general population women (not from a health care setting) who were controls in an earlier study;	DEBQ (completed by bariatric candidates only), PANAS	After adjusting for other eating behaviours, emotional eating was associated with increased negative affect ($p = 0.002$) in bariatric candidates

					controls matched on age and education		
Zimmerman et al. (2007)	500	81.4	41.5 (10.1)	Not reported for total sample	Reviewed pre-surgery patient evaluations and outcomes	Surgery clearance form data: whether patient was cleared for surgery; if not, psychiatrist's reason(s)	Most common reason for not clearing individuals for surgery (62.0% of those with a reason recorded) was "overeating to cope with stress or emotional distress"

BDI, beck depression inventory; BES, binge eating scale; BMI, body mass index; BPD, biliopancreatic diversion; DSM, diagnostic and statistical manual of mental disorders; DEBQ, dutch eating behaviour questionnaire; EDE-I, eating disorder examination – interview; EDE-Q, eating disorder examination – questionnaire; EES, emotional eating scale; FCQ-T, food craving questionnaire – trait; HADS, hospital anxiety and depression scale; AGB, adjustable gastric banding; NEO FFI, NEO five factor inventory; NEO PI-R, NEO personality inventory – revised; PANAS, positive and negative affect schedule; QEWP, questionnaire on eating and weight patterns; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, Roux-en-Y gastric bypass; SCID, structured clinical interview for DSM disorders; SD, standard deviation; SF-36, short form 36 health survey; TFEQ, three-factor eating questionnaire; TFEQ-R21, three-factor eating questionnaire-r21; WALI, weight and lifestyle inventory.

3.4.5 Food cravings and addiction

Ten articles examining bariatric candidate food cravings and addiction were identified (Table 3.5). Two studies of food cravings have suggested that these may be stronger and more problematic in bariatric candidates than in normal weight individuals. Abiles et al. (2010) noted that bariatric candidates experienced stronger, more intense food cravings which were more often triggered by their environment, were more likely to plan to consume craved foods, more often sought and anticipated relief from negative feelings by eating, felt more guilt as a result of having and giving into cravings, believed they had less control over their eating and were more preoccupied with food. Leahey et al. (2012) found that bariatric candidates had more food cravings, both overall and for high-fat and fast foods, and were also more likely to actually consume the high-fat foods they craved. Crowley et al. (2012) found links between common mental health issues and cravings in candidates, reporting that experiencing greater depressive symptoms was associated with stronger craving-related symptoms including greater intention to eat craved foods, anticipating more positive reinforcement and relief from negative feelings from eating, feeling a lack of control over cravings, greater food preoccupation, feeling more emotion related to cravings and feeling depression and anxiety symptoms were related to more craving-related guilt. Demographic characteristics related to food cravings, especially those comparing cravings in bariatric candidates to those of similarly obese individuals, including associations between experiencing food cravings and actually eating as a result of cravings require further study, along with the impact of cravings on food consumption and preparation for surgery and the utility of intervention to manage cravings.

Beyond cravings, bariatric candidates in several qualitative studies have described their own pre-surgical eating as an ‘addiction’ or ‘obsession’ (Engstrom & Forsberg, 2011; Ogden et al., 2006). In recent years, a ‘food addiction’ model of overeating and obesity has been widely debated, with the recognition of similarities between addictive disorders such as alcohol or tobacco addiction and the excessive consumption of calorie-dense, hyperpalatable foods. These similarities have been noted as both neurobiological, including increased dopamine and opioid neural circuitry, and behavioural, with

cravings triggered by cues, consumption in spite of negative consequences and a desire to cut down and loss of control over the behaviour (Gearhardt et al., 2011; Meule, 2011). However, the concept of food addiction remains highly controversial (Meule & Kübler, 2012). The 2009 publication of the Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009), modelled on the DSM-IV criteria for substance use disorder, provided a standardised assessment tool and has spurred research into food addiction. The YFAS has been validated in a bariatric candidate population (Meule, Heckel, & Kübler, 2012), and as shown in Table 3.5, all of the identified quantitative studies of food addiction in candidates utilised the YFAS as their sole measure of food addiction. These investigations into food addiction in bariatric candidates reported prevalences from 16.9 to 53.7% (Clark & Saules, 2013; Meule, Heckel, Jurowich, Voegele, & Kübler, 2014; Meule et al., 2012; Miller-Matero et al., 2014; Pepino, Stein, Eagon, & Klein, 2014).

Two studies, by Meule et al. (2014) and Pepino et al. (2014), have further examined characteristics and correlates of food addictions in bariatric candidates, finding no difference related to a food addiction diagnosis in terms of gender, age (Meule et al., 2014), BMI (Meule et al., 2014; Pepino et al., 2014) or weight (Pepino et al., 2014). Both research teams also examined links between food addiction and food cravings, with Meule et al. (2014) finding that those with food addiction had more trait food cravings, but not state food cravings, while Pepino et al. (2014) noted that candidates with food addiction craved foods both in general, and particularly starches and fast foods, more often than those without food addiction. This was not the case for sweet and high-fat foods. Candidates with food addiction were also found to experience more days of binge eating, greater depression symptoms, more eating, weight and shape-related concerns (Meule et al., 2014), and more external and emotional eating, but no more restrained eating, than those without a food addiction (Pepino et al., 2014).

Positively, attempts to avoid possible recall and ‘faking good’ biases were noted in several investigations of candidate food addiction, with methodologies used including emphasising that candidates’ responses would have no influence on their surgical eligibility (Meule et al., 2014; Meule

et al., 2012) and recruiting patients who had already completed their pre-surgical assessment and were scheduled for surgery (Pepino et al., 2014). It is interesting to note that the only publication that used retrospective data collection, by Clark and Saules (2013), reported the highest prevalence of food addiction, while the single study utilising data from pre-surgical candidate assessments, by Miller-Matero et al. (2014), noted the lowest prevalence (see Table 3.5).

No studies to date have compared the prevalence or characteristics of bariatric candidates' food addiction to those of similarly obese individuals not undergoing bariatric surgery. This would be useful information. Qualitative and mixed-method research will be valuable to assist our understanding of candidates' experiences and understandings of food addiction, how these relate to the symptoms assessed by the YFAS and the relation of a perceived or diagnosed food addiction to candidates' expectations of their upcoming bariatric surgery. Research is also needed to identify the differences and similarities between cravings and food addictions, their impacts and correlates, especially in relation to psychosocial functioning and distress, and the potential efficacy of therapeutic interventions for these issues.

Table 3.5. Summary of characteristics of included studies on food cravings and addiction.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Abiles et al. (2010)	26 candidates with type III obesity 24 candidates with type IV obesity 25 normal-weight controls	77.0 79.2 64.0	39.3 (8.7) 38.5 (8.3) 40.7 (12.4)	45.0 (3.0) 55.9 (5.5) 23.6 (2.2)	Prospective observational comparison of bariatric candidates and normal-weight controls with "similar" age, education, cultural, and socioeconomic characteristics	FCQ-T, EDE-Q	Obese candidates made more plans and had greater intention to eat craved foods, more often anticipated relief from negative feelings by eating, felt they had lost control over eating, had cravings triggered by external cues, felt cravings as hunger and due to emotions, were more preoccupied with food, and felt more guilt about cravings and eating (all $p < 0.05$); no difference in anticipated positive reinforcement from eating ($p = 0.15$); types III and IV obesity patients differed only in anxiety (lower in type IV patients) and tough-mindedness (higher in type IV patients; both $p < 0.05$), not on variables including cravings, eating disorders, depression, self-esteem
Clark et al. (2013)	67	62.7	42.7 (25-73) at time of data collection	Not reported for pre-surgery	Participants recruited from previous studies and an online support group completed an online survey on their current and pre-surgical (retrospective data collection) behaviours	YFAS	53.7% retrospectively reported meeting criteria for pre-surgical food addiction
Crowley et	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluations for bariatric surgery	FCQ-T, CES-D 10, BAI	Higher depression was related to greater intentions/plans to consume craved foods

al. (2012)					conducted by psychologist involving semi-structured clinical interview and questionnaires; also assessed by dietitian		(p = 0.001), anticipation of positive reinforcement (p = 0.009) and relief from negative states and feelings (p = 0.001) from eating craved foods, lack of control over eating (p = 0.01), food preoccupation (p = 0.006), greater emotion before or during cravings (p = 0.037), and feeling guilt about having/giving into cravings (p = 0.003); no relationship between depression and hunger or cues that may trigger cravings; greater anxiety was associated only with feeling guilt from having/giving into cravings (p = 0.023)
Engstrom and Forsberg (2011)	16	75.0	36.8 (24-44)	56.0 (not presented)	Qualitative interviews at pre-surgery and 1 and 2 years post-surgery, focusing on changes from pre- to post-surgery	Pre-surgical open-ended questions on expectations of surgery and how obesity effected the individual; similar questions at post-surgery	"Many informants viewed their relationship to food as an abuse and some drew analogies to alcoholism. 'I view this as an addiction. In the same way as alcoholism is an addiction, I am addicted to food'" (p. 4)
Leahey et al. (2012)	32 surgical candidates 20 normal-weight controls	87.5 90.0	47.9 (10.6) 47.9 (9.2)	Not reported for total surgical sample 22.5 (1.3)	Comparison of candidates/patients and normal-weight controls, assessed up to 6 weeks before surgery and at 3 and 6 months post-surgery	FCI	Before surgery, candidates reported more overall cravings, more cravings for high-fat and fast food (all p < 0.02), and were more likely than controls to consume craved high-fat foods (p = 0.04)
Meule et al. (2012)	96	65.6	39.9 (11.5)	50.6 (9.0)	Cross-sectional study; participants approached in bariatric clinic but told participation would be unrelated to	YFAS	41.7% (n = 40) received a food addiction diagnosis

					surgical eligibility		
Meule et al. (2014)	38 with food addiction 56 without food addiction	65.6 (not reported by group)	39.3 (9.8) 40.4 (12.7)	50.9 (8.1) 50.6 (9.7)	Cross-sectional comparison study; candidates approached in bariatric clinic, told participation would be unrelated to surgical eligibility	YFAS, FCQ-T, EDE-Q, Barratt Impulsiveness Scale - Short Form, AUDIT, CES-D	40.4% had a food addiction; those with and without food addiction did not differ by gender, age, or BMI; food addiction group had higher depression scores ($p < 0.001$) and higher trait ($p < 0.001$) but not state cravings; also had greater eating ($p < 0.001$), weight, and shape (both $p < 0.01$) concerns, reported more binge days ($p < 0.001$), and had higher attentional impulsivity ($p < 0.05$); no difference in motor, non-planning, or overall impulsivity by diagnosis
Miller-Matero et al. (2014)	142	81.0	46.3 (11.7)	49.1 (9.6)	Retrospective analysis of pre-surgery evaluations (semi-structured interviews) of consecutive patients	YFAS	16.9% met criteria for food addiction diagnosis
Ogden et al. (2006)	15	93.3	41.1 (25-50)	47.5 at pre-surgery (39.5-58.0)	Interviews with patients who had surgery in previous four years, data analysed using Interpretative Phenomenological Analysis	Open-ended questions including reasons for having surgery, whether surgery changed how the patient felt about food and self	"Many described how before the surgery they had been quite preoccupied with food and many used words such as 'addiction' and 'obsession'" (p. 285)
Pepino et al. (2014)	14 with food addiction 30 without food addiction	88.6 (not reported by groups)	43.2 (11.1) 42.6 (10.9)	47.5 (8.0) 48.2 (8.2)	Patients scheduled for surgery completed questionnaires both before surgery and after losing ≥ 15% of their initial body weight after surgery, on return for follow	YFAS, DEBQ, FCI	31.8% of candidates met criteria for food addiction; no group differences by body weight or BMI; candidates with food addiction more frequently craved foods in general, and particularly starches and fast foods (all $p < 0.05$) than those without food addiction; no differences in sweet or high-fat cravings; those with food

		up	addiction reported more external and emotional eating (both $p < 0.05$), but restrained eating did not differ

AUDIT, alcohol use disorders identification test; BAI, beck anxiety inventory; BMI, body mass index; CES-D, centre for epidemiological studies depression scale; CES-D 10, centre for epidemiological studies short depression scale; DEBQ, dutch eating behaviour questionnaire; EDE-Q, eating disorder examination – questionnaire; FCI, food craving inventory; FCQ-T, food craving questionnaire – trait; SD, standard deviation; YFAS, yale food addiction scale.

3.4.6 Pre-surgical expectations of eating after surgery

Five studies (Table 3.6) on bariatric candidates' pre-surgical expectations of whether and how their eating behaviours will change after surgery were identified. Interviews with bariatric candidates suggest they commonly believe that they have lost control over their own diet and ability to lose weight and feel that this control cannot be regained internally. Choosing to undergo bariatric surgery is seen as a way to end the never-ending, unwinnable struggle with food and weight, and hand control over to a surgeon, who candidates believe will release them from obesity by changing how their body works. This will change the individual's eating habits, causing them to lose weight (da Silva & da Costa Maia, 2012; Engstrom & Forsberg, 2011; Ogden et al., 2006; Wolfe & Terry, 2006). Engstrom et al. (2011) reported that candidates were looking for a new bodily mechanism to help them to control their eating, as they believed their mind was no longer able to do so.

Analyses of candidate narratives also indicate that pre-surgical expectations may be very high. Da Silva and Maia (2012) found that candidates often saw their upcoming surgery as 'the miracle that will solve all life's problems' (p. 1721), believing it would lead to significant, long-term weight loss, resolution of health, employment, family, romance, self-esteem and social difficulties, and increased independence and happiness (da Silva & da Costa Maia, 2012; Engstrom & Forsberg, 2011; Engstrom et al., 2011; Ogden et al., 2006). Candidates may also see themselves as passive elements in their forthcoming surgery, with Engstrom et al. (2011) noting that very few candidates 'spoke about their own part in this treatment and of losing weight after surgery' (p. 6). One quantitative study by Wolfe and Terry (2006) examined procedure-specific expectations of post-surgical eating, finding that RYGB candidates expected the physiological changes of their surgery would virtually guarantee large amounts of weight loss by leading the individual to dislike sweets and feel satisfied with less food. Most also expected that weight loss from their surgery would increase their ability and desire to engage in exercise.

With few studies having examined candidate experiences of eating and their eating-related surgical expectations, investigation is needed into how bariatric candidates believe their upcoming bariatric surgery procedure will affect their eating behaviours, disordered eating, appetite, hunger, cravings and food addictions, whether candidate expectations are realistic regarding their particular procedure and the impacts of realistic and unrealistic expectations about anticipated changes in eating behaviours. Qualitative research will be especially important to provide rich, in-depth data regarding candidates' real-life experiences and expectations.

Table 3.6. Summary of characteristics of included studies on candidate expectations of post-bariatric surgery eating.

Author (year)	N	% female	Mean age, years (SD or range)	Mean baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
da Silva and Maia (2012)	30	66.7	39.2 (8.8)	47.5 (8.2)	Pre-surgery interviews with surgical candidates	Open-ended questions including living with weight gain, reasons for choosing surgery, relationship with food, expectations of life after surgery	"Bariatric surgery emerges as the only treatment for obesity, and participants highlight this moment as the beginning of a new life where health professionals have the main role. Bariatric surgery candidates see their eating behaviour as out of their control, and to commit to its demands is seen as a big sacrifice. For these patients, surgery is understood as a miracle moment that will change their lives without requiring an active role or their participation" (p. 1714)
Engstrom et al. (2011)	23	60.9	40.9 (21-62)	52.2 (38.4-67.6)	Interviews with bariatric surgery candidates, phenomenological hermeneutic approach to data analysis	Open-ended questions including reasons for choosing surgery, expectations, patients' views of themselves and their body, eating behaviours, and relationship to food	"Several of the informants […] desired a mechanism in their body that could help them control their eating behaviour. 'I need this superior person telling me what to do. I view the operation as a superior person, since it will make my bowel smaller, thus I have to eat less. It may sound strange, but somehow my stomach will set the limit. Now my stomach tells me to eat more and more. I won't be like that after the operation…'" (p. 3)
Engstrom et al. (2011)	16	75.0	36.8 (24-44)	56.0 (not presented)	Interviews pre-surgery and at 1 and 2 years post-surgery, focus on changes from pre- to	Pre-surgically, open-ended questions about expectations of surgery and how obesity affected the	"…They desired a mechanism in their body to help them control their eating behaviour" (p. 6) "Hoping to have some quality of life, […]

					post-surgery	individual, similar questions at post-surgery	become more physically active and being able to keep or receive a job as well as becoming happier. Having a well-functioning social situation in the family, with friends, and playing an active part in society was something that the informants were hoping to achieve with help from the surgery and the weight loss…" (p. 6)
Ogden et al. (2006)	15	93.3	41.1 (25-50)	47.5 at pre-surgery (39.5-58.0)	Interviews with patients who had undergone surgery in past four years, data analysed using Interpretative Phenomenological Analysis	Open-ended questions including reasons for having surgery and whether surgery changed how the individual felt about food and self	"…Many patients described how they realised that they were not going to lose weight on their own and stated how they wanted to hand over control and responsibility for their weight loss to someone else" (p. 280)
Wolfe and Terry (2006)	93	87.1	42.1 (10.4)	52.5 (10.1)	Reviewed medical charts and mailed surveys to all patients who had undergone first-time RYGB prior to April 2003	Researcher-created survey on pre-surgical (retrospectively reported) and current weight, physical health, dietary patterns, exercise, relationships, mood, and eating behaviours	"Pre-RYGB patients invariably express hope and expectation that the physical changes imposed by the surgery will cause them to develop distaste for sweets and become satisfied with less food, consequently assuring great weight loss" (p. 1627). "While most patients expected surgically-induced weight loss to increase their ability and desire to exercise, few talked about it causing them to increase their desire to self-monitor food intake" (p. 1627)

BMI, body mass index; RYGB, Roux-en-Y gastric bypass; SD, standard deviation.

3.5 Discussion

The literature indicates that patterns of eating including BED, emotional eating, grazing, NES and food cravings and addiction are common in bariatric candidates, and often more so than in the general or non-obese populations. In addition, studies have suggested that there may be a number of common 'clusters' of problematic eating-related issues experienced by candidates, with the most commonly reported between NES and BED. Investigations into the prevalence, characteristics, experiences and impacts of individual and comorbid disordered eating patterns in pre-surgical candidates are needed.

A number of studies have suggested that BED may be more common in bariatric candidates than in similarly obese non-surgical populations. To better understand this potentially important difference between bariatric candidates and other similarly obese individuals, further investigation of this finding and longitudinal studies of its causation are required: are individuals with BED more likely to opt for bariatric surgery than those without these behaviours, and if so, why, or do bariatric candidates develop these behaviours after choosing to undergo bariatric surgery? Is there another explanation? This investigation may assist in understanding the unique experiences of bariatric candidates and their reasons for undergoing bariatric surgery.

More generally, to understand the specific motivations, characteristics and needs of bariatric candidates, significant further research is needed into the differences in eating habits, expectations and disordered eating patterns of those who choose to undergo bariatric surgery, compared with those engaged in non-surgical weight loss strategies, and similarly obese individuals who are not attempting to lose weight. In comparisons of bariatric candidates with normal weight individuals, it is difficult to infer whether any observed differences or common experiences are related to an individual's status as a bariatric candidate or are instead related to their obesity or obesity-related factors. To address this, investigations comparing bariatric candidates to other similar-weight individuals should be prioritised to facilitate better understanding of the characteristics, correlates and motivations for undergoing bariatric surgery of this population, beyond obesity.

In this rapidly expanding research field, it is to be expected that further investigation and replication of existing findings will be required. However, this review has identified common limitations in the existing literature and a number of distinct areas for improvement in further studies. The research to date has in places suffered from potential methodological weaknesses including possible biases of candidates 'faking good' in their pre-surgical assessments, as well as the use of post-surgical retrospective reporting of pre-surgical behaviours. Lack of consistent definitions of key variables and use of unclear, unvalidated, non-replicable assessment methods are also significant limitations (Colles & Dixon, 2006; Colles et al., 2008a; Conceição et al., 2014a). These methodological issues prevent understanding of the clinical significance of potential eating-related issues and are problematic for cross-study comparisons, generalisation and attempts to build on existing findings. Hypothesis-driven, prospective studies of eating-related issues, clearly, consistently and accurately defining variables, using validated, accurate measures and replicable methodologies are needed in future research and will be invaluable for advancing the literature. Evaluation of the circumstances under which patients attempt to appear psychologically well and the effect of this on responses, and the impact of using retrospective data vs. prospective data to assess pre-surgical eating-related issues, are also needed.

Attention should be paid to investigating the experiences of individuals not fitting the 'typical' bariatric candidate characteristics. The vast majority of investigations into eating in bariatric candidates have studied samples overwhelmingly comprised of middle-aged, female candidates. Although this is largely representative of those undergoing bariatric surgery in many Western countries (Korda, Joshy, Jorm, Butler, & Banks, 2012; Padwal, 2005), it will also be important to understand the eating-related behaviours and stories of demographic groups often underrepresented in bariatric surgery populations, including men, younger and older patients, and candidates with very high BMIs. While a number of studies have investigated eating behaviours in samples solely comprised of female candidates and several compared disordered eating of candidates with different racial backgrounds, there has been little focus on other specific demographic groups within the larger bariatric candidate population. Both qualitative and quantitative research methodologies will assist in beginning to understand their experiences, needs and expectations.

As surgery is often considered by bariatric candidates as the only viable option to change their eating and weight, expectations are very high, and candidates commonly hope their surgical procedure will cause positive changes in their eating, give them back control over their behaviour, and virtually guarantee weight loss and other positive health and psychosocial outcomes. Further research is needed into how pre-surgical candidates expect their eating to be affected by the particular bariatric surgery they are scheduled to undergo and the accuracy of these expectations, candidates' beliefs about the longevity of the anticipated surgery-related changes to their eating and their understanding of the mechanisms of weight loss related to their particular surgery. The effects of expectations need to be further understood, with consideration given to assessing the potential benefits of counselling and education for candidates with highly unrealistic expectations.

With problematic eating patterns before bariatric surgery often related to significant candidate distress and an increased likelihood of various other undesired consequences, detailed pre-surgical assessments provide an important opportunity to identify these issues and consider further assistance. Identification of symptoms or indications of eating-related distress should be followed by thorough and compassionate exploration, assessment of psychosocial and eating-related comorbidities and consideration of referral to appropriate medical or allied health services. However, additional research will be vital to understand whether surgical candidates with disordered eating may benefit from assistance prior to surgery to reduce their disordered eating behaviours as well as potentially related consequences such as depression, distress and reduced quality of life (Jones-Corneille et al., 2012). Several studies have reported on the impact of pre-surgical interventions on binge eating, with Abiles et al. (1995) reporting a 12.7% reduction in BED prevalence in their sample after twelve 2-h group cognitive-behavioural sessions that were not specifically focused on binge eating treatment. Ashton et al. (2009; 2011) found both a significant reduction in candidate binge eating episodes after only four 90-min group cognitive-behavioural therapy sessions for binge eating and later noted that patients who had responded positively to this intervention had also lost significantly more weight at both 6 and 12 months after bariatric surgery. Further investigation of the longevity of any eating and well-being-related improvements, longitudinal studies of the impact of pre-surgery eating-related treatments on

both pre-surgical and post-surgical outcomes, and examinations of pre-surgical programmes for problematic eating behaviours beyond binge eating will be of significant interest. Further consideration will also be needed into the optimal timing of any eating-related intervention. For example, Leahey et al. (2009) found that pre-surgical candidates were less likely to initiate treatment, attended fewer sessions and were less likely to complete an intervention for problematic eating than post-operative patients. The authors suggested that treatment 'ought to consider balancing the needs of the pre-operative patients presenting with maladaptive eating behaviour with the likelihood of them participating in a behavioural intervention before surgery' (p. 99).

While much of the existing bariatric research is focused on important questions around whether pre-surgical eating behaviours, disorders, hunger, appetite, experiences and expectations are related to suboptimal post-surgical eating-related behaviours and poorer outcomes, Jones-Corneille et al. (2012) provide an important reminder that 'the amelioration of patient suffering – from depression, anxiety, and other conditions – is a critical objective in itself, regardless of whether the pre-operative amelioration of psychopathology improves the outcome of bariatric surgery' (p. 395). Regardless of the impact on post-surgical outcomes, understanding the eating-related motivations, concerns, disorders, behaviours, expectations and perspectives of individuals before bariatric surgery is likely to be vital for providing appropriate support, care and education, and to reduce distress and discomfort.

Conflict of interest statement: No conflict of interest was declared.

Author contributions: MO conceived and produced the drafts of this paper and was responsible for the overall publication, with ACH and GW contributing to the concept and content. All authors were involved in revisions and gave final approval for the submitted and published version.

Chapter 4. Changes in problematic and disordered eating after Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy

Please note: The published article is included as Appendix I.

Statement of authorship

Title of paper	Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy: A systematic review of pre-post studies.
Publication status	Published (submitted 18 March 2016; revised 15 April 2016; accepted 18 April 2016)
Publication details	Opozda, M., Chur-Hansen, A., & Wittert, G. (2016). Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy: A systematic review of pre-post studies. *Obesity Reviews, 17*(8), 770-792. https://doi.org/10.1111/obr.12425

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Contribution to paper	Developed study protocol, conducted searches and retrieved papers, appraised and extracted data, acted as corresponding author, wrote and revised manuscript based on supervisor and reviewer feedback.
Overall percentage	85%
Certification	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signed and dated _____ _____

CO-AUTHORS

By signing the Statement of Authorship, each co-author certifies that:
- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100%, less the candidate's stated contribution.

Co-author name	Anna Chur-Hansen
Contribution to paper	Provided guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

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Contribution to paper	Provided guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

4.1 Abstract

Despite differences in their mechanisms and outcomes, little is known about whether post-surgical changes in eating behaviours also differ by bariatric procedure. Following a systematic search, 23 studies on changes in binge eating disorder (BED) and related behaviours, bulimia nervosa and related behaviours, night eating syndrome, grazing, and emotional eating after Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), and vertical sleeve gastrectomy (VSG) were reviewed. Significant methodological problems and a dearth of literature regarding many behaviours and VSG were seen. Regarding BED and related behaviours, though later re-increases were noted, short-to-medium term reductions after RYGB were common, and reported changes after AGB were inconsistent. Short to medium-term reductions in emotional eating, and from a few studies, short to long-term reductions in bulimic symptoms, were reported after RYGB. Reoccurrences and new occurrences of problem and disordered eating, especially BED and binge episodes, were apparent after RYGB and AGB. Further conclusions and comparisons could not be made due to limited or low-quality evidence. Long-term comparison studies of changes to problematic and disordered eating in RYGB, AGB, and VSG patients are needed. It is currently unclear whether any bariatric procedure leads to long-term improvement of any problematic or disordered eating behaviour.

Keywords: eating, eating disorder, problematic eating, bariatric surgery

4.2 Introduction

Bariatric surgery is the most effective long-term treatment currently available for severe obesity (Colquitt et al., 2014). The most commonly performed bariatric procedures worldwide are currently Roux-en-Y gastric bypass (RYGB; 45% of worldwide), vertical sleeve gastrectomy (VSG; 37%), and adjustable gastric banding (AGB; 10%), though their relative popularity varies by country and region (Angrisani et al., 2015). These surgeries were designed to either reduce the volume of the stomach to restrict food intake and induce earlier satiety (AGB, VSG), or combine restriction with food malabsorption to also reduce the body's absorption of calories and nutrients (RYGB; Colquitt et al., 2014). However, their mechanisms are now understood to be much more complex than initially believed, with changes seen in hunger, food preferences, intolerances, and taste, food-related rewards, energy expenditure, vagal and hypothalamic signalling, gut-brain signals and gut microbial factors, and the levels, types, and circulation of bile acids in the gut (Miras & le Roux, 2013; Sandoval, 2011). The role and influence of these varies by procedure. Outcomes also often differ by surgery, with the majority of the literature suggesting greatest average weight loss after RYGB, followed closely by VSG, and superior remission and improvement of conditions including Type II diabetes, dyslipidaemia, and hypertension in RYGB patients compared to VSG or AGB (Caiazzo & Pattou, 2013; Courcoulas et al., 2013; Ianelli, Anty, Schneck, Tran, & Gugenheim, 2011).

A substantial proportion of pre-surgical bariatric patients experience often significant, long-standing disordered eating patterns, with our recent review (Opolski, Chur-Hansen, & Wittert, 2015) showing that 4-45% may have binge eating disorder (BED), 20-60% graze, 2-42% have night eating syndrome (NES), 38-59% emotionally eat, and 17-54% fit the criteria for food addiction. While significant research attention has focused on whether these problematic and disordered eating behaviours persist or disappear after bariatric surgery, as a whole, in spite of their significantly differing physiological alterations, mechanisms of change, and weight and health-related outcomes, just one research team (Herpertz et al., 2003) has reviewed whether the varying "anatomical realities" of different bariatric procedures may "lead to differing consequences for eating behaviour" (p. 1308). In this paper,

Herpertz et al. (2003) compared studies with ≥ 1-year follow-up on changes in binge eating disorder and behaviours, eating disorder scores, general eating behaviours, and the acceptability and variability of foods in patients who had undergone restrictive procedures, gastric bypass, or biliopancreatic diversion. They found significant procedure-based differences, concluding that "exclusively restrictive surgery procedures such as gastric banding or [vertical banded] gastroplasty have a different impact on eating behaviour compared to bypass procedures such as gastric bypass or biliopancreatic diversion" (p.1310-1311). Despite this, subsequent reviews of problematic and disordered eating behaviours in current bariatric procedures have either focused on a single bariatric procedure (Dodsworth et al., 2010) or have examined multiple procedures together under the larger banner of 'bariatric surgery' (Meany et al., 2014; Niego et al., 2007; Wimmelmann et al., 2014).

4.3 Method

This study aims to systematically review and compare the literature on pre- to post-surgery changes in the following problematic and disordered eating behaviours after RYGB, AGB, and VSG: binge eating disorder and associated behaviours (e.g. binge episodes, uncontrolled eating); bulimia nervosa and associated behaviours; emotional eating; night eating syndrome; and grazing.

4.3.1 Inclusion/exclusion criteria

All included studies were original English-language research papers, either published, in-press, or in-process in a peer-reviewed journal between 1 January 1990 and 22 May 2015. Studies were considered for inclusion if they reported data on adult participants who had undergone RYGB, AGB, or VSG, were pre-post studies with at least one assessment pre-surgery and post-surgery, and reported comparable pre- and post-surgery current/recent (not lifetime) prevalence or changes in any of the target eating variables.

Studies were excluded if they reported only the lifetime prevalence of a disordered eating behaviour, focused on child or adolescent patients (studies including a small proportion of participants under 18 years old were not excluded), utilised only retrospective measurement of pre-surgical eating behaviours, or if the bariatric intervention was not specified or data from multiple bariatric procedures were combined. Studies of specific interventions for disordered eating before and/or after surgery were excluded, though studies in which some patients may have utilised an offered or available intervention, treatment, support group, or similar (but where this assistance was not the research focus) were considered for inclusion. As this review aims to investigate *changes* in prevalence and characteristics from pre- to post-surgery, and does not seek to establish the prevalence of these disorders in bariatric populations, studies comprising participants who all had a particular disordered eating behaviour, or which compared eating behaviour changes in groups with differing characteristics (e.g. in those who had successful and unsuccessful weight loss) were not excluded on that basis.

To facilitate a manageable review of changes in eating disorders, symptoms, and problematic eating behaviours, studies of changes in additional potentially important related eating-related variables including food cravings and addiction, cognitive restraint, disinhibition, sweet eating, dietary changes, eating patterns, nutrients, hunger, appetite, satiety, self-efficacy, eating-related quality of life, changes in taste and preference, and food aversions and intolerances were not included in this review.

4.3.2 Search strategy and study selection

The review was conducted and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement (Moher, Liberati, Tetzlass, Altman, & The PRISMA Group, 2009). Initial limited database searches, conducted to identify key terms, were followed by full searches using identified keywords and index terms in Medline, PsycINFO, Embase, and the Cochrane Central Register of Controlled Trials. Studies published, in press, and in process were sought, and to avoid false exclusion of relevant articles, the only database search limits used

(where relevant) were articles in English, from 1 January 1990 to 22 May 2015. The specific variables to be reviewed in this paper were finalised after the initial database searches.

Each database was searched using similar terms, modified as needed to fit the particular system. In Medline, the following search was conducted: (1) bariatric surgery[mh] OR gastric bypass[mh] OR bariatric[tiab] OR gastric bypass[tiab] OR RYGB[tiab] OR lap band*[tiab] OR LAGB[tiab] OR gastric band*[tiab] OR sleeve gastrectomy[tiab] OR gastric sleeve[tiab] OR VSG[tiab] AND (2) feeding behaviour[mh] OR diet[mh] OR food preferences[mh] OR eat[tiab] OR eating[tiab] OR food*[tiab] OR diet[tiab] OR diets[tiab] OR dietary[tiab] OR taste[tiab] OR eating disorders[mh] OR eating disorder*[tiab] OR disordered eating[tiab] OR binge*[tiab] OR bulimia[tiab] OR anorexia[tiab] OR night eating[tiab] OR emotional eating[tiab] OR grazing[tiab] OR uncontrolled eating[tiab] OR loss of control [tiab] OR restraint[tiab] OR disinhibition[tiab] OR satiation[mh] OR hunger[mh] OR appetite[mh] OR satiation[tiab] OR satiety[tiab] OR hungry[tiab] OR hunger[tiab] OR appetite[tiab] OR behaviour, addictive[mh] OR craving[mh] OR addict*[tiab] OR craving*[tiab] (3) NOT rat[tiab] NOT rats[tiab] NOT porcine[tiab] NOT mouse[tiab] NOT mice[tiab] NOT swine[tiab] NOT pig[tiab] NOT canine[tiab] NOT dogs[tiab] NOT cats[tiab] NOT feline[tiab] NOT rodent[tiab].

After excluding duplicates using Endnote and manual searches, each record was manually screened for initial suitability based on its title and abstract. The full text of each potentially suitable article was obtained, and the complete article content assessed for eligibility against the review inclusion and exclusion criteria. The reference lists of eligible articles were also manually searched to identify additional relevant articles.

4.3.3 Data extraction

Data related to study characteristics, methodology, and relevant results were extracted by the first reviewer (MO) using standardised data extraction parameters. In studies comparing a bariatric surgery of interest to an excluded procedure, data related only to the surgery of interest was extracted for

review. The authors of two articles were contacted for clarifications: one regarding a misprinted number (S. Scholtz, email communication, 14 July 2015), the other about sample overlap (M. White, email communication, 6 January 2016). The results are described using narrative summary. Meta-analytic techniques were not used because of the broad range of outcomes under review and their differing methods of assessment.

4.3.4 Methodological quality assessment

An existing NIH tool designed to assess the quality of non-control group pre-post studies (National Heart Lung and Blood Institute, 2014) was used to assess the methodological quality of each included study (Supplementary Information Table S1), with additional items from the Joanna Briggs Institute (JBI) appraisal checklists for 'cohort/case control studies' and 'studies reporting prevalence data' (Joanna Briggs Institute, 2014a, 2014b) added to ensure all relevant methodological aspects were covered. The complete list of items was finalised through discussion by all authors. MO carried out the initial quality assessment and methodological design ratings, with assistance from GW and discussion with ACH to achieve consensus on ambiguous items. As the NIH tool was "not designed to provide a list of factors comprising a numeric score," checklist items were used to consider and rate each study's overall risk of bias related to flaws in study design or implementation. 'Good' studies have the lowest risk of bias and results considered valid, a 'fair' study suggests some bias considered insufficient to invalidate its results, and a 'poor' rating suggests significant risk of bias.

4.4 Results

A total of 3963 papers were identified from database searches. After removing duplicates and excluding papers based on their title and abstract, 65 articles (including four identified from the reference lists of retrieved articles) were closely examined. Forty-one did not fit the inclusion criteria or fit exclusion criteria, leaving 24 articles in the review. Two of these (Wood & Ogden, 2012, 2014) were grouped together as they reported the same relevant finding from the same sample, leaving a

final 23 separate studies from 24 articles. Two articles by White et al. (2010; 2006) used overlapping samples, with their 2006 study participants merged with a separate sample for their 2010 study, but are reported separately here. Figure 4.1 illustrates this process.

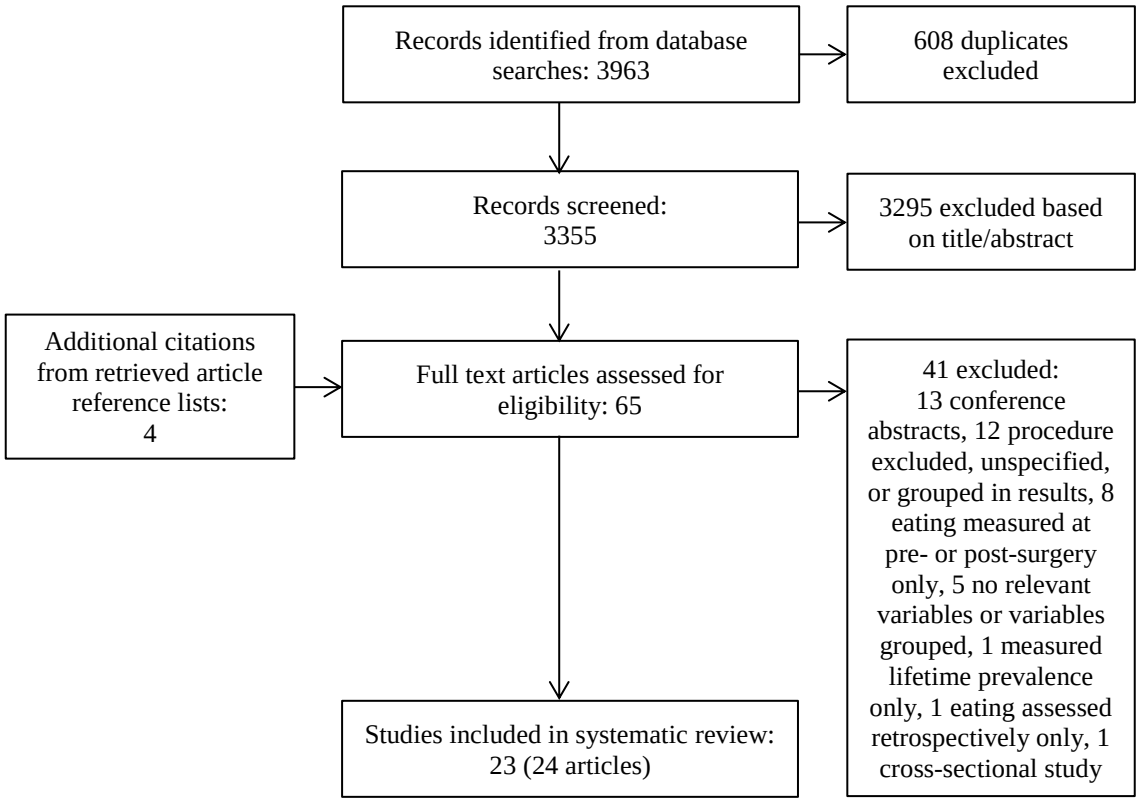

Figure 4.1. PRISMA flow chart for study inclusion.

4.4.1 Study characteristics

Details of the 23 studies included in this review are shown in Table 4.1. Sixteen studies investigated RYGB patients (Alfonsson, Sundbom, & Ghaderi, 2014; Boan, Kolotkin, Westman, McMahon, & Grant, 2004; Bryant et al., 2013; Castellini et al., 2014a; de Zwaan et al., 2010; Dymek, le Grange, Neven, & Alverdy, 2001; Kalarchian, Wilson, Brolin, & Bradley, 1999; Kruseman, Leimgruber, Zumbach, & Golay, 2010; Laurenius et al., 2012; Malone & Alger-Mayer, 2004; Matini, Ghanbari Jolfaei, Pazouki, Pishgahroudsari, & Ehtesham, 2014; Petereit, Jonaitis, Kupcinskas, & Maleckas,

2014; Thonney, Pataky, Badel, Bobbioni-Harsch, & Golay, 2010; Turkmen, Andreen, & Cengiz, 2014; White et al., 2010; White et al., 2006), with a total *N* of 1244 (excluding White et al. [2006], *N* = 139, as these participants were also in White et al. [2010]; *M* = 82.9 participants per study, range: 9-361), six examined AGB patients (total *N*: 335, *M* = 55.8 per study, range: 27-129; Castellini et al., 2014a; Colles et al., 2008a; De Panfilis et al., 2007; Lang, Hauser, Buddeberg, & Klaghofer, 2002; Scholtz et al., 2007; Wood & Ogden, 2012, 2014), and two looked at disordered eating in VSG patients (total *N*: 156, *M* = 78.0 per study, range: 46-110; Melero, Ferrer, Sanahuja, Amador, & Hernando, 2014; Sioka et al., 2013). One paper investigated multiple procedures, comparing RYGB and AGB patients (Castellini et al., 2014a), another utilised a non-obese reference group for comparison with RYGB patients (Laurenius et al., 2012), and another compared groupings of patients who had been assessed at differing timepoints after surgery (Sioka et al., 2013). All other studies assessed a single bariatric sample before and after surgery. Every study reported on a predominantly female sample, and three reported on wholly female samples (Kruseman et al., 2010; Thonney et al., 2010; Turkmen et al., 2014). Participants' ages ranged from 31.4-45.2 years, and pre-surgical BMIs ranged from 43.0-56.7.

Post-surgical follow-up periods ranged from three months to eight years, with final assessment most often carried out at 12 months post-surgery (11 studies). Only three studies (Kruseman et al., 2010; Scholtz et al., 2007; Sioka et al., 2013) conducted follow-up beyond two years post-surgery. Every study utilised a single pre-surgery assessment, and the majority (16 studies) examined participants at a single post-surgery timepoint. Almost all collected data via pre- and post-surgery interviews and/or written measures, while two papers utilised retrospective case note audits. One of these (Scholtz et al., 2007) reviewed patient casenotes from pre-surgery and five years post-surgery for evidence of eating disorders, while the other (Kruseman et al., 2010) extracted retrospective case note data on eating disorder diagnoses from pre-surgery and one-year post-surgery visits, and asked participants to return for an additional assessment at an average of eight years post-surgery. One study recruited a specific subgroup of female RYGB patients with diagnosed polycystic ovary syndrome (Turkmen et al., 2014), while all others investigated general patient samples comprising bariatric candidates either

before their pre-surgical assessment or from those who had already been assessed as eligible for surgery.

Table 4.1. Characteristics of the included studies.

Author (year)	Surgery	N % female M age (SD) M pre-surgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
Alfonsson (2014)	RYGB	129 78.2% 42.8 (10.5) 43.0 (4.0)	Sweden	Yes	NR; participants "recruited among patients eligible for Roux-en-Y gastric bypass surgery at a university hospital"	NR beyond measures used	5 months before surgery (M = 153 days; SD = 10.5) and 12 months after surgery (M = 370 days; SD = 77.3)	Changes over time via repeated-measures ANOVA	177 patients approached; number completed baseline NR; complete data from 129 analysed	Fair
Boan (2004)	RYGB	40 85.0% 41.2 (9.1) 52.9 (8.9)	USA	NR	NR; "sample consisted of 40 morbidly obese patients […] who underwent evaluation for RYGB"	Participants completed written measures at time of pre-surgical medical assessment and "again 6 months post-operatively"	Before surgery and 6 months post-surgery	Paired t-tests for comparisons	Number approached, retained NR	Fair
Bryant (2013)	RYGB	12 75.0% 36 (2) 45.3 (1.9)	Sweden	Yes	NR (all patients non-diabetic but unclear whether diabetes was an exclusion criterion; no further details on criteria or recruitment)	Participants completed measure on morning of each in-person test day (study also involved in-lab eating and blood collection)	Before surgery and 3 days post-surgery, 2 months post-surgery, and 1-year post-	Repeated-measures ANOVA to investigate changes	Number approached to participate NR; 12 of 14 recruited provided complete data	Fair

							surgery		(86%)	
Castellini (2014a)	RYGB AGB	30 93.3% 43.6 (9.8 49.5 (6.8) 27 83.2% 43.9 (11.4) 44.8 (5.3)	Italy	Yes	Recruited from 133 consecutive first-time clinic referrals and bariatric candidates; patients allocated to surgery (RYGB, AGB, or BPD) based on BMI or metabolic criteria; inclusion criteria: 18-65 years, BMI > 40 or > 35 with significant related issues, > 5 years obese, previous weight loss failure, no past bariatric surgery, understand surgery and risks; exclusions: intellectual disability, illiteracy, high surgical risk, current severe mental disorder	Face to face interviews by two psychiatrists who were unaware of surgery type, on first day of admission (before evaluation of inclusion/exclusion criteria for surgery) and a year post-surgery during a "control visit"; all assessments part of routine clinic assessment	Before surgery (M = 21.2 weeks before; SD = 14.8) and 1-year post-surgery	Linear mixed models to analyse repeated measures data (controlling for BMI and age)	133 initially included; 42 excluded (37 did not meet inclusion, 5 refused surgery); 8 enrolled but not available at follow-up (3 AGB, 1 RYGB, 4 BPD); final sample of 83 (91%)	Good
Colles (2008a)	AGB	129 79.8% 45.2 (11.5) 44.3 (6.8)	Australia	Yes	Severely obese persons accepted to bariatric surgery program at The Avenue Hospital, Melbourne, August 2004-December 2005 invited to participate if 18-65 years old; exclusion criteria: previous bariatric surgery	Self-report questionnaires with interview confirmation if applicable; any reported binge eating behaviours confirmed by semistructured clinical interview at baseline, and semistructured phone	Before surgery and 12 months (M = 12.3; SD = 1.1) post-surgery	Changes over time analysed using t-tests (continuous variables) and chi-square (categorical)	173 of 180 recruited at baseline were eligible to participate (1 died, 6 did not have surgery); 129 of 173 returned both surveys (75%)	Fair

						interview at 12 months; interviews performed by single "experienced" clinician)				
De Panfilis (2007)	AGB	35 88.6% 41.2 (8.3) 45.5 (4.8)	Italy	NR	Study recruitment procedure NR; sample was patients accepted (after physical, surgical, and anesthesiologic examination and psychiatric assessment) for and who underwent AGB at Parma University Hospital, Italy, March 2002-April 2004	Assessed as part of pre-surgical psychiatric assessment and again at post-surgery with same instruments (by psychiatrist or experienced psychiatric resident)	Before (approximately 1-month prior to) surgery and 12 months post-surgery	Changes analysed using chi-square with Fisher's exact test; t-test for symptom changes	30 of 65 recruited not accepted for or refused surgery; all 35 who were accepted for and underwent AGB also completed 1-year follow-up (100%)	Fair
de Zwaan (2010)	RYGB	59 84.7% 44.5 (9.9) 51.3 (9.0)	USA	Yes	Candidates recruited prior to surgical evaluation; selection procedure and inclusion/exclusion NR beyond fulfilling criteria for surgery	At pre-surgery, questionnaire to assess current disordered eating; at post-surgery, interview used to retrospectively assess pre-surgical BED, then assess current (past 6 months) disordered eating	3-6 months before surgery and 2 years (M = 1.9; SD = 0.4) post-surgery	Proportion meeting diagnostic criteria as percentages; no statistical tests on this data	23 of 119 recruited did not have surgery; 28 of 96 who had surgery could not be contacted for or declined follow-up (71%); further 9 excluded from analyses as ≤ 1 year after surgery	Fair
Dymek	RYGB	32	USA	NR	Patients had qualified	Questionnaires	Before	Repeated-	32 patients had	Poor

(2001)		81% 39.1 (8.5) 56.7 (11.5)			for surgery (BMI > 40 or > 35 with related comorbidities, approved after multidisciplinary evaluation including medical exam by surgeon, nutritional evaluation by dietitian, psychological evaluation by psychologist); sample was 32 consecutive patients who underwent RYGB at University of Chicago Hospitals, Nov 1998-Mar 1999	completed at pre-surgical assessment, at first clinic appointment post-surgery, and at a later routine appointment	surgery, 1-3 weeks post-surgery and "approximately 6 months" post-surgery	measures ANOVA for change over time with post hoc paired samples t-tests	surgery and completed the pre-surgery and first post-surgery assessment; 20 of the 32 completed all 3 assessments (63%)	
Kalarchian (1999)	RYGB	50 76.0% 38 (19-66) 52.8 (10.4)	USA	NR	132 consecutive candidates for surgery at Robert Wood Johnson University Hospital, New Jersey, approached to participate; all participants had failed at previous weight loss attempts and were ≥ 45.4kg above ideal	Interviewed pre- and post-surgery – at pre-surgery, regarding the past 3 months, at post-surgery, regarding past 28 days	Before surgery and 4 months (M = 3.8; SD = 0.9) post-surgery	Proportion reporting binge episodes (objective bulimic episodes and subjective bulimic episodes) as percentages; no statistical tests on this data	106 of 132 approached completed pre-surgery assessment; those who had surgery were reassessed 4 months post-surgery: 50 of first 62 to have surgery (81%) completed follow-up	Fair
Kruseman	RYGB	80	Switzerland	Yes	Study dietitians not involved in usual care	Pre-surgical eating behaviour assessed by	Before surgery, 1-	Comparisons using paired	135 of 141 patients who	Good

(2010)		100% NR for N = 80 45.9 (7.6)			extracted existing data from baseline and 1-year post-surgery visit casenotes of 141 patients, then contacted each by phone to ask them to return for a final appointment	psychologist as part of usual pre-surgical assessment, patients saw dietitian and surgeon at routine post-surgical follow-up (unclear who administered measures), 8-year post-surgery assessments carried out by study dietitians	year post-surgery, and a mean of 8 years (SD = 1.2) post-surgery	t-tests	underwent RYGB were followed-up at 1 year; 80 of those (59%) were reassessed at 8 years post-surgery	
Lang (2002)	AGB	66 87.9% 38.1 (11.2) 48.1 (8.2)	Switzerland	NR	NR ("66 selected morbidly obese patients […] who underwent AGB with the Lap-Band and were followed during 1 year")	Completed questionnaires at home after pre-surgery examination (before surgery), and then every 3 months post-surgery to 1 year	Before surgery and 3, 6, 9, and 12 months post-surgery	Repeated-measures ANOVA for changes over time; McNemar test for significance of change	66 of 97 assessed at baseline completed all 4 assessments (68%)	Fair
Laurenius (2012)	RYGB	43 72.1% 42.6 (9.7) 44.5 (4.9)	Sweden	Yes	Participants on waiting list for laparoscopic RYGB invited to participate, April 2004-April 2008; inclusion criteria: BMI 35-50, exclusion criteria: inability to understand instructions, insulin-treated diabetes	Participants completed questionnaires and experimental meals at each assessment point; a non-obese "reference group" (n = 31) was assessed by the same method at one time point	Before surgery, and 6 weeks post-surgery, 1-year post-surgery, and 2 years post-surgery	Kolmogorov-Smirnoff test for normal distribution, one-way ANOVA, Pearson's correlation for associations	50 patients recruited; of 47 enrolled, 2 excluded pre-surgery for very high daily energy intake, 2 after surgery after developing appetite-effecting illnesses; of 43 included, one	Good

										(unclear whether same participant each time) missed assessment at each post-surgery point	
Malone (2004)	RYGB	109 83.5% NR for N = 109 (Non-binge eaters: 46 [10], moderate binge eaters: 44 [12], severe binge eaters: 45 [8]) NR for N = 109 (Non-binge eaters: 47.7 [19.8], moderate binge eaters: 47.5	USA	Yes	Part of ongoing prospective longitudinal study initiated in 1997; patients 18+ years old scheduled for RYGB within Division of Clinical Nutrition, Albany Medical College, invited to participate	Questionnaires completed before surgery and at annual follow-up outpatient appointments	1-4 weeks before surgery and 1-year post-surgery	Repeated-measures ANOVA of data for n = 56	Number eligible NR; 109 baseline participants; 56 of 76 with 12-month weight data also completed 12-month questionnaires (51% of baseline participants; 74% of those with 12-month weight data)	Fair

		[15.3], severe binge eaters: 48.1 [14.7])								
Matini (2014)	RYGB	67 94.0% 36.8 (8.5) 48.8 (4.7)	Iran	Yes	Patients enrolled to study by "convenient sampling" before surgery; assured participation would not influence medical care; exclusion criteria: unable to return for follow-up, education below fifth grade, < 18 years old, not first bariatric surgery	Unclear; "data gathering through instruments was done by two psychiatrists"	Before surgery and 6 months post-surgery	Paired-sample t-tests to analyse change over time	11 declined to participate; of 70 enrolled, 3 withdrew at follow-up; complete data collected for 67 (96%)	Poor
Melero (2014)	VSG	46 78.3% 37 (NR) 43 (5)	Spain	NR	VSG candidates underwent multidisciplinary assessment, approved for/advised to have surgery if BMI 35-40 (-50 in "special cases") and ≥ 3 of: "sweet eater", family history of obesity, insulin-dependent diabetes, cardiovascular and musculoskeletal limitations on exercising; study	After psychological evaluation, participants completed self-administered questionnaires before surgery, same protocol repeated at 12 months	"Days before" surgery and 12 months post-surgery	Comparisons using related-samples Wilcoxon signed tests	NR; study sample consisted of all patients who underwent VSG and completed both assessments	Fair

					inclusion/exclusion criteria and recruitment procedure NR					
Petereit (2014)	RYGB	180 71.1% 42.7 (10.5) 45.2 (6.4)	Lithuania	Yes	180 of all 295 patients who underwent laparoscopic RYGB in Sep 2010-Jan 2013 prospectively consented to participate in study; inclusion criteria: 18-65 years old, BMI ≥ 40 or ≥ 35 with at least one related comorbidity	Baseline questionnaire completion process not detailed; participants completed follow-up measures at outpatient clinic visit	Before surgery and 1-year post-surgery	Raw scores transformed to scores out of 100, normality assessed with Kolmogorov-Smirnov test; Wilcoxon signed-ranks test to analyse changes	180 of 295 enrolled and completed pre-surgery measures; 99 completed follow-up (55%)	Fair
Scholtz (2007)	AGB	29 96.6% 39 (9) 45 (7)	UK	Not noted	Analysis of case notes from a series of 37 patients who underwent AGB by one surgeon at a UK centre between April 1997-June 2000 using Swedish adjustable gastric band; only exclusion noted: not having undergone full assessment by a psychiatrist or psychologist with specialist eating disorders experience prior to surgery	Data collected via retrospective audit of patient notes for evidence of past or current psychiatric disorders as per DSM-IV criteria; trained auditor applied measure to casenotes (including pre-surgical assessment) to assess binge eating episodes and diagnoses; assessors blinded to outcomes "wherever possible"	Before surgery and 0-5 years post-surgery (5-year prevalence)	Proportion with evidence of objective bulimic episodes (objective binges with perceived LOC), objective overeating (binges without LOC), and full BED as percentages; no statistical tests on this	Retrospective case note review; 8 of 37 excluded because they had not had full pre-surgery assessment	Fair

								data		
Sioka (2013)	VSG	110 78.2% NR for N = 110 (< 3 month group: 38.2 [10.8], 3-6 months: 38.0 [10.0], 6-12 months: 42.1 [10.9], 1-2 years: 39.6 [9.2], 2-3 years: 40.4 [9.7], > 3 years: 38.6 [10.8]) NR for N = 110 (< 3 month group: 43.7 [8.3], 3-6 months: 43.9 [5.7], 6-12 months: 45.9 [6.1], 1-2 years:	Greece	Yes	All 133 patients who underwent laparoscopic VSG at University Hospital of Larisa, Greece, August 2006-February 2011, were enrolled; all met criteria for surgery (inclusion: BMI > 40 or > 35 with related comorbidities; exclusions: GORD, "sweet eaters", severe mental health issues, drug addiction, alcoholism, high surgery risk)	Data retrieved from existing database for study; "eating patterns were assessed in the interview by a dietitian pre-operatively and post-operatively at the timing point of the follow-up. Additionally, the QEWP-R was employed"; assessed eating patterns were "defined according to the IFSO European Accreditation Council for Bariatric Surgery (EAC-BS) including volume eater, binge eating disorder, sweet eater, night eater, snacker, and emotional eater" (definitions not provided in article or by referenced website at time of this review); patients grouped by timing of follow-up	Before surgery and either < 3 months (n = 10), 3-6 months (n = 11), 6-12 months (n = 11), 1-2 years (n = 39), 2-3 years (n = 23), or > 3 years (n = 16) post-surgery	Shapiro-Wilk test for normality; group eating pattern comparisons analysed by ANOVA with posthoc Bonferroni correction	23 of 133 enrolled were lost to post-surgical follow- up (83%)	Poor

		46.1 [5.8], 2-3 years: 46.5 [6.8], >3 years: 44.8 [5.6])								
Thonney (2010)	RYGB	43 100% 39.3 (SE = 1.4) 44.7 (SE = 0.4)	Switzerland	Yes	Patients prospectively recruited at Service of Therapeutic Education for Chronic Diseases, University Hospitals of Geneva, 1998-2003; inclusion/exclusion criteria and selection procedure NR	Standardised questionnaires were used for pre- and post-operative assessments "using a semistructured interview by a trained psychologist"	Before surgery and 1 and 2 years post-surgery	Differences in means over time calculated using one-tailed, one-sample t-tests	NR; "43 women were evaluated in this study"	Fair
Turkmen (2014)	RYGB	9 100% 31.4 (7.4) 47.2 (8.9)	Sweden	Yes	Participants enrolled from female outpatients at the Department of Surgery, Sundsvall County Hospital; inclusion criteria: 18-40 years old with a BMI > 40 and diagnosed PCOS; exclusions: hormone therapy, benzodiazepines, or psychoactive drugs within 3 months of study enrolment, known psychiatric or premenstrual dysphoric disorder,	Participants completed examination, provided blood samples, and completed questionnaires at each assessment point	Before surgery and 6 and 12 months post-surgery	Friedman two-way ANOVA compared timepoints, post-hoc Wilcoxon signed-rank test to detect differences by time point	9 of 13 with PCOS at centre had surgery; 8 of 9 completed follow-up (89%)	Fair

					history of drug or alcohol abuse, pregnancy					
White (2010)	RYGB	361 86.1% 43.7 (10.0) 51.1 (8.3)	USA	Yes	Inclusion/exclusion criteria and recruitment procedure NR; participants informed results would have no impact on care/surgery; only participants with ≥ 1 completed follow-up assessment included in analyses	"Participants completed a battery of assessments" at each timepoint	Before surgery and 6, 12, and 24 months post-surgery	Binary logistic regressions to analyse whether pre-surgery LOC predicted post-surgery, chi-square to compare prevalence over time, non-linear mixed model with random intercept and logarithmic transformation to analyse whether post-surgery LOC was a function of pre-surgery LOC and time	311 of 361 assessed pre-surgery completed follow-up at 6 months (86%), 294 (81%) at 12 months, and 171 (47%) at 24 months	Fair
White (2006)	RYGB	139 89.2% 42.4 (10.2) 51.7 (7.9)	USA	Yes	Inclusion/exclusion criteria NR; participants informed participation would not influence surgical care and assessments completed for	NR; participants completed questionnaires at both time points	Before surgery and 12 months post-surgery	Proportion with no binge episodes, infrequent episodes (< 1/week), regular	Number enrolled to participate NR; 137 of 139 baseline participants completed both	Fair

					research study only; all participants "underwent gastric bypass surgery at a general medical centre"			episodes (1 to < 2/week), and DSM-IV threshold episodes (≥ 2/week) as percentages; no statistical tests on this data	assessments (99%)	
Wood (2012, 2014)	AGB	49 73.5% 41.4 (10.4) 43.1 (8.5)	UK	Yes	Participants recruited from two private hospitals in Kent, England, where they were scheduled for surgery; surgical indications: BMI ≥ 40 or ≥ 35 with serious comorbidity; no further inclusion/exclusions for study specified; recruitment procedure NR	Participants completed pre-surgical measures two weeks before surgery; follow-up questionnaires mailed to participants 3 months later	Two weeks before surgery and 3 months post-surgery	Proportion meeting DSM-IV diagnostic criteria as percentages; no statistical tests on this data	49 of 55 agreed to participate; 43 of 49 (88%) completed pre- and post-surgery measures	Poor

AGB, adjustable gastric banding; ANOVA, analysis of variance; BED, binge eating disorder; BMI, body mass index; BPD, biliopancreatic diversion; DSM-IV, diagnostic and statistical manual of mental disorders, 4th ed.; GORD, gastro-oesophageal reflux disease; AGB, adjustable gastric banding; LOC, loss of control; M, mean; N, number of participants; NR, not reported; PCOS, polycystic ovary syndrome; QEWP-R, questionnaire on eating and weight patterns - revised; RYGB, roux-en-Y gastric bypass; SD, standard deviation; VSG, vertical sleeve gastrectomy

Table 4.2 displays the number of studies reviewed that investigated each eating behaviour after each surgery.

Table 4.2. No. of included studies on each disorder or behaviour after each procedure.

	RYGB	AGB	VSG
BED and related symptoms	13	6	1
BED	2	4	1
Binge eating symptoms	5	2	0
Binge eating episodes	3	2	0
Uncontrolled/loss of control eating	6	1	0
Bulimia and related symptoms	3	2	1
Bulimia nervosa	0	1	0
Bulimic symptoms	3	1	1
Emotional eating	7	1	1
Night eating syndrome	0	1	1
Grazing	0	1	1

4.4.2 Methodological study appraisals

Based on study ratings for each appraisal checklist item, three studies were classified as 'good' (lowest vulnerability to bias; Castellini et al., 2014a; Kruseman et al., 2010; Laurenius et al., 2012), 16 were 'fair' (medium vulnerability to bias; Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; Colles et al., 2008a; De Panfilis et al., 2007; de Zwaan et al., 2010; Kalarchian et al., 1999; Lang et al., 2002; Malone & Alger-Mayer, 2004; Melero et al., 2014; Petereit et al., 2014; Scholtz et al., 2007; Thonney et al., 2010; Turkmen et al., 2014; White et al., 2010; White et al., 2006), and four were deemed 'poor' (highest vulnerability to bias; Dymek et al., 2001; Matini et al., 2014; Sioka et al., 2013; Wood & Ogden, 2012, 2014). Within the three 'good' studies, Castellini et al. (2014a) looked at binge eating symptoms and emotional eating in RYGB and AGB patients at pre-surgery and one year post-surgery, Laurenius et al. (2012) examined uncontrolled eating and emotional eating in

RYGB patients at pre-surgery, six weeks post-surgery, one year post-surgery, and two years post-surgery, and Kruseman et al. (2010) assessed bulimic symptoms in RYGB patients at pre-surgery and an average of eight years post-surgery.

Key limitations of the studies included papers often not clearly describing the eligibility and selection criteria for their study population and demonstrating that these had been prespecified (Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; De Panfilis et al., 2007; de Zwaan et al., 2010; Matini et al., 2014; Melero et al., 2014; Thonney et al., 2010; White et al., 2010; White et al., 2006; Wood & Ogden, 2012, 2014) and not describing the study participants and setting in sufficient detail (Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; Lang et al., 2002; Laurenius et al., 2012; Melero et al., 2014; White et al., 2006). In almost all studies, the researchers did not provide evidence that their sample size was adequate to provide confidence in the findings (Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; Castellini et al., 2014a; Colles et al., 2008a; De Panfilis et al., 2007; de Zwaan et al., 2010; Dymek et al., 2001; Kalarchian et al., 1999; Laurenius et al., 2012; Malone & Alger-Mayer, 2004; Matini et al., 2014; Melero et al., 2014; Petereit et al., 2014; Scholtz et al., 2007; Sioka et al., 2013; Thonney et al., 2010; Turkmen et al., 2014; White et al., 2010; White et al., 2006; Wood & Ogden, 2012, 2014), and others did not utilise prespecified, clearly defined, valid, reliable, and consistently assessed measures of disordered eating and BMI (Colles et al., 2008a; de Zwaan et al., 2010; Lang et al., 2002; Sioka et al., 2013; White et al., 2010), or provided insufficient detail to determine whether or not this was the case (Boan et al., 2004; Bryant et al., 2013; Dymek et al., 2001; Malone & Alger-Mayer, 2004; Matini et al., 2014; Melero et al., 2014; Petereit et al., 2014; Scholtz et al., 2007; Turkmen et al., 2014). Further limitations included 20% or greater loss to follow-up from baseline (Colles et al., 2008a; de Zwaan et al., 2010; Dymek et al., 2001; Kruseman et al., 2010; Lang et al., 2002; Malone & Alger-Mayer, 2004; Petereit et al., 2014; White et al., 2010) or insufficient detail to determine the proportion lost to follow-up (Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; Melero et al., 2014; Thonney et al., 2010), follow-up of less than 18 months duration post-surgery (Alfonsson et al., 2014; Boan et al., 2004; Bryant et al., 2013; Castellini et al., 2014a; Colles et al., 2008a; De Panfilis et al., 2007; Dymek et al., 2001; Kalarchian et al., 1999; Lang

et al., 2002; Malone & Alger-Mayer, 2004; Matini et al., 2014; Melero et al., 2014; Petereit et al., 2014; Turkmen et al., 2014; White et al., 2006; Wood & Ogden, 2012, 2014), and a lack of reported statistics with p-values examining pre to post-surgery changes in disordered eating (de Zwaan et al., 2010; Dymek et al., 2001; Kalarchian et al., 1999; Scholtz et al., 2007; Sioka et al., 2013; White et al., 2006; Wood & Ogden, 2012, 2014). Each study's ratings can be seen in Supplementary Table S1.

4.4.3 Binge eating disorder, symptoms, episodes, and uncontrolled eating

The reviewed studies of BED, binge symptoms, binge episodes, and uncontrolled eating are shown in Table 4.3. In RYGB patients, while the literature strongly suggests positive changes in BED and related symptoms in the short- to medium-term after surgery, there was also some evidence that these issues may re-increase after that initial decrease. The highest quality ('good') evidence reported positive medium-term changes after RYGB in both binge symptoms (one year post-surgery; Castellini et al., 2014a) and uncontrolled eating (at six weeks, one year, and two years post-surgery; Laurenius et al., 2012), with RYGB patients found to have significantly more uncontrolled eating than non-obese comparisons before but not after surgery. These positive findings were supported by 'fair' rated studies showing large reductions (25.5% to 0%) in BED diagnoses at two years (de Zwaan et al., 2010), significant binge symptom decreases at six months (Boan et al., 2004) and one year post-surgery (Malone & Alger-Mayer, 2004), significant improvements in uncontrolled eating behaviours at six months (Turkmen et al., 2014) and one year (Alfonsson et al., 2014; Petereit et al., 2014; Turkmen et al., 2014), and large reductions in rates of binge episodes at four months (44% to 0% ≥ 1 objective binge episode [OBE; perceived loss of control while eating objectively, excessively large amounts of food] per week, 4% ≥ 1 subjective binge episode [SBE; perceived loss of control while eating small to normal amounts of food] per week; Kalarchian et al., 1999) and one year (23.8% to 0.7%; White et al., 2006) after RYGB.

No studies found no overall change or an overall increase in BED and related symptoms after RYGB; however, several 'fair' rated studies did report significant re-increases after an initial reduction.

Bryant et al. (2013) noted an overall significant decrease in uncontrolled eating to one year, finding no change at three days post-surgery and reductions from pre-surgery to two months and one year, with a significant re-increase between two months and one year. White et al. (2010) also found a significant initial decrease in binge episodes at six months after RYGB (61.2% to 30.7%), followed by a re-increase in symptoms from six to 12 (36.4%) and 24 months (39.4%). Results of the 'poor' rated (highest risk of bias) studies are presented in each Table but are not discussed in-text.

Six studies looked at BED and related symptoms in AGB patients, reporting less consistent findings than the reductions reported after RYGB. While the single 'good' study that found a significant reduction in binge eating at a year after RYGB also found the same in AGB (Castellini et al., 2014a), findings from 'fair' studies varied. Several studies reported significant decreases in BED rates at one year post-surgery (Colles et al., 2008a; De Panfilis et al., 2007), while another found no change in the proportion with BED between pre-surgery and 0-5 years after surgery (Scholtz et al., 2007). Lang et al. (2002) noted a significant initial short-term decrease in binge symptoms (to three months post-surgery), followed by a significant re-increase from three to six months, and no change through to twelve months post-surgery, but did not report the overall significance of this change. Studies of binge episodes reported significant decreases (Lang et al., 2002) and no change (Colles et al., 2008a) at 12 months after AGB, while a further study found no change in rates at 0-5 years post-surgery (Scholtz et al., 2007). No 'good' or 'fair' studies examined uncontrolled eating in AGB patients. No studies with a 'good' or 'fair' rating examined BED or any related symptoms in VSG patients.

Table 4.3. Pre- to post-surgery changes in binge eating disorder and related symptoms, by procedure.

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Binge eating disorder (BED)					
RYGB	de Zwaan (2010)	QEWP (pre-surgery), EDE-BSV (post-surgery)	Proportion meeting BED diagnostic criteria	Pre-surgery: 23.7% (QEWP), 25.5% (EDE-BSV, retrospectively rated) 2 years post-surgery: 0% (OBE criteria), 3.4% (SBE criteria)	NR
	Dymek (2001)	QEWP-R	Proportion meeting DSM-IV BED diagnostic criteria	Pre-surgery: 32% 1-3 weeks post-surgery: 6% 6 months post-surgery: 0%	NR
AGB	Colles (2008)	QEWP-R; semi-structured clinical/phone interview	Proportion with BED according to DSM-IV criteria	Pre-surgery: 14.0% 12 months post-surgery: 3.1% (2/4 had not reported pre-surgical BED)	Decrease pre-surgery to 12 months, $p < .05$ At 12 months post-surgery, 61.1% of those with pre-surgery BED were grazers ($p = .029$), 44% reported loss of control or continued BED ($p = .048$), and 33.3% had no eating pathology ($p = .032$)
	De Panfilis (2007)	SCID-I/P; confirmed by structured interview as per Spitzer et al. (1992)	Proportion with BED according to DSM-IV criteria	Pre-surgery: 37.1% 12 months post-surgery: 11.4% (62.9% did not have BED at pre- or post-surgery, 25.7% with pre-surgical BED were recovered at 12 months; 11.4% had BED both pre-surgery and at 12 months post-surgery)	Change over time, $p \leq .01$

	Scholtz (2007)	EDE	Proportion with current BED according to DSM-IV criteria	Pre-surgery: 17.2% 0-5 years post-surgery: 17.2% (BED recurred in 33% with a pre-surgery history of BED; 66% of those with a history of BED had no post-surgery BED)	NR
	Wood (2012; 2014)	EDDS	Proportion with current BED according to DSM-IV criteria	Pre-surgery: 49.0% (24/49) 3 months post-surgery: 7.0% (3/43; 19/22 with pre-surgical BED did not have BED at follow-up)	NR
VSG	Sioka (2013)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified with BED	Pre-surgery: 23.6% (26/110) Post-surgical data presented in graph only; "few patients (3.6%) presented the binge eating disorder pattern post-operatively" (p. 506)	NR

Binge eating symptoms

RYGB	Boan (2004)	BES	BES mean score (SD)	Pre-surgery: 15.1 (8.2) 6 months post-surgery: 2.7 (2.7)	Decrease pre-surgery to 6 months, $p < .001$
			Proportion with severe binge eating symptoms (BES ≥ 27)	Pre-surgery: 10.0% 6 months post-surgery: 0%	NR
			Proportion with moderate binge eating symptoms (BES 18-26)	Pre-surgery: 20.0% 6 months post-surgery: 0%	NR
			Proportion with no binge eating symptoms (BES ≤ 17)	Pre-surgery: 70.0% 6 months post-surgery: 100%	NR
	Castellini (2014)	BES	BES mean score (SD)	Pre-surgery: 20.1 (9.5) 1 year post-surgery: 6.1 (4.2)	Treatment effect over time, $p < .001$

	Malone (2004)	BES	Pre-surgery non-binge eaters (n = 25), BES mean score (SD)	Pre-surgery: 12 (6) 1 year post-surgery: 4 (3)	Decrease pre-surgery to 1 year, p < .001 Pre-surgical non-binge eaters still had lower symptoms than pre-surgical moderate and severe binge eaters at 1 year post-surgery, p <.05
			Pre-surgery moderate binge eaters (n = 18), BES mean score (SD)	Pre-surgery: 20 (3) 1 year post-surgery: 10 (7)	Decrease pre-surgery to 1 year, p < .001
			Pre-surgery severe binge eaters (n = 13), BES mean score (SD)	Pre-surgery: 31 (5) 1 year post-surgery: 13 (9)	Decrease pre-surgery to 1 year, p < .001 No difference between pre-surgical moderate and severe binge eaters at 1 year post-surgery, p > .05
AGB	Castellini (2014)	BES	BES mean score (SD)	Pre-surgery: 15.5 (9.6) 1 year post-surgery: 6.0 (6.4)	Treatment effect over time, p < .01
	Lang (2002)	BSQ	BSQ mean score (SD)	Pre-surgery: 14.2 (10.4) 3 months post-surgery:4.9 (8.1) 6 months post-surgery: 6.9 (9.4) 9 months post-surgery: 6.2 (8.9) 12 months post-surgery: 6.2 (9.3)	Decrease pre-surgery to 3 months, p < .001 Increase 3 months to 6 months, p < .05 No change 6 months to 9 months, p > .05 No change 9 months to 12 months, p > .05

Binge eating episodes

RYGB	Kalarchian (1999)	EDE-I	Proportion “binge eaters”	Pre-surgery: 44.0% (≥ 1 OBE per week) 4 months post-surgery: 0% ≥ 1 OBE per week, 0% any OBEs, 4% ≥ 1 SBE per week, 16% any SBEs	NR
	White (2006)	EDE-Q	Proportion with no episodes	Pre-surgery: 60.4% 12 months post-surgery: 90.5%	NR

		Proportion with "infrequent" (< 1/week) episodes	Pre-surgery: 15.8% 12 months post-surgery: 8.8%	
		Proportion with "regular" (1 to < 2/week) episodes	Pre-surgery: 13.7% 12 months post-surgery: 0.7%	
		Proportion with DSM-IV threshold (≥ 2/week) episodes	Pre-surgery: 10.1% 12 months post-surgery: 0%	
White (2010)	EDE-Q	Proportion with "general LOC" (SBEs or OBEs)	Pre-surgery: 61.2% 6 months post-surgery: 30.7% (38.4% of participants who had "general LOC" pre-surgery, 17.3% of participants who did not have "general LOC" pre-surgery) 12 months post-surgery: 36.4% (45.3%, 23.0%) 24 months post-surgery: 39.4% (49.0%, 24.2%)	Pre-surgery predictive of 6 months, p < .001 Pre-surgery predictive of 12 months, p < .001 Pre-surgery predictive of 24 months, p = .002 Decrease pre-surgery to 6 months, p < .001 Increase 6 months to 12 months, p = .03 Increase 6 months to 24 months, p = .02 No change 12 months to 24 months, p = .46 Pre-surgery predicted post-surgery, p = .0001 Increase with time after surgery, p = .04
		Proportion with "objective LOC" (OBEs)	Pre-surgery: 42.4% 6 months post-surgery: 30.7% (41.5% of those who had objective LOC pre-surgery, 22.4% of those who did not have objective LOC pre-	Pre-surgery predictive of 6 months, p < .001 Pre-surgery predictive of 12 months, p < .001 Pre-surgery not predictive of 24

				surgery) 12 months post-surgery: 36.9% (49.6%, 28.1%) 24 months post-surgery: 39.5% (46.2%, 33.7%)	months, p = .102
			Proportion with "subjective LOC" (SBEs)	Pre-surgery: 40.2% 6 months post-surgery: 30.9% (40.6% of participants who had subjective LOC pre-surgery, 23.7% of participants who did not have subjective LOC pre-surgery) 12 months post-surgery: 36.6% (47.4%, 29.4%) 24 months post-surgery: 39.3% (52.5%, 31.4%)	Pre-surgery predictive of 6 months, p = .002 Pre-surgery predictive of 12 months, p = .002 Pre-surgery predictive of 24 months, p = .010
AGB	Colles (2008)	QEWP-R; semi-structured clinical/phone interview	Proportion with uncontrolled eating (OBE or SBE ≥ 1 per week in past 6 months; not BED)	Pre-surgery: 31.0% 12 months post-surgery: 22.5%	No change pre-surgery to 12 months, p > .05
	Lang (2002)	BSQ	Proportion reporting binge eating episodes	Pre-surgery: 63.6% 12 months post-surgery: 28.8% (31.8% had no binge eating pre- and post-surgery, 39.4% ceased binge eating after surgery, 24.2% continued to report binge eating, 4.5% reported new binge eating after surgery)	Significance of changes, p < .001
	Scholtz (2007)	EDE	Proportion with binge eating episodes	Pre-surgery: 13.8% 0-5 years post-surgery: 13.8%	NR
Uncontrolled eating					

RYGB	Alfonsson (2014)	G-FCQ-T	Lack of control over eating subscale, mean (SD)	Pre-surgery: 2.8 (1.1) 12 months post-surgery: 1.4 (0.5)	Decrease pre-surgery to 1 year, $p < .001$
	Bryant (2013)	TFEQ-R18	Uncontrolled eating subscale, mean (SD)	Pre-surgery: 43.7 (29.2) 3 days post-surgery: 43.2 (19.2) 2 months post-surgery: 19.8 (12.1) 1 year post-surgery: 20.9 (10.9)	Change over time, $p < .001$ Decrease pre-surgery to 2 months, $p < .05$ Decrease pre-surgery to 1 year, $p < .05$ Increase 2 months to 1 year, $p < .05$ No change all other comparisons, $p > .05$
	Laurenius (2012)	TFEQ-R21	Uncontrolled eating subscale	Data presented in graph only	Decrease pre-surgery to 6 weeks, $p < .001$ Decrease pre-surgery to 1 year, $p < .001$ Decrease pre-surgery to 2 years, $p < .003$
	Petereit (2014)	TFEQ-R18	Uncontrolled eating subscale, mean	Pre-surgery: 59.1 1 year post-surgery: 20.6	Decrease pre-surgery to 1 year, $p < .001$
	Turkmen (2014)	TFEQ-R21	Uncontrolled eating subscale, mean (SD)	Pre-surgery: 42.7 (20.1) 6 months post-surgery: 20.3 (14.5) 12 months post-surgery: 22.3 (14.8)	Change over time, $p = .03$ Decrease pre-surgery to 6 months, $p = .017$ Decrease pre-surgery to 12 months, $p = .017$ No change 6 months to 12 months, $p > .05$

AGB, adjustable gastric banding; BED, binge eating disorder; BES, binge eating scale; BSQ, body shape questionnaire; DSM-IV, diagnostic and statistical manual of mental disorders, 4th ed.; EDDS, eating disorder diagnostic scale; EDE, eating disorder examination; EDE-BSV, eating disorder examination – bariatric surgery version; EDE-I, eating disorder examination – interview; EDE-Q, eating disorder examination – questionnaire; G-FCQ-T, general food cravings questionnaire – trait; LOC, loss of control; NR, not reported; OBE, objective binge episode; QEWP, questionnaire on eating and weight patterns; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, roux-en-Y gastric bypass; SBE, subjective binge episode; SCID-I/P, structured clinical interview for DSM-IV axis I disorders, research version, patient version; SD, standard deviation; TFEQ-R18, three factor eating questionnaire – r18; TFEQ-R21, three factor eating questionnaire – r21

4.4.4 Bulimia nervosa and related symptoms

The limited amount of acceptable-quality evidence reviewed here suggests positive short, medium, and longer-term changes in bulimic symptoms after RYGB (Table 4.4). One 'good' study found a significant decrease in bulimic symptoms at eight years post-surgery (Kruseman et al., 2010), and 'fair' studies also reported significant decreases to six months (Matini et al., 2014) and one and two years (Thonney et al., 2010) after surgery. No 'good' or 'fair' studies examined changes in bulimia nervosa after RYGB.

Fewer studies examined bulimia and bulimic symptoms in AGB and VSG. In AGB, Scholtz et al. (2007) reported that no patients in their sample at pre-surgery and 0-5 years post-surgery had bulimia nervosa, and significant reductions were found in bulimic symptoms at twelve months after AGB (De Panfilis et al., 2007) and VSG (Melero et al., 2014; all rated 'fair').

Table 4.4. Pre- to post-surgery changes in bulimia nervosa and related symptoms, by procedure.

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Bulimia nervosa					
AGB	Scholtz (2007)	EDE	Proportion with current bulimia nervosa according to DSM-IV criteria	Pre-surgery: 0% 0-5 years post-surgery: 0%	NR
Bulimic symptoms					
RYGB	Kruseman (2010)	EDI-II	Bulimia subscale, mean (SD)	Pre-surgery: 3.4 (3.9) 8 years post-surgery: 2.1 (3.2)	Decrease pre-surgery to 8 years, p = .001
	Matini (2014)	EDI-3	Bulimia subscale, mean (SD)	Pre-surgery: 11.5 (6.1) 6 months post-surgery: 7.9 (5.2)	Decrease pre-surgery to 6 months, p < .0001
	Thonney (2010)	EDI-II	Bulimia subscale, mean (SD)	Pre-surgery: 2.9 (0.6) 1 year post-surgery: 1.4 (0.5) 2 years post-surgery: 1.2 (0.3)	Decrease pre-surgery to 1 year, p < .01 Decrease pre-surgery to 2 years, p < .01
AGB	De Panfilis (2007)	EDI-2	Bulimia subscale, mean (SD)	Pre-surgery: 5.9 (4.1) 12 months post-surgery: 3.1 (1.9)	Decrease pre-surgery to 12 months, p ≤ .01
VSG	Melero (2014)	EDI-1	Bulimia subscale, mean	Pre-surgery: 1.96 12 months post-surgery: 0.22	Decrease pre-surgery to 12 months, p < .01

AGB, adjustable gastric banding; EDE, eating disorders examination; EDI-1, eating disorder inventory - 1; EDI-II/2, eating disorder inventory - 2; EDI-3, eating disorder inventory - 3; NR, not reported; RYGB, roux-en-Y gastric bypass; SD, standard deviation; VSG, vertical sleeve gastrectomy

4.4.5 Emotional eating

The reviewed studies consistently suggest positive short to medium-term changes in emotional eating after RYGB (Table 4.5). Two 'good' rated studies found significant decreases in emotional eating between pre-surgery and one year (Castellini et al., 2014a), and from pre-surgery to six weeks, one year, and two years, with RYGB patients reporting significantly more emotional eating than non-obese reference subjects before but not after surgery (Laurenius et al., 2012). These positive results were supported by 'fair' studies that showed: significant decreases in emotional eating at one year (Alfonsson et al., 2014; Petereit et al., 2014) and six months and one year (no change from six to twelve months; Turkmen et al., 2014), a significant change over time to one year (assessment at three days, two months, and one year; Bryant et al., 2013), and significant changes over time in anxiety-, anger-, and depression-related emotional eating between pre-surgery and six months, with a decrease pre-surgery to 1-3 weeks and no change 1-3 weeks to six months (Dymek et al., 2001).

There was little evidence related to emotional eating in AGB, with the 'good' study that reported a significant decrease in emotional eating in RYGB patients showing a similarly large but non-significant change in emotional eating at one year after AGB (Castellini et al., 2014a). No reviewed studies examined emotional eating changes after VSG.

4.4.6 Night eating syndrome

One 'fair' study examined changes in NES after AGB. With no endorsed criteria available, Colles et al. (2008a) composed questions according to the definition of Stunkard et al. (1996): that within the last three months the individual usually had no appetite for breakfast, consumed half or more of their total energy intake after 7pm, and had trouble getting to sleep or staying asleep three or more nights per week. Based on these criteria, they found a significant decrease in NES from pre-surgery (17.1%) to 12 months post-surgery (7.8%). No studies investigated changes in NES after RYGB or VSG (Table 4.5).

4.4.7 Grazing

No reviewed studies examined grazing in RYGB or VSG patients, and the same single 'fair' study of NES also examined grazing in AGB patients (Table 4.5). Again lacking recognised criteria, Colles et al. (2008a) defined grazing according to Saunders et al. (2004) as "consumption of smaller amounts of food continuously over an extended period of time, eating more than the subject considers best for them" (p. 616). They asked whether participants had often engaged in grazing in the past six months, and found a significant increase in grazing between pre-surgery (26.4%) and 12 months post-surgery (38.0%).

Table 4.5. Pre- to post-surgery changes in problematic eating behaviours: emotional eating, night eating syndrome, and grazing, by procedure.

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Emotional eating					
RYGB	Alfonsson (2014)	G-FCQ-T	Emotional food cravings subscale, mean (SD)	Pre-surgery: 2.27 (1.03) 12 months post-surgery: 1.39 (0.72)	Decrease pre-surgery to 12 months, $p < .001$
	Bryant (2013)	TFEQ-R18	Emotional eating subscale, mean (SD)	Pre-surgery: 58.9 (33.2) 3 days post-surgery: 61.1 (31.3) 2 months post-surgery: 37.0 (24.8) 1 year post-surgery: 37.4 (24.5)	Change over time, $p = .025$
	Castellini (2014)	EES	EES mean score (SD)	Pre-surgery: 43.1 (12.4) 1 year post-surgery: 0.8 (0.7)	Treatment effect over time, $p < .01$
	Dymek (2001)	EES	Anger subscale, mean (SD)	Pre-surgery: 13.9 (10.3) 1-3 weeks post-surgery: 5.3 (8.4) 6 months post-surgery: 5.4 (7.8)	Change over time, $p < .009$ Decrease pre-surgery to 1-3 weeks, $p < .05$ No change 1-3 weeks to 6 months, $p > .05$
			Anxiety subscale, mean (SD)	Pre-surgery: 11.3 (8.0) 1-3 weeks post-surgery: 4.7 (7.3) 6 months post-surgery: 5.4 (7.8)	Change over time, $p < .009$ Decrease pre-surgery to 1-3 weeks, $p < .05$ No change 1-3 weeks to 6 months, $p > .05$
			Depression subscale, mean (SD)	Pre-surgery: 8.9 (5.3) 1-3 weeks post-surgery: 3.8 (5.3)	Change over time, $p < .001$ Decrease pre-surgery to 1-3 weeks, $p < .05$

				6 months post-surgery: 2.5 (4.2)	No change 1-3 weeks to 6 months, p > .05
	Laurenius (2012)	TFEQ-R21	Emotional eating subscale	Data presented in graph only	Decrease pre-surgery to 6 weeks, p < .001 Decrease pre-surgery to 1 year, p < .001 Decrease pre-surgery to 2 years, p = .046
	Petereit (2014)	TFEQ-R18	Emotional eating subscale, mean	Pre-surgery: 28.2 1 year post-surgery: 17.2	Decrease pre-surgery to 1 year, p < .001
	Turkmen (2014)	TFEQ-R21	Emotional eating subscale, mean (SD)	Pre-surgery: 47.9 (27.6) 6 months post-surgery: 32.1 (27.5) 12 months post-surgery: 33.8 (24.0)	Change over time, p = .021 Decrease pre-surgery to 6 months, p = .027 Decrease pre-surgery to 12 months, p = .017 No change 6 months to 12 months, p > .05
AGB	Castellini (2014)	EES	EES mean score (SD)	Pre-surgery: 46.3 (9.9) 1 year post-surgery: 1.3 (1.0)	No treatment effect over time, p > .05
VSG	Sioka (2013)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified "emotional eaters" (criteria unclear)	Pre-surgery: 14.5% (16/110) Post-surgical data presented in graph only	NR
Night eating syndrome					
AGB	Colles (2008)	Researcher-composed items based on Stunkard et al.	Proportion with NES (over past 3 months)	Pre-surgery: 17.1% 12 months post-surgery: 7.8% (60% of those did not have pre-surgical NES; only 18.1% of those with pre-surgical	Decrease pre-surgery to 12 months, p < .05

		(1996) proposed diagnostic criteria		NES had post-surgical NES)	
VSG	Sioka (2013)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified "night eaters" (criteria unclear)	Pre-surgery: 5.5% (6/110) Post-surgical data presented in graph only	NR
Grazing					
AGB	Colles (2008)	Researcher-composed item based on Saunders (1999, 2004) definition	Proportion "grazers" (over past 6 months)	Pre-surgery: 26.4% 12 months post-surgery: 38.0% (94.1% of pre-surgical grazers continued grazing after surgery; 31% higher prevalence post-surgery)	Increase pre-surgery to 12 months, $p > .05$
VSG	Sioka (2013)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified "snacker eaters" (criteria unclear)	Pre-surgery: 29.1% (32/110) Post-surgical data presented in graph only	NR

AGB, adjustable gastric banding; EES, emotional eating scale; G-FCQ-T, general food craving questionnaire – trait; NES, night eating syndrome; NR, not reported; RYGB, roux-en-Y gastric bypass; SD, standard deviation; TFEQ-R18, three factor eating questionnaire – r18; TFEQ-R21, three factor eating questionnaire – r21; VSG, vertical sleeve gastrectomy

4.4.8 Reoccurrences and new occurrences of problematic and disordered eating

Reports from the reviewed literature of reoccurrences and new occurrences of binge behaviours and NES after RYGB, and especially after AGB, are noteworthy. The only study of RYGB patients (White et al., 2010) to mention these issues found a substantial rate of new occurrences of binge episodes, with 17.3% of patients who had not reported pre-surgical binge episodes (SBEs or OBEs) reporting binge episodes at six months, 23.0% at 12 months, and 24.2% at 24 months. Rates of post-surgical reoccurrences were almost twice those of new occurrences. Of those who had experienced pre-surgical binge episodes, 38.4% reported their reoccurrence at six months post-surgery, 36.4% at 12 months, and almost half (49.0%) reported a reoccurrence at 24 months.

A larger number of studies reported on reoccurrences and new occurrences after AGB than RYGB. In reports of new occurrences, Colles et al. (2008a) found that 50% of those with BED at 12 months after surgery (of the 3.4% of the sample) and 60% of those with NES (of that 7.8% of the sample) had not been diagnosed at pre-surgery, Scholtz et al. (2007) found identical rates of BED at pre-surgery and 0-5 years post-surgery but noted that these "were not the same actual patients, as some developed the disorder de novo, or progressed from isolated bingeing to the full disorder" (S. Scholtz, email communication, 14 July 2015), and Lang et al. (2002) noted a 4.5% rate of new occurrences in binge episodes at 12 months. Reports of reoccurrence or continuations again suggest these may be more common than new occurrences, with reports of an 11.4% BED reoccurrence at 12 months post-surgery (De Panfilis et al., 2007), 33% BED reoccurrence rate between 0-5 years post-surgery in those with any history of BED (Scholtz et al., 2007), and a 24.2% reoccurrence rate of binge episodes at 12 months (Lang et al., 2002). Colles et al. (2008a) found that 18.1% of those with NES and 94.1% of those with significant grazing behaviours reported reoccurrences at 12 months after AGB. No reviewed studies reported on new occurrences or reoccurrences of problematic or disordered eating behaviours after VSG.

4.5 Discussion

To the best of our knowledge, this is the first systematic review to compare the literature on changes in eating disorders, symptoms, and problematic eating behaviours from before to after each of the three most common current bariatric surgeries: Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy. While there are substantial limitations on the scope and strength of the literature, a number of preliminary but potentially valuable insights can be drawn from the available evidence.

4.5.1 Changes in problematic and disordered eating behaviours

While the literature strongly suggests overall significant reductions in BED and related symptoms in the short- and medium-term after RYGB, there is some evidence that these issues may follow a pattern of an initial large reduction, followed by a later re-increase in symptoms. The longer-term trend and significance of this re-increase has not been investigated. The literature on changes in BED and related symptoms after AGB is inconsistent, with reports of increases, decreases, and no change. Several review articles have found strong evidence linking binge eating, BED, and loss of control eating after bariatric surgeries to poorer weight loss or greater weight regain (Meany et al., 2014; Niego et al., 2007; Sheets et al., 2015), though links between pre-surgical binge eating and poorer post-surgical outcomes are less consistent (Mechanick et al., 2013; Niego et al., 2007). Wood and Ogden (2012) found that whether or not the patient's binge eating decreased or persisted after AGB, rather than simply the presence of BED at pre-surgery or post-surgery, was predictive of weight loss.

The limited reviewed evidence suggests positive short, medium, and longer-term changes in bulimic symptoms after RYGB, but there was little to review related to AGB and VSG, or in regard to bulimia nervosa. Pre- and post-surgical rates of bulimia nervosa are largely unknown (Conceição et al., 2015). As a recommended contraindication to surgery (Mechanick et al., 2013), it may be that few patients with bulimia, or few who admit to it, undergo bariatric surgery. However, bulimia nervosa may

develop after surgery even if not present before (Conceição et al., 2013a). Similarly little is understood about the effects of bulimia and its symptoms in bariatric surgeries, though Thonney et al. (2010) found that bulimic symptoms were not related to weight loss at two years post-RYGB.

This review found consistent evidence for significant reductions in emotional eating in the short to medium-term after RYGB. There was little evidence on emotional eating after AGB and none on VSG. Though widely viewed as a risk factor for poorer post-surgical outcomes and a common reason for exclusion from bariatric surgery (Zimmerman et al., 2007), the literature on the actual effects of emotional eating after bariatric surgeries is inconsistent (Conceição et al., 2015). While some studies have found no link between pre-surgical emotional eating and weight outcomes (Banerjee, Ding, Mikami, & Needleman, 2013; Fischer et al., 2007), Castellini et al. (2014a) reported that greater pre-surgical emotional eating predicted lower BMI reductions one year after AGB and RYGB, and Canetti et al. (2009) found a relationship between greater post-surgical emotional eating and poorer weight loss. Interestingly, several studies have linked emotional eating with improved post-bariatric weight loss outcomes. Wedin et al. (2014) reported that a self-reported pre-surgical history of emotional eating was associated with five times increased odds of successful weight loss at two years after RYGB, AGB, or VSG, and Mathus-Vliegen (2007) noted that women with successful weight loss at a mean of 8.2 years after VBG or RYGB reported more post-surgical emotional eating than reference norm scores. The effects of emotional eating on post-bariatric outcomes are yet to be well understood. Further, there are questions as to whether or not responses on emotional eating questionnaires, which commonly ask about feeling the ‘urge’ or ‘need’ to emotionally eat rather than actual emotional eating, accurately reflect an individual’s emotional eating behaviours (Evers et al., 2009).

None of the reviewed studies investigated changes in NES after RYGB or VSG, and just one study reported a significant decrease in NES at one year after surgery (Colles et al., 2008a). The few studies to date have found no clear links between pre-surgical (Colles et al., 2008a; Latner, Wetzler, Goodman, & Glinski, 2004; Powers et al., 1999) or post-surgical NES (Colles et al., 2008a) and

poorer post-surgical outcomes. Pre-surgical NES has been strongly linked to pre-surgical BED (Colles et al., 2007, 2008a), and has also been found not to predict post-surgical NES, uncontrolled eating, or grazing (Colles et al., 2008a). Research into NES in bariatric populations is in its early stages and little can be concluded at this stage. It is hoped that the recent inclusion of NES in the DSM-5 (American Psychiatric Association, 2013), involving recurrent episodes of night eating, either after waking from sleep during the night or excessive food consumption after dinner, which the individual is aware of and can recall, and which cause significant distress or impairment, and the likely forthcoming publication of measures of NES as per the new DSM criteria will inspire researchers to further investigate this issue in patients after bariatric surgeries.

Just one study investigated grazing in AGB patients, finding a significant decrease in both NES diagnoses and the proportion who grazed at one year after surgery (Colles et al., 2008a). No studies investigated this in RYGB or VSG. The few studies that have investigated the effects of grazing to date have consistently linked pre-surgical (Colles et al., 2008a) and post-surgical (Colles et al., 2008a; Conceição et al., 2014b; Leite Faria, de Oliveira, Pereira Faria, & Kiyomi Ito, 2009) grazing with reduced weight loss and increased weight gain. It has also been reported that individuals with pre-operative binge eating may be likely to 'swap' to grazing behaviours after bariatric surgery (Colles et al., 2008a; Saunders, 2004).

There has been significant discussion regarding the need for research and clinical differentiation between grazing as a normative, healthy eating pattern and grazing as a problematic, disordered eating behaviour (Conason, 2014; Lane & Szabó, 2015). Although linked to poorer outcomes after bariatric surgery, grazing may actually be more common in non-clinical populations than eating disordered populations (Conceição et al., 2013b), and has been described as a behaviour that may only be problematic under certain circumstances or in particular populations (Conceição et al., 2014b). Lane and Szabó (2015) have proposed that perceived loss of control may be the factor that distinguishes between healthy and 'disordered' grazing. Grazing research to date has also been hindered by the lack of specific, validated assessment measures. However, two new measures of grazing may prove useful

in bringing consistency and validation to definitions and measures of grazing. The first reflects repetitive eating behaviours and a sense of loss of control (Lane & Szabó, 2013), while the other (Conceição et al., 2014a) examines two types of grazing: compulsive, characterised by a perceived loss of control over eating, and non-compulsive, involving distracted eating. Conason (2014) notes that bariatric research has commonly failed to differentiate disordered grazing, which is not a response to hunger and satiety signals, from both mindful eating in an unplanned way in response to hunger and satiety, and from eating in accordance with post-bariatric surgery eating recommendations to consume numerous small 'meals' per day. Whether these measures, or others, are able to differentiate these variations requires investigation.

4.5.2 Reoccurrences and new occurrences

The findings of this review support previous assertions that patients with pre-surgical disordered or problematic eating behaviours, especially binge behaviours, are at greater risk for the continuation or redevelopment of these issues after surgery (Mitchell et al., 2014). In their review, Niego et al. (2007) reported that "despite some indications that binge eating behaviour is eliminated by gastric restrictive surgeries, many patients continue to have maladaptive and psychologically distressing eating behaviours following surgery" (p. 356). They found that post-surgical binge eating was most often seen in those who had binge eating behaviours before surgery, many of whom continued to report feelings of loss of control when eating much smaller amounts of food after surgery. While less common than the redevelopment of pre-surgical issues, it is a worrying prospect that bariatric surgery may in fact result in an individual developing a new and serious eating problem or disorder (Marino et al., 2012). The majority of evidence regarding reoccurrences and new occurrences in this review was found in regard to AGB, though a single study suggested these may also occur after RYGB. It is yet to be seen whether similar patterns are seen after VSG, and whether further research finds differing or similar patterns of reoccurrence and new occurrences in the different disordered and problematic eating behaviours across the three most common bariatric surgeries and over time after surgery.

A small but substantial proportion of RYGB, AGB, and VSG patients either do not ever experience significant weight loss after their surgery or regain significant weight often from one or two years after their operation. In the Swedish Obese Subjects study, weight loss peaked at 1-2 years after RYGB and AGB, with regain in subsequent years that finally levelled off after 8-10 years. At 10 years, 8.8% of RYGB patients and 25.0% of AGB patients had lost less than 5% of their original weight (Sjöström, 2013; Sjöström et al., 2004), and at 15 years post-surgery, RYGB patients had regained an average 5% from their highest weight loss and AGB patients had regained 7%. Golomb et al. (2015) reported similar regain and weight loss failure in VSG, with average excess weight loss of 76.8% at one year, 69.7% after three years, and 56.1% at five years post-surgery, and excess weight loss of < 50% at 13.3% at one year, 21.1% at three years, and 38.5% at five years. Multiple determinants, including biological, surgical, social, behavioural, and psychological factors such as problematic and disordered eating behaviours, have been linked to poor weight loss and weight regain (Kushner & Sorensen, 2015; Sarwer, Dilks, & West-Smith, 2011). Hsu et al. (1997) hypothesised that patients may experience an initial post-surgical improvement in problematic and disordered eating during which they lose weight, but which erodes at approximately two years post-surgery, resulting in subsequent weight regain. However, the reasons why maladaptive eating behaviours may reoccur after an initial remission and often return at one to two years post-surgery require investigation.

As Meany et al. (2014) outlined in relation to BED, binge eating, and loss of control, but which appear applicable to the wider spectrum of disordered and problematic eating behaviours, there are a number of items related to reoccurrences and new occurrences that require investigation: (a) why some patients, but not others, experience new occurrences or reoccurrences of problematic and disordered eating, (b) whether there is a critical follow-up for the emergence or re-emergence of these problems after surgery, (c) whether there are predictive factors for these occurrence or reoccurrences, and (d) whether clinicians can pre-surgically distinguish patients who will cease their disordered or problematic eating behaviour after surgery, from those who will show reoccurrences, and those who show no issues before but develop them after undergoing bariatric surgery.

4.5.3 Issues of measurement and follow-up

The American Society for Bariatric Surgery recommends that ideal follow-up after bariatric surgery should be for five years or longer, and discourages reporting weight loss with less than two years of follow up (American Society for Bariatric Surgery Standards Committee, 1997). Though the attainability of that goal may be debated (Sarwer, Wadden, & Fabricatore, 2005), this seems a similarly appropriate recommendation in regard to the study of disordered and problematic eating behaviours. Given evidence that disordered and problematic eating disorders may abate long-term, occur de novo, continue unchanged, return in the short- or long-term, or 'swap' from one symptom or disorder to another, the one-year follow-up period most often seen in this review appears inadequate for understanding the bigger patterns of changes in problematic or disordered eating after RYGB, AGB, and VSG. As with weight changes, data collection that concludes at just one or two years after surgery will often report only a short chapter of a longer, more complex story (Meany et al., 2014; Sarwer et al., 2011). Further, with the potential start or reoccurrence of eating issues at one to two years after surgery, any links between problematic and disordered eating issues and outcomes are likely to depend on the point at which they are examined.

The findings of this review appear to support assertions that while a substantial proportion of patients may not fit the full criteria for an eating disorder before and/or after bariatric surgery, many will still experience problematic eating behaviours that are often still distressing and difficult (Sarwer et al., 2011). Measuring full disorders rather than symptoms may mean missed links between subdiagnostic eating-related issues and outcomes, or may lead to inaccurate conclusions that an eating disorder has been 'cured' after surgery when the patient is still experiencing substantial, problematic (but subdiagnostic) symptoms. It will be important to explore the utility of exploring symptoms or diagnoses to improve our understanding of eating behaviours and their related impacts after bariatric surgeries.

This review demonstrates that while patients may not able to eat an objectively large amount of food, binge behaviours may continue after bariatric surgery, though they may be expressed differently, altered, or limited (Niego et al., 2007). Investigation of binge eating in bariatric patients is complicated by limitations on the amounts of food patients are usually able to eat post-surgery (Conceição et al., 2015; Niego et al., 2007; Sarwer et al., 2005). Because of the anatomical and physiological alterations of bariatric procedures (Meany et al., 2014), is generally very difficult or impossible for patients to eat an 'objectively large' amount of food (definitely larger than most people would eat in a similar time under similar circumstances; required for diagnosis of BED under the DSM-5 (American Psychiatric Association, 2013)) after bariatric surgery. Given this difficulty of measurement and the lack of diagnostic distinction between eating issues in the general population and populations with anatomical and physiological limitations on their diet and eating behaviour (Conceição et al., 2015), there has been a push away from using standard criteria to diagnose BED in bariatric populations. Instead, a number of researchers have suggested 'loss of control' over eating as the defining characteristic of binge eating, rather than the quantity of food ingested (Hsu et al., 1997; Mond, Latner, Hay, Owen, & Rodgers, 2010; Niego et al., 2007; Sarwer et al., 2005), and recommend investigating loss of control rather than objective binges (Conceição et al., 2015). Indeed, Niego et al. (Niego et al., 2007) note in their review that studies that utilised the DSM-IV criteria for binge episodes have largely reported an absence of binge eating after surgery, as opposed to those studies that omitted or modified the 'objectively large' criteria. Further study of experiences of loss of control over eating as a standalone concept rather than as a symptom of BED may also facilitate investigation of loss of control related to other patterns of problematic and disordered eating. For example, Saunders (2004) described that many who binged pre-surgery reported a shift towards grazing behaviours with feelings of loss of control after RYGB. The push toward investigation of concepts such as loss of control over eating appears useful for understanding links between loss of control and other problematic eating behaviours in bariatric populations.

4.5.4 Review limitations

This review highlights the dearth of high-quality evidence on changes in many types of disordered and problematic eating behaviours after RYGB, AGB, and VSG. No 'good' or 'fair' (acceptable quality) rated studies investigated changes in bulimia nervosa, NES, or grazing after RYGB, and just one examined BED. In AGB patients, only one study each examined bulimia nervosa, bulimic symptoms, emotional eating, NES, and grazing. The most conspicuous absence of evidence was in regard to VSG, with just one acceptable quality study (on bulimic symptoms), and none on changes in BED, binge eating symptoms or episodes, uncontrolled eating, bulimia nervosa, emotional eating, NES, or grazing found. With VSG only approved as a standalone primary procedure in 2009 (Clinical Issues Committee of the American Society for Metabolic and Bariatric Surgery, 2010), investigations into changes in maladaptive eating patterns after VSG are hopefully forthcoming. The lack of studies regarding most of the eating behaviours makes it difficult to both see and understand any differences in the impacts of RYGB, AGB, and VSG on disordered eating, and is a significant limitation of this review. As such, the findings of this review should be treated as preliminary and require further investigation.

Beyond this scarcity of evidence, a large proportion of the existing literature is limited by methodological issues and vulnerability to bias. Just three of the 23 studies included were rated as 'good', and comparisons and generalisations were impeded by weaknesses including large loss to follow-up, inconsistently defined key variables, non-reporting of the statistical change significance, and researchers not using validated, reliable, consistent measures. Few papers examined any potential influence of pre- or post-surgical support received from clinicians such as a psychologist or dietitian on eating-related outcomes. There was often little description of the pre-surgical data collection, and if it had been conducted as part of pre-surgical psychological evaluation, whether that was likely to have influenced patient responses. As bariatric surgery candidates may minimise symptoms in order to receive a positive recommendation for surgery (Ambwani et al., 2009) and poor agreement has been reported between diagnoses obtained during routine pre-surgical psychological evaluation and

those obtained separately for research purposes (Mitchell et al., 2010), the method of pre-surgical data collection may influence findings. Just one study compared (non-randomised) surgery groups (Castellini et al., 2014a). While randomised controlled trials are likely inappropriate, it is hoped that future research will prioritise prospective comparison studies of changes in disordered and problematic eating behaviours from before to after different bariatric surgeries.

As only three studies reviewed reported any assessment beyond two years post-surgery, little can be understood at this stage about longer-term patterns of disordered and problematic eating behaviours after bariatric surgery, let alone comparing differences in this between RYGB, AGB, and VSG. With several investigations having reported initial decreases followed by re-increases in symptoms, it is currently unclear whether any short or medium-term changes are sustained in the longer-term and whether these differ by surgical procedure.

The reviewed studies overwhelmingly studied female bariatric patients in their middle adulthood. Although this may reflect the average characteristics of bariatric patients in many Western countries (Korda et al., 2012; Padwal, 2005), it is unlikely to represent wider populations of obese and surgery-seeking individuals. Further, the vast majority of the studies were conducted in western, industrialised countries (primarily European and North American) and their results may be bound to those regions. As Herpertz et al. (2003) also note, patients in most bariatric studies have survived a number of selection biases including actively seeking surgery and being approved for surgery by a psychiatrist or psychologist. Therefore, the findings of many studies may not be generalisable to morbidly obese or pre-bariatric populations.

To facilitate a manageable paper, a number of further eating-related variables identified as important in previous research (Conceição et al., 2015; Opolski et al., 2015), including sweet eating, cravings, and food addiction were not included in this review. It is hoped other researchers will address this in future reviews. Similarly, important links between changes in problematic and disordered eating and outcomes after different bariatric surgeries were not systematically reviewed.

Supplementary Table S1. *Methodological quality of the included studies.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Overall rating
Alfonsson (2014)	Y	N	N	Y	CD	CD[c]	NR	Y	NA	CD	N	Y	N	NA	Fair
Boan (2004)	Y	N	N	CD	CD	CD[b]	Y	CD[f]	NA	CD	N	Y	N	NA	Fair
Bryant (2013)	Y	N	N	CD	CD	CD[a]	Y	CD[f]	NA	CD	N	Y	N	NA	Fair
Castellini (2014)	Y	Y	Y	Y	Y	CD[a]	Y	Y	Y	Y	N	Y	N	NA	Good
Colles (2008)	Y	Y	Y	N	CD	CD[c]	Y[d]	N	NA	N	N	Y	N	NA	Fair
De Panfilis (2007)	Y	N	Y	N	CD	CD[a]	NR	Y	NA	Y	N	Y	N	NA	Fair
de Zwaan (2010)	Y	N	Y	Y	CD	CD[b]	NR	N	NA	N	Y	N	N	NA	Fair
Dymek (2001)	Y	Y	Y	CD	CD	CD[a]	Y	CD[f]	NA	N[h]	N	N	N	NA	Poor
Kalarchian (1999)	Y	Y	Y	Y	N	CD[b]	Y[e]	Y	NA	Y	N	N	N	NA	Fair
Kruseman (2010)	Y	Y	Y	Y	Y	Y[b]	NR[d, e]	Y	NA	N[h]	Y	Y	N	NA	Good
Lang (2002)	Y	Y	N	N	CD	Y[b]	Y[e]	N	NA	N	N	Y	N	NA	Fair
Laurenius (2012)	Y	Y	N	Y	N	CD[b]	Y[e]	Y	NA	Y	Y	Y	N	NA	Good
Malone (2004)	Y	Y	Y	Y	CD	CD[a]	NR	CD[f]	NA	N	N	Y	N	NA	Fair
Matini (2014)	Y	N	Y	N	N	CD[b]	NR	CD[f]	NA	Y[h]	N	Y	N	NA	Poor
Melero (2014)	Y	N	N	CD	CD	CD[b]	Y[d,e]	CD[f]	NA	CD	N	Y	N	NA	Fair
Petereit (2014)	Y	Y	Y	Y	CD	CD[b]	Y	CD[f]	NA	N[i]	N	Y	N	NA	Fair
Scholtz (2007)	Y	Y	Y	Y	CD	CD[a]	NR	CD	Y	NA	Y	N	N	NA	Fair
Sioka (2013)	Y	Y	Y	Y	Y	CD[a]	Y[e]	N	NA	Y	Y	N	N	NA	Poor
Thonney (2010)	Y	N	Y	CD	CD	CD[b]	NR	Y	NA	CD	Y	Y	N	NA	Fair
Turkmen (2014)	Y	Y	Y	N	Y	CD[a]	Y	CD	NA	Y	N	Y	N	NA	Fair

White (2010)	Y	N	Y	CD	CD	CD[c]	NR	N[g]	NA	N[i]	Y	Y	N	NA	Fair
White (2006)	Y	N	N	CD	CD	CD[c]	NR	Y	NA	Y	N	N	N	NA	Fair
Wood (2012; 2014)	Y	N	Y	CD	N	CD[b]	NR	Y	NA	Y[h]	N	N	N	NA	Poor

CD = cannot determine; N = no; NA = not applicable; NR = not reported; Y = yes

[a] Smallest/final assessment n = < 40. [b] Smallest/final assessment n = 40-99. [c] Smallest/final assessment n = 100+. [d] Authors reported on, excluded, or statistically accounted for post-surgical complications, conversions, further surgeries, and/or hospital readmissions. [e] Authors also noted routine post-surgical clinic visits, support, dietary advice, or assistance provided to patients. [f] Relevant eating measures fulfil criteria, but paper did not specify BMI assessment method. [g] Relevant eating measures fulfil criteria, but BMI was self-reported. [h] Authors report no significant pre-surgery differences between completers and non-completers. [i] Authors report ≥ 1 significant difference between completers and non-completers.

Assessment items:
1. Study question/objective clearly stated
2. Eligibility/selection criteria for study population prespecified and clearly described
3. Study subjects and setting described in detail
4. Study participants representative of those who would be eligible for the intervention in the clinical population of interest
5. All eligible participants that met the prespecified entry criteria enrolled
6. Researchers provided evidence that sample size sufficiently large to provide confidence in the findings
7. Test/service/intervention clearly described and delivered consistently
8. Outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all participants
9. Outcome assessors blinded to participants' exposures/interventions
10. Loss to follow-up after baseline 20% or less
11. Follow-up carried out over a sufficient time period (18+ months)
12. Statistical methods with p-values to examine changes in outcomes from before to after intervention
13. Outcome measures of interest taken multiple times before and after the intervention
14. Statistical analyses in group-level interventions take into account use of individual-level data to determine effects at the group level

Chapter 5. Patients' reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy

Please note: The published article is included as Appendix J.

Statement of authorship

Title of paper	Patients' reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy.
Publication status	In press (submitted 2 Feb 2017; revised 27 Apr 2017; accepted 6 Jul 2017)
Publication details	Opozda, M., Wittert, G., & Chur-Hansen, A. (in press). Patients' reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy. *Surgery for Obesity and Related Diseases.* https://doi.org/10.1016/j.soard.2017.07.013

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Contribution to paper	Developed research method, collected, cleaned, analysed, and interpreted data, wrote and revised manuscript based on supervisor and reviewer feedback, acted as corresponding author.
Overall percentage	90%
Certification	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signed and dated _____ _____

CO-AUTHORS

By signing the Statement of Authorship, each co-author certifies that:
- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100%, less the candidate's stated contribution.

Co-author name	Anna Chur-Hansen
Contribution to paper	Guided and assisted choice of methodology, qualitative data coding, and analyses, edited manuscript, provided additional guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

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Contribution to paper	Provided guidance, assistance, and critical feedback throughout all steps of this research.

Signed and dated _____ _____

5.1 Abstract

Background: The most common bariatric procedures, Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), and sleeve gastrectomy (VSG), generally induce significant weight loss and health improvements. However, little is known about how patients decide which procedure to undergo.

Objective: Investigate patients' reasons for and against undergoing RYGB, AGB, and VSG.

Setting: Online questionnaire.

Methods: Data were analysed from 236 Australian adults with current RYGB (15.7%), AGB (22.0%), or VSG (62.3%) who completed a questionnaire including an open-ended question about why they underwent their procedure. Data were coded for content and analysed.

Results: Patients most often underwent RYGB because of its *evidence base and success rate* and the *patient's characteristics*, while the most common reason for VSG was *a medical practitioner's recommendation, preference, or choice*, followed by the patient's *evaluation of information* gathered from their own research and observations of others' success. The most common reasons for undergoing AGB related to *characteristics of the procedure*, including its reversibility and a perception of AGB as less invasive. The most common reason against undergoing both RYGB and VSG was a desire to avoid *post-surgical complications and risks* such as leaks or malabsorption, while the most common reason against AGB was *information and evidence* from other people's unsuccessful experiences and failure rates.

Conclusions: Patients' reasons for and against procedures differed by procedure. In addition to the surgeon's influence, patients demonstrated clear procedure preferences based on their own research, knowledge, and experiences, which should be understood to assist patients to choose the most appropriate procedure for their circumstance.

Keywords: bariatric surgery, Roux-en-Y gastric bypass, adjustable gastric band, vertical sleeve gastrectomy, procedure, choice, reason, decision

5.2 Introduction

Roux-en-Y gastric bypass (RYGB) comprises almost half (45%) of all bariatric procedures performed, followed by sleeve gastrectomy (VSG; 37%), and adjustable gastric banding (AGB; 10%; Angrisani et al., 2015). The magnitude of achieved weight loss varies across procedures, with RYGB and VSG demonstrating significantly greater average weight reductions than AGB (Colquitt et al., 2014). Although positive results from bariatric surgery may be maintained for more than 10 years (Colquitt et al., 2014), a substantial minority of patients do not ever lose a significant amount of weight after these procedures (Caiazzo & Pattou, 2013; Sugerman, Londry, & Kellum, 1989).

Further, while "most [bariatric] operations have the ability to be successful in providing a given patient meaningful weight loss" (Needleman & Happel, 2008, p. 1005), each patient's characteristics and circumstances may mean that they are more likely to achieve a better outcome with one particular procedure rather than another. The bariatric population is extremely heterogeneous and it is impractical to assume that any single bariatric procedure would succeed in all patients (Abeles et al., 2010). For example, a nationwide French study found that the best profile for a successful outcome (EWL > 50%) two years after AGB was a patient who was < 40 years old, with an initial body mass index < 50, who changed their eating habits and was physically active after surgery (Chevallier et al., 2007). However, little is known about why patients undergo one bariatric procedure rather than another.

In their review of the literature, Khan, Madan, and Tichansky (2008) suggested that choice of either AGB or RYGB was most often based on either patient choice or a surgeon's recommendation. However, information seminars and meetings with a surgeon have also been shown to rarely influence choice of procedure by patients who have decided on a procedure prior to these visits (Taddeucci, Madan, & Tichansky, 2007). Insurance coverage may also influence procedure choice, with a U.S. survey of patients 3-24 months post-surgery (Ternovits, Tichansky, & Madan, 2006) finding that 19% of patients who had undergone RYGB had insurance policies that would not cover AGB. The most

common reason for choosing RYGB in this cohort was the expectation of greater weight loss, while AGB was chosen for its lower risk.

Procedure perceptions and preferences also appear to vary by location. While VSG is currently the most frequently performed procedure in the North America and Asia-Pacific regions, RYGB is most common in Europe and Latin and South America (Angrisani et al., 2015). Ren, Cabrera, Rajaram, and Fielding (2005) interviewed pre-surgical patients using open-ended questions, finding that Australian patients preferred AGB due to its safety, while US patients' preference for the procedure was most often related to a perception of it being the least invasive bariatric surgery. RYGB was preferred by US patients because of its lack of a foreign body and "inability to cheat", while for Australian patients, a desire for dumping was the most common primary reason for choosing this procedure. In their book chapter, Abeles, Tari, and Shikora (2010) suggest that choice of operation may be influenced by factors including health insurance restrictions, government coverage of procedures, patient and surgeon opinion, and patient characteristics such as the degree of adiposity, comorbid conditions, previous surgeries, underlying gastrointestinal disorders, and eating habits such as binge and sweet eating.

No study to date has examined patients' broader repertoires of reasons for undergoing one procedure rather than others. Reasons against undergoing other procedures, which may also play important roles in the decision-making process, have also not been investigated. Of particular interest are reasons for and against undergoing VSG, which was only approved as a standalone primary procedure in 2009 (Clinical Issues Committee of the American Society for Metabolic and Bariatric Surgery, 2010). This paper aims to begin to fill these gaps in the literature.

5.3 Methods

Data for the current study were collected as part of an investigation into the eating-related behaviours of people who undergo bariatric surgery. The reasons patients ascribe to why they undergo one

procedure rather than another have not been extensively researched to date. In order to provide a wider and richer understanding than is currently available in the literature (Braun & Clarke, 2013), this study took a qualitative, exploratory approach.

5.3.1 Procedure

The participants were individuals living in Australia with a current RYGB, AGB, or VSG that had been performed in Australia when they were 18+ years old. The study was promoted on online Australian bariatric forums and Facebook groups, in the media and in bariatric and medical practices, and by clinicians directly to patients. Promotions directed individuals to the study website, where they could learn about the research, provide consent, undergo screening, and participate. Data were collected April-August 2016. Participation was anonymous and no tangible incentive was offered. Approval (16/12) for the study was obtained from the University of Adelaide Human Research Ethics Subcommittee.

5.3.2 Materials

Participants completed a single online questionnaire collecting quantitative and qualitative data about their pre-surgery and post-surgery eating-related behaviours and experiences. Online questionnaires offer a number of advantages over paper-based surveys, including lower rates of social desirability bias, more truthful self-reports, higher levels of self-disclosure, and fewer non-responses regarding questions on sensitive or personal topics (Booth-Kewley, Larson, & Miyoshi, 2007; Kays, Gathercoal, & Buhrow, 2012; Kiesler & Sproull, 1986).

For this study, responses to the open-response question, “For what reasons did you have a band, bypass, or sleeve (the procedure or procedures currently in your body), and not a different procedure? (For example, if you have a bypass: Why did you have a bypass, rather than a sleeve or band?)” were investigated.

Demographic data including self-reported pre-surgical and current weights and height were collected. Participants were also asked questions about current and previous bariatric surgeries, including which type of procedure(s) they currently had, whether they had undergone any previous bariatric surgeries, when and where their current procedure had been carried out, and how their surgery was funded. Patients provided pre-surgical and current ratings of their general mental and physical health (e.g. 'In general, would you say your physical health before surgery was:' 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent), with changes calculated by taking pre-surgical from post-surgical ratings (positive results indicating improvement). Ratings of satisfaction with surgical result, weight loss, current eating behaviours, current physical appearance, physical activity, and social support (e.g. 'How satisfied are you with… your weight loss since surgery?', 1 = extremely dissatisfied, 5 = extremely satisfied; Cronbach's $\alpha = 0.84$ for all items; Bradley et al., 2016) were averaged to create an overall score of post-surgical satisfaction. Percentage of excess BMI lost (%EBMIL) was calculated using the formula [(pre-operative BMI - current BMI) / (pre-operative BMI - 25)] x 100.

5.3.3 Analysis

The qualitative data were first subjected to content analysis, a data analysis technique that uses a "systematic classification process of identifying themes and patterns" (Hsieh & Shannon, 2005) to transform qualitative text into meaningful categorical data that may then be numerically described and statistically analysed (Krippendorf, 2004). Each patient response was examined to understand its meaning, with categories given labels to reflect their meaning. Categories were generated inductively from the data, as is appropriate for studies that intend to develop new knowledge, rather than describe existing phenomena or replicate previous findings. Codes were assigned to any amount of text, whether a single word or entire paragraph, that represented a relevant category (Zhang & Wildemuth, 2009). The constant comparison method was used, with each new piece of text assigned to a category compared systematically to the data already within the category. Coding was checked for consistency within and against other categories throughout and following the first round of coding. Following the initial round of coding, thematically similar categories were collapsed where appropriate. Coders were

blind to patient details during coding. MO carried out the initial coding, ACH checked its consistency, and both agreed on the final categories and coding.

Analyses were then performed in SPSS 23.0. P-values less than .05 were considered statistically significant. Fisher's Exact Test was used to assess associations between categorical variables, with adjusted standardized residuals examined to identify cells making a significant contribution (z = +/- 1.96) within significant results (Sharpe, 2015). One-way analyses of variance (ANOVA; Welch's ANOVA when homogeneity of variance was violated) with Šídák method for multiple comparisons were used with continuous variables.

5.3.4 Response rate

Of the 408 consenting participants, 386 were eligible. Of those, 150 responses were excluded due to missing data (n = 144) or the participant having multiple current bariatric procedures (n = 6). Likely explanations for the high proportion of missing data included the complexity and length of the questionnaire and lack of completion incentive. Data from the remaining 236 participants (61.1%) were analysed.

5.4 Results

5.4.1 Participants

As shown in Table 5.1, 62.3% of participants had a current VSG, 22.0% had AGB, and 15.7% had RYGB, with a mean age of 45.5 years and 93.9% female. Patients with an AGB had undergone their surgery significantly earlier than the other procedure groups. While their pre-surgery BMIs did not significantly differ, patients with an AGB had lost less excess BMI and body weight and had lower post-surgical physical health change and poorer post-surgical satisfaction than had patients with an RYGB or VSG. Patients with an RYGB were more likely to have had previous bariatric surgery.

Significantly more patients with RYGB (91.7%) and VSG (84.7%), and fewer with AGB (47.6%), reported that they would choose the same procedure again.

Table 5.1. Participant characteristics.

	All participants (N = 236)	RYGB patients (n = 37; 15.7%)	AGB patients (n = 52; 22.0%)	VSG patients (n = 147; 62.3%)	*p*-value
Months since surgery (M, SD)	26.6 (36.4)	21.6 (35.8)	62.9 (52.6)#	15.2 (15.8)	< .0005*
Previous bariatric surgery (n, %)	36 (15.3%)	16 (43.2%)~	0 (0%)^	20 (13.6%)	< .0005*
Surgery funding					
Public health system (no cost to patient)	13 (5.5%)	2 (5.4%)	4 (7.7%)	7 (4.8%)	.634
Private health insurance with/without gap payment	177 (74.2%)	31 (83.8%)	37 (71.1%)	109 (74.2%)	
Fully self-funded	25 (10.6%)	1 (2.7%)	6 (11.5%)	18 (12.2%)	
Other (accessed superannuation, another individual or organisation paid, specialist did not charge)	21 (8.9%)	3 (8.1%)	5 (9.6%)	13 (8.8%)	
Gender (n, %)					
Female	214 (93.9%)	35 (94.6%)	48 (92.3%)	131 (94.2%)	.868
Male	13 (5.7%)	2 (5.4%)	4 (7.7%)	7 (5.0%)	
Other	1 (0.4%)	0 (0%)	0 (0%)	1 (0.7%)	
Age (M, SD)	45.5 (10.1)	47.0 (9.6)	45.3 (10.4)	45.2 (10.2)	.644
Weight (M, SD)					
BMI before surgery	45.5 (8.0)	46.3 (9.1)	45.1 (8.3)	45.4 (7.6)	.770
% excess BMI loss	63.6 (29.1)	75.6 (25.7)	50.0 (29.7)#	65.4 (28.0)	< .0005*
Weight loss (kg)	34.9 (20.5)	42.9 (22.5)	27.3 (23.1)#	35.6 (17.9)	.001*
Mental health (M, SD)					
Before surgery	2.2 (1.2)	2.2 (1.1)	1.9 (0.9)	2.3 (1.2)	.070
Change (current – before)	0.9 (1.2)	1.0 (1.4)	1.2 (0.2)	1.1 (0.1)	.526
Physical health (M, SD)					

Before surgery	1.9 (0.9)	1.8 (0.8)	1.9 (0.8)	1.9 (1.0)	.712
Change (current – before)	1.5 (1.1)	1.9 (1.0)	1.1 (1.3)	1.6 (1.0)	.002*
Post-surgical satisfaction (M, SD)	3.8 (0.8)	4.0 (0.7)	3.3 (1.1)#	4.0 (0.7)	< .0005*
Would have bariatric surgery again if could re-do					
No (probably/definitely not)	5 (2.1%)	0 (0%)	2 (3.8%)	3 (2.0%)	.780
Yes (probably/definitely)	221 (93.6%)	36 (97.3%)	47 (90.4%)	138 (93.9%)	
Unsure	10 (4.2%)	1 (2.7%)	3 (5.8%)	6 (4.1%)	
If would have bariatric surgery again, which surgery would choose					< .0005*
RYGB	54 (24.8%)	33 (91.7%)~	3 (7.1%)^	18 (13.1%)^	
AGB	21 (9.6%)	0 (0%)^	20 (47.6%)~	1 (0.7%)^	
VSG	134 (61.5%)	2 (5.6%)^	16 (38.1%)^	116 (84.7%)~	
Unsure	9 (4.1%)	1 (2.8%)	3 (7.1%)	2 (1.5%)	

AGB, adjustable gastric banding; M, mean; RYGB, roux-en-Y gastric bypass; SD, standard deviation; VSG, vertical sleeve gastrectomy

* $p < .05$. # AGB vs. VSG and RYGB. ~ over-represented in sample compared to expected. ^ under-represented in sample compared to expected.

5.4.2 Reasons for and against undergoing RYGB

Patients with a current RYGB cited *information and evidence* (50.0%), almost always related to the procedure's *evidence base, success rates, and long-term effectiveness* (46.4%), as their most frequent reason for having chosen this surgery. The second most commonly-noted reason for undergoing RYGB related broadly to patient characteristics (35.7%). Specific reasons included the aim to lose a larger amount of weight than might be expected with other procedures, damage to the stomach and/or scar tissue from a previous AGB, and pre-existing medical conditions including reflux and diabetes. The third and fourth most common reasons were a *medical professional's recommendation, preference, or choice* (21.4%), and a desire for *procedure-related effects*, most often *physical repercussions* like dumping and malabsorption (17.9%). Those who underwent RYGB were significantly more likely to have chosen this procedure due to the *characteristics of the patient*, for its *physical repercussions*, and because of its *evidence base* (Table 5.2).

Concerns regarding undesirable *procedure-related effects* (37.8%; most often possible *post-surgical complications and risks* such as malabsorption or irritable bowel exacerbations) were AGB and VSG patients' most common reason against undergoing RYGB. Their next frequently noted reason against RYGB was related to the procedure's *characteristics* (35.1%) – most often a perception of RYGB being *too invasive, extreme, or permanent* (Table 5.3).

Table 5.2. Patient reasons for undergoing their particular bariatric procedure.

Category	Overall	RYGB patient responses (n = 28)	AGB patient responses (n = 41)	VSG patient responses (n = 97)	Fisher's Exact	*p*-value	Sample patient responses
Medical professional recommendation/preference/choice	57 (34.3%)	6 (21.4%)	4 (9.8%)^	47 (48.5%)~	14.69	.001*	*"Recommended as best for me by the surgeon"* *"The sleeve was suggested/preferred by my surgeon for me and my circumstances"*
Information and evidence	49 (29.5%)	14 (50.0%)~	4 (9.8%)^	31 (32.0%)	14.28	.001*	
Evidence base/success rates/long-term effectiveness	*22 (13.3%)*	*13 (46.4%)~*	*1 (2.4%)^*	*8 (8.2%)^*	*25.48*	*< .0005**	*"Chose the bypass because it has the greatest level of weight loss and long-term success in keeping the weight off"* *"There was more scientific data about the effectiveness of this operation, it had been done for a longer time than the sleeve"* *"The bypass has been used for over 50 years for weight loss surgery, whereas the sleeve has only been used for 10 years, so there are no long-term studies about the effects and impacts"*
Own research	*17 (10.2%)*	*1 (3.5%)*	*2 (4.9%)*	*14 (14.4%)*	*2.55*	*.271*	*"… and I did my own research and decided the sleeve would be a better option for me"* *"I had the sleeve as it appeared from my research to have better long-term success than the band"*
Others' success with the procedure	*12 (7.2%)*	*0 (0%)*	*1 (2.4%)*	*11 (11.3%)*	*3.97*	*.112*	*"Knew people who'd had the band and it hadn't been a terrific result and knew people who'd had the sleeve and it had been terrific"* *"I had seen two family members fail to lose weight with the band and when an acquaintance explained*

							that she had succeeded after having the sleeve, I realised that it was my last chance to ever conquer my weight struggle"
Characteristics of the procedure	48 (28.9%)	4 (14.3%)	28 (68.3%)~	16 (16.5%)^	37.80	< .0005*	
Wanted a reversible/removable procedure	*28 (16.9%)*	*3 (10.7%)*	*25 (61.0%)~*	*0 (0%)^*	*75.10*	*< .0005**	*"I had the bypass as it is reversible if any issues arise"* *"Chose the band because it is reversible if reacted adversely with me"* *"I liked that the band wasn't permanent"*
Less invasive/drastic than other procedures	*15 (9.0%)*	*2 (7.1%)*	*9 (22.0%)~*	*4 (4.1%)^*	*11.55*	*.002**	*"Less invasive than the other procedures"* *"A band is the least invasive procedure"* *"Sleeve was less invasive […] than the bypass"*
Wanted a permanent procedure	*8 (4.8%)*	*0 (0%)*	*0 (0%)*	*8 (8.2%)*	*3.80*	*.097*	*"I wanted a permanent solution…"* *"Had the band first because of the ability to reverse it. When this did not suit, I desperately needed to lose weight for health reasons so went with the permanent gastric sleeve"* *"Sleeve surgery was to me a more permanent solution to my problems"*
Wanted an adjustable/controllable procedure	*8 (4.8%)*	*0 (0%)*	*8 (19.5%)~*	*0 (0%)^*	*21.17*	*< .0005**	*"As it is adjustable…"* *"So it was able to have ongoing adjustments as required"* *"I can control it"*
Allows for further surgery later if needed	*3 (1.8%)*	*0 (0%)*	*0 (0%)*	*3 (3.1%)*	*0.85*	*.742*	*"I understood that if the sleeve gastrectomy did not result in adequate weight loss, I could proceed to a bypass"* *"Sleeve so there is another option if needed (i.e. bypass)"* *"Personally I also felt bypass would be the last step*

							for me if something went wrong with the sleeve"
No ongoing procedures or follow-up needed	*2 (1.2%)*	*0 (0%)*	*0 (0%)*	*2 (2.1%)*	*0.69*	*1.000*	*"No ongoing procedures required"* *"I didn't want the band due to […] the number of follow ups and interventions"*
Procedure-related effects	29 (17.5%)	5 (17.9%)	4 (9.8%)	20 (20.6%)	2.32	.334	
Fewer complications/shorter recovery time/less risky than other procedures	*11 (6.6%)*	*2 (7.1%)*	*4 (9.8%)*	*5 (5.2%)*	*2.00*	*.367*	*"I had the sleeve because I thought it has less long-term complications than the band"* *"I had the band because it was a quicker recovery time than the other surgeries"* *"The recovery time was more beneficial for me, as I have a 10 month old"*
Ability to eat normally and healthily, learn new habits	*8 (4.8%)*	*0 (0%)*	*0 (0%)*	*8 (8.2%)*	*3.80*	*.097*	*"I was considering a band, but once I found out that I would be limited by the fresh foods that I could eat (apple, lettuce, etc.) […] this changed my mind"* *"I love that I can still eat all of the foods I love – just smaller portions"* *"I also thought long-term I would be able to deal with that surgery and eat and live most 'normally' afterwards"*
Avoid side-effects (e.g. malabsorption) associated with other procedures	*7 (4.2%)*	*0 (0%)*	*0 (0%)*	*7 (7.2%)*	*3.07*	*.179*	*"Had sleeve because my research indicated that side effects were minimal compared to other bariatric procedures"* *"I had a sleeve as […] less side effects like malnutrition and dumping syndrome"* *"Had the sleeve due to less side effects"*
Wanted physical repercussions associated with procedure	*5 (3.0%)*	*5 (17.9%) ~*	*0 (0%)*	*0 (0%)^*	*16.00*	*< .0005**	*"I chose the bypass because I knew my weakness was highly fatty and sugary food. I wanted there to be a repercussion if I chose to eat badly because I knew it was the only way I'd learn to eat healthier"* *"I wanted the malabsorption and dumping benefit that bypass may bring"*

							"I have a sweet tooth and wanted to be turning off craving sweets"
Allows good quality of life/normal life	*3 (1.8%)*	*0 (0%)*	*0 (0%)*	*3 (3.1%)*	*0.85*	*.742*	*"Sleeve seemed to be the least lifestyle invasive"* *"Chose the sleeve for quality of life"*
Chosen due to patient characteristics	17 (10.2%)	10 (35.7%)~	3 (7.3%)	4 (4.1%)^	19.40	< .0005*	*"Sleeve was recommended by my doctor due to my age and lower BMI"* *"I had sleeve instead of bypass as I don't suffer from reflux"* *"I had a bypass because I believed my body absorbed more fats from my food than other people do"*
Only procedure provided/mentioned/offered	6 (3.6%)	0 (0%)	4 (9.8%)~	2 (2.1%)	5.33	.046*	*"Only option at the time"* *"I refused to have the band so they said I could only have the sleeve"* *"It was offered to me free as part of a […] trial"*

AGB, adjustable gastric banding; RYGB, roux-en-Y gastric bypass; VSG, vertical sleeve gastrectomy

* $p < .05$. ~ over-represented in sample compared to expected. ^ under-represented in sample compared to expected.

5.4.3 Reasons for and against undergoing VSG

A *medical professional's recommendation, preference, or choice* was VSG patients' most common reason cited for undergoing this procedure (48.5%). *Information and evidence* was their second most common reason for undergoing VSG, but in contrast with patients' reasons for undergoing RYGB, the sources of these data were most often the *patients' own research* (14.4%) and *others' success with the procedure* (11.3%). A wish for *procedure-related effects*, most often the *ability to eat normally and healthily and to learn new habits* (8.2%), was the third most frequently cited reason for undergoing VSG (20.6%). Patients with VSG were significantly more likely to have chosen this procedure due to the *influence of a medical professional*, and less likely to have chosen it for reasons including its *evidence base*, *patient characteristics*, and because they desired what they perceived to be a *less invasive or drastic procedure* (Table 5.2).

As seen in the reasons against RYGB, the most common reason against undergoing VSG was also concern regarding undesired *procedure-related effects* (26.7%), most often *post-surgical complications and risks* such as suture line leaks or reflux. Patients' next most common reason against VSG related to the *procedure's characteristics* (20.0%), with VSG perceived as *too invasive, extreme, or permanent*. Further reasons cited against undergoing VSG related to the *procedure not being suitable for the patient*, often due to a current medical condition or previous surgical damage to the body (20.0%), or VSG *not having been offered, available, or considered* at the time of the patient's decision (20.0%; Table 5.3).

Table 5.3. Patient reasons for not undergoing other procedures.

Category	Reasons against RYGB (n = 37 responses)	Reasons against AGB (n = 50 responses)	Reasons against VSG (n = 15 responses)	Sample patient responses
Information and evidence	1 (2.7%)	24 (48.0%)	2 (13.3%)	
Other people's unsuccessful experiences	*1 (2.7%)*	*14 (28.0%)*	*0 (0%)*	*"Everyone I knew that had the band it didn't work"* *"I know many people who have 'eaten around' a band…"* *"Bypass didn't appear to be permanently effective – knew several people who regained their weight in 2-3 years"*
Concerns re: effectiveness/failure	*0 (0%)*	*10 (20.0%)*	*0 (0%)*	*"Bands fail"* *"I […] found many band recipients suffered complications and/or less than desired weight loss"* *"I had read a lot of evidence around failure, slippage, and adverse outcomes with band"*
New procedure/lack of evidence	*0 (0%)*	*0 (0%)*	*2 (13.3%)*	*"…the sleeve was a relatively new procedure"* *"Given that the sleeve is a newer procedure and there was less information available about long term results (i.e. whether patients had kept the weight off long-term)…"*
Unwanted procedure-related effects	14 (37.8%)	20 (40.0%)	4 (26.7%)	
Potential post-surgical complications/risks	*14 (37.8%)*	*14 (28.0%)*	*4 (26.7%)*	*"...heard many problems with band slipping, eroding"* *"Concern about nutrient malabsorption and ongoing nutritional deficiencies"* *"I considered bypass, but as I have IBS I was concerned that I may end up with intolerable bowel issues"*
Eating-related concerns	*0 (0%)*	*9 (18.0%)*	*0 (0%)*	*"I was considering a band, but once I found out that I would be limited by the fresh foods that I could eat (apple, lettuce, etc.) and run the risk of food getting stuck, this changed my mind"* *"I also wanted to change my eating habits and did not like the idea of being able to*

				adjust the band at different events. It felt like cheating"
Characteristics of the procedure	13 (35.1%)	13 (26.0%)	3 (20.0%)	
Procedure too invasive/extreme/permanent	*13 (35.1%)*	*0 (0%)*	*3 (20.0%)*	*"I had my band done in 2006 and back then bypass was considered too radical and risky"* *"Removing a part of my stomach sounded frightening"* *"Sleeve was too permanent"*
Did not want foreign object in body/ongoing upkeep	*0 (0%)*	*12 (24.0%)*	*0 (0%)*	*"Didn't want a port under my skin, I'm needle phobic. Didn't like the idea of having something additional in my body"* *"I was not keen on a band because I didn't want something foreign in my body"* *"Did not want the upkeep of a band"*
Did not want a reversible procedure	*0 (0%)*	*1 (2.0%)*	*0 (0%)*	*"I opted to have the sleeve over the band as I was not interested in a reversible procedure"*
Procedure not suitable	7 (18.9%)	4 (8.0%)	3 (20.0%)	*"I was morbidly obese with multiple comorbidities and my research indicated that the band was unsuitable in those circumstances"* *"Already had a fundo so surgeon wouldn't do the sleeve"* *"The bypass was performed as the stomach was too damaged from the band slippage for the sleeve option"*
Procedure not offered/available/considered	5 (13.5%)	0 (0%)	3 (20.0%)	*"The surgeon didn't discuss a bypass with me"* *"My surgeon recommended the sleeve only after doing a gastroscopy to eliminate the need for bypass"* *"Bypass […] wasn't on offer as a public patient anyway"* *"Sleeve was not available at the time"*
Medical professional recommended against procedure	0 (0%)	4 (8.0%)	0 (0%)	*"My surgeon no longer feels bands are a good effective option for weight loss surgery"* *"…surgeon no longer performs or recommends banding"* *"…surgeon won't do lap band"*

AGB, adjustable gastric banding; RYGB, roux-en-Y gastric bypass; VSG, vertical sleeve gastrectomy

5.4.4 Reasons for and against undergoing AGB

In contrast with patients' reasons for RYGB and VSG, the most common reasons for undergoing AGB (68.3%) were all related to *specific characteristics of the procedure*. Patients most frequently cited and were statistically more likely to cite AGB's ability to be *reversed and removed* (61.0%) and *adjusted and controlled* (19.5%), and reported a positive perception of the procedure as being *less invasive and dramatic than other procedures* (22.0%). Patients with AGB significantly less often cited *information and evidence* (9.8%) or a *medical professional's recommendation, preference, or choice* (9.8%) as reasons why they had undergone their procedure, but were significantly more likely to note that AGB had been the *only procedure provided, mentioned, or offered* at the time of their decision (9.8%; Table 5.2).

RYGB and VSG patients' most common reasons against undergoing AGB were related to *information and evidence* (48.0%); specifically, *other people's unsuccessful experiences* (28.0%) and concerns regarding the procedure's *effectiveness and failure rates* (20.0%). The second most frequent reason against AGB (40.0%) was concern regarding undesired *procedure-related effects*, most commonly *post-surgical complications and risks* such as bands slipping or eroding (28.0%), followed by *eating-related concerns* including regarding food intolerances (18.0%). The next most frequent reason related to AGB's *characteristics*, with patients reporting *not wanting a foreign object in their body and not wanting ongoing upkeep* (24.0%). AGB was the only procedure that any patients noted their *surgeon had specifically recommended against* (8.0%; Table 5.3).

5.5 Discussion

In this first study to examine patients' reasons for and against the three current most common bariatric surgeries, reasons for and against each procedure varied. The influence of medical professional recommendation in patients' decisions for and against various bariatric procedures seen in this study was significant. In their review, Khan et al. (2008) concluded that "surgeon's bias may have very little

role in patients' decisions as they already have decided on the type of procedure for themselves […] surgeon visit will only affect the undecided patient" (p. 59). However, the influence of medical practitioners (primarily bariatric surgeons) on the choice of VSG appeared to be substantial in this cohort, with just under half of those who had undergone VSG stating that their medical practitioner's recommendation, preference, or choice had influenced them to undergo that procedure. Over one in five in the RYGB group also cited a medical practitioner's influence for their choice of procedure, contrasting with the findings of Ren et al. (2005), in which US and Australian patients did not report this as a reason for undergoing RYGB. AGB was also the only procedure that any patients reported a medical practitioner had recommended against. This is consistent with a recent large trend away from this procedure in Australia (Angrisani et al., 2015). In keeping with the overwhelming popularity of AGB in Australia at the average time our AGB participants underwent surgery (82.5% of all Asia-Pacific bariatric procedures in 2008; Buchwald & Oien, 2009), patients were more likely to have undergone AGB because it was the only procedure offered or available at the time of their surgery.

Reversibility and removability was the most commonly-cited reason for undergoing AGB, but despite also being reversible (Colquitt et al., 2014), was cited by only 10.7% of those who had undergone RYGB a reason for choosing this procedure. Reversing RYGB is a more complex and much less common operation than reversal of AGB (Vilallonga, van de Vrande, & Himpens, 2013). It may be that RYGB's potential reversibility is not known or not an appealing feature to many who undergo it. Given that RYGB is associated with the greatest long-term weight loss and comorbidities resolution of the three investigated surgeries (Colquitt et al., 2014), it may be unsurprising that patients who underwent RYGB more often cited the procedure's evidence base, success rate, and long-term effectiveness as reasons for choosing this procedure. Patients' understanding and beliefs about the potential risks and effects of revisional surgery or band removal are unclear and would benefit from further investigation.

While the procedure's evidence base, success rates, and long-term evidence was the most common information influencing patients towards RYGB, for VSG this most often came from patients' own

research and seeing others' success after having VSG. Given VSG's relatively recent introduction and swift rise in popularity (Clinical Issues Committee of the American Society for Metabolic and Bariatric Surgery, 2010), it is understandable that patients were significantly less likely to have undergone it due to its evidence base, success rates, and long-term effectiveness, and more often due to seeing others' success and doing their own research. Information and evidence was significantly less likely to have positively influenced patients towards AGB and was the most common reason cited *against* undergoing AGB. Little is currently known about sources and accuracy of patient information and whether the evidence used by pre-surgical patients to make procedure decisions is relevant to their own personal circumstances.

Patients' reasons against procedures they had not undergone also showed interesting patterns. A greater proportion of patients reported not undergoing RYGB (37.8%) due to the procedure's perceived extreme, invasive, or permanent nature than reported not undergoing VSG (26.7%) for the same reasons. Given that RYGB requires significant but reversible anatomical changes, whereas VSG involves permanent, irreversible removal of the majority of the stomach, perceptions of RYGB as more radical than VSG are interesting and require further investigation. Potential post-surgical complications and risks including malabsorption, reflux, irritable bowel, and band erosions and eating-related difficulties were also frequent reasons against RYGB, VSG, and AGB.

Other people's unsuccessful experiences were another commonly cited reason against undergoing AGB. Though it has been theorised that patients may use media, the internet, or personal acquaintances to gather information on procedures (Khan et al., 2008; Taddeucci et al., 2007), this is the first study to document the significant specific influence of other patients' experiences on considerations of which bariatric procedure to undergo. Whether these influential others are personally known to the individual, such as family members or friends, or are at a greater distance, such as via media stories or other anecdotal accounts is yet to be explored.

There is no simple flow chart to indicate which surgery will best fit each patient, and no consensus on one 'best' bariatric procedure for everyone. Given this, understanding why patients undergo one particular procedure over others is important. Patients may be basing their procedure selection on potentially inaccurate or inapplicable information, such as the positive or negative experiences of a friend or colleague or celebrity whose medical, behavioural, psychological, and social circumstances may differ in ways that will likely affect their outcome after undergoing the particular procedure. Patients may undergo a surgery based on their belief about the extreme or invasive nature of a procedure. Knowing these potential motivators will hopefully prompt and assist clinicians to enquire why patients wish to undergo a particular bariatric procedure, and target the provision of appropriate and accurate information to inform and guide patients towards the most appropriate procedure for their individual circumstances.

Medical professionals have significant influence over patients' choices for and against bariatric procedures. The training and experience of bariatric surgeons may be limited to one particular procedure or another. For example, the Roux-en Y gastric bypass is more time consuming to perform and requires a high level of technical skill, with a reported learning curve of up to 500 cases (Doumouras et al., 2017; Tice, Karliner, Walsh, & Feldman, 2008). Therefore, surgeons may limit their practice to one particular operation (Abeles et al., 2010), or if not may hold unconscious bias toward or against a particular procedure. There may be referral bias by primary care practitioners, who are not aware of the different bariatric procedures and their risks and benefits for particular patients resulting in referral to a surgeon who performs the favoured operation. Patients seeking bariatric surgery may request a particular procedure based on anecdotal evidence or unrealistic expectations, or have circumstances that make them more suitable for one procedure over another (Abeles et al., 2010). In other cases, patients may not have a strong preference for or against any procedure. In either case, practitioners have an obligation to provide informed, accurate, and personalized information in the most objective manner possible. In the event that the surgeon involved does not competently perform each of the procedures patients should receive independent advice and referral to the most appropriate surgeon (Abeles et al., 2010; Khan et al., 2008).

Doctors' reasons for recommending for and against particular bariatric procedures remain largely unclear. While it seems intuitive that surgeons would recommend for and against particular bariatric procedures based on their assessment of a patient's medical concerns, current conditions, or weight loss goals, the influence of these issues versus patient demands and the surgeon's ability to perform, or comfort performing, a particular procedure remain unclear. Where choice is available, procedure selection should be guided by unbiased evidence-based guidelines and patients counselled with impartiality and cognisance regarding their level of health literacy and potential pre-existing biases. Where the procedure performed is dictated by the payer, it should be the one where the evidence is unequivocal in terms of overall superiority.

Limitations of this study include the smaller AGB and RYGB groups, procedure-based differences in time since surgery, and retrospective patient responses, all of which may have influenced findings. Our procedure groups (VSG 62.3%, AGB 22.0%, RYGB 15.7%) roughly approximated but statistically differed from the distributions of the three surgeries in Australia over the three years prior to our study (VSG 71.7%, AGB 19.4%, RYGB 8.8%; $\chi^2(2)=16.09$, $p=0.0003$; Australian Government Department of Human Services, 2017). The representativeness of the sample against the Australian bariatric population is not known.

While a strength of this study was that we did not limit responses to only patients' primary reasons for and against procedures, further research may benefit from investigating the relative influence of each reason on patient decisions. Additional research will also be important to understand whether reasons for and against procedures relate to variables including patients' disordered eating behaviours and psychological symptoms, and how a patient's pre-surgical reasons for choosing their particular procedure, and whether those expectations match their actual post-surgical experiences, relate to their outcomes after surgery. Investigation is also needed into patients' sources of information and evidence for and against procedures, and to understand medical practitioners' reasons for making recommendations for and against bariatric procedures.

5.6 Conclusion

Patients report a wide and varied range of reasons for and against undergoing different bariatric procedures. Those who chose AGB most commonly desired a reversible and removable procedure, those selecting RYGB valued its strong evidence base, success rate, and long-term effectiveness, and VSG was most often chosen based on the recommendation, choice, or preference of a medical professional. The most common reasons against both RYGB and VSG were a desire to avoid post-surgical complications and risks, while patients most often cited information and evidence, commonly other people's unsuccessful experiences and concerns about effectiveness, as their reasons for having not chosen AGB. In addition to the influence of the surgeon on choice, patients show clear preferences based on their own research, knowledge and experiences, which require further investigation and understanding in order to assist patients to decide upon the most appropriate procedure for their circumstance.

Chapter 6. Patients' expectations and experiences of eating behaviour change after bariatric procedures

Statement of authorship

Title of paper	Patients' expectations and experiences of eating behaviour change after bariatric procedures.
Publication status	Unpublished and unsubmitted work written in a manuscript style
Publication details	N/A

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Contribution to paper	Developed research method, collected, cleaned, analysed, and interpreted data, wrote and revised manuscript based on supervisor feedback.
Overall percentage	90%
Certification	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signed and dated _____ _____

CO-AUTHORS

By signing the Statement of Authorship, each co-author certifies that:
- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100%, less the candidate's stated contribution.

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6.1 Abstract

Patients' pre-surgical expectations and post-surgical experiences of eating-related behaviour change after bariatric surgery may differ by both procedure type and time since surgery. To investigate this hypothesis, data were coded from 206 Australian adults ≥ 2 months post-Roux-en-Y gastric bypass (RYGB; 17.0%), adjustable gastric band (AGB; 22.8%), or vertical sleeve gastrectomy (VSG; 60.2%) who completed an online questionnaire including open-ended questions about pre-surgical eating-related expectations and post-surgical experiences. Participants were 94.0% female, with a mean age of 45.9 years (SD = 10.0). Average time since surgery varied (AGB: 69.6 months, RYGB: 22.8, VSG: 17.8). The most common pre-surgical expectations were eating less and feeling increased satiety (47.0%) and reduced hunger (30.4%). Following surgery, patients more often reported 'positive' (84.9%; most often eating less) than 'negative' eating-related experiences (43.7%; most often continued or new problematic/disordered eating behaviours). Overall, 55.4% reported only positive experiences, 13.3% reported only negative, and 31.3% reported positive and negative experiences. Problematic/disordered eating behaviours persisted or emerged in 17.1% and improved or resolved in 18.1%. Negative experiences were more frequently reported ≥ 18 months than < 1 year ($p = .019$). Reporting any (one or more) negative eating-related experience was related to poorer outcomes, and reporting any positive experience was related to better outcomes, after VSG and AGB, but not RYGB. The findings emphasise the need for longer-term patient monitoring and multidisciplinary care, and investigation into eating-related change after different procedures.

6.2 Background

Substantial evidence indicates that problematic patterns of eating can be significant contributors to the development and maintenance of obesity (Marcus & Wildes, 2014; Tanofsky-Kraff & Yanovski, 2004). Bariatric (weight loss) surgery is the most effective treatment for severe obesity (Buchwald, 2005). A substantial proportion of candidates for the most common bariatric procedures, Roux-en-Y bypass (RYGB), vertical sleeve gastrectomy (VSG), and adjustable gastric banding (AGB), report significant problematic eating behaviours such as binge eating disorder, night eating syndrome, emotional eating, food addiction, and grazing (Opolski et al., 2015). Pre-surgical candidates commonly believe that bariatric surgery will virtually guarantee improved eating behaviours, increase their ability to make changes to their diet, help them feel satisfied with less food, and move their preference towards healthier foods (Bauchowitz, Azarbad, Day, & Gonder-Frederick, 2007; Opolski et al., 2015; Wolfe & Terry, 2006). Consistent with those expectations, qualitative data have shown that patients after AGB, RYGB, VSG, or vertical banded gastroplasty report reduced hunger, cravings, and food intake, helpful changed food preferences, and unpleasant but desired bodily reactions after eating the 'wrong' foods, quickly, or in large portions (Ogden et al., 2006). Our systematic review found short to medium-term improvements in binge eating and emotional eating after RYGB, and short to long-term improvements in bulimia nervosa after AGB (Opozda, Chur-Hansen, & Wittert, 2016).

However, positive eating-related changes do not always occur after surgery, and initial improvements may not persist (Benson-Davies, Davies, & Kattelmann, 2013; Dodsworth et al., 2010; Hsu et al., 1997; White et al., 2010). We also noted reports of binge eating reoccurring or beginning de novo after bariatric surgery, often at one to two years post-surgery (Opozda et al., 2016). A number of studies have suggested distinct "phases" of eating behaviour over time after bariatric surgery, with difficulties often reoccurring or becoming more intrusive after an initial post-surgical remission (Benson-Davies et al., 2013; Engstrom & Forsberg, 2011; Hsu et al., 1997; Lynch, 2016). Post-surgical eating-related change has also been shown to differ depending on the particular bariatric

procedure (Herpertz et al., 2003; Himpens, Dapri, & Cadière, 2006; Karamanakos, Vagenas, Kalfarentzos, & Alexandrides, 2008; Overs, Freeman, Zarshenas, Walton, & Jorgensen, 2012). Despite the common bariatric procedures involving differing physiological alterations, mechanisms of change, average weight losses, failure and weight regain rates, and improvements in obesity-related health conditions (Buchwald et al., 2004; Caiazzo & Pattou, 2013; Colquitt et al., 2014; Courcoulas et al., 2013; Suter, Calmes, Paroz, & Giusti, 2006), most reviews of eating behaviour change after bariatric surgery have examined either a single procedure or multiple procedures under a single 'bariatric surgery' banner (Dodsworth et al., 2010; Meany et al., 2014; Niego et al., 2007; Wimmelmann et al., 2014). No previous studies have examined patients' own descriptions of their expectations and experiences of eating behaviour change before and after the three most common bariatric procedures.

This study investigates patients' (a) pre-surgical expectations of how their eating behaviours would change after surgery and (b) actual eating behaviour change after surgery. Relationships between these expectations and experiences and time since surgery, procedure, and post-surgical outcomes are examined.

6.3 Materials and methods

6.3.1 Design and procedure

This study (the Bariatric Eating Experiences Study) investigated individuals living in Australia with a current RYGB, AGB, and/or VSG that was performed in Australia when they were 18+ years old. Data on patients' reasons for undergoing their particular bariatric procedure have already been published (Opozda, Wittert, & Chur-Hansen, in press). Approval (16/12) was obtained from the University of Adelaide Human Research Ethics Subcommittee. The research was promoted on online bariatric groups and forums, in the media, in bariatric and other medical practices, and by clinicians. Promotions included the study website address, where all participants provided informed consent and

completed the questionnaire. Information on eating-related assistance organisations was available for download before and after participation. Data were collected between April and August 2016. Participation was anonymous and no tangible incentive was offered.

6.3.2 Materials

All participants completed a single online questionnaire collecting data about their pre-surgery and current eating-related behaviours. This paper investigates responses to two qualitative (open-response) items:

1. Before you had surgery, how did you expect or hope your eating behaviours would change after surgery? (For example, you might have hoped for changes in what or how much you ate, your appetite/hunger, or patterns of eating such as grazing, emotional eating, night eating, or bingeing.)
2. How, if at all, have your eating and eating behaviours actually changed since you had bariatric surgery? How have they changed over time since your surgery? How did your expectations compare to what actually happened after surgery?

Self-reported pre-surgical and current ratings of mental and physical health (e.g. 'In general, would you say your mental health before surgery was:' 1 = poor, 5 = excellent), demographic data including pre-surgical and current weights and height, and details of patients' current and previous bariatric surgeries were collected from participants. Ratings of surgical result, weight loss, eating behaviours, physical appearance, physical activity, and social support (e.g. 'How satisfied are you with your weight loss since surgery?', 1 = extremely dissatisfied, 5 = extremely satisfied; Cronbach's $\alpha = 0.84$) were averaged to measure overall post-surgical satisfaction.

6.3.3 Analysis

Data were content analysed, a "systematic classification process of identifying themes and patterns" (Hsieh & Shannon, 2005, p. 1278) used to transform qualitative text into meaningful categorical data

that can be numerically described and statistically analysed (Krippendorf, 2004). Steps outlined by Zhang and Wildemuth (2009) were followed. Categories were generated inductively from the data. Each patient response was examined to understand its meaning, with codes assigned to any amount of text that represented a relevant theme (Zhang & Wildemuth, 2009). Consistency was checked throughout, and coders were blind to patient details during coding. Following the initial coding, thematically similar categories were collapsed. The final categories were also grouped into overarching 'positive' (healthy, helpful, or desired), 'negative' (unhealthy, unhelpful, or undesired), and 'other' (no obvious positive or negative connotation) experiences (see Tables 6.2-6.3). MO conducted the initial coding, ACH checked a subset for consistency, and all authors agreed on the final coding.

The categorised data were then examined to explore response frequencies and their relation to patients' (a) procedures, (b) time since surgery, and (c) post-surgical outcomes. Data were analysed using SPSS 23.0 with significance at .05. Percentage of excess BMI lost (%EBMIL) was calculated by [(pre-operative BMI - current BMI) / (pre-operative BMI - 25)] x 100. Pre- to post-surgery changes in mental and physical health were calculated by taking pre-surgical from post-surgical ratings, with positive numbers indicating improvement. With initial data exploration suggesting changes at 12 and 18+ months, patients were categorised as 2-11.9 months (n = 76; 37.4%), 12-17.9 months (n = 29; 14.3%), or 18+ months (n = 98; 48.3%) post-surgery for analyses of time since surgery. Fisher's exact test assessed relationships between eating-related expectations and experiences and categorical variables, with adjusted standardised residuals examined to identify cells making significant contributions (z = +/-1.96) in significant results (Sharpe, 2015). One-way analysis of variance (Welch's ANOVA where homogeneity of variance was violated) with Šídák method for multiple comparisons was conducted with continuous variables.

6.3.4 Response rate

Of the 408 individuals who consented, 386 were eligible. Of those, 180 were excluded due to the participant having a high proportion of missing data (n = 144), multiple current bariatric procedures (n = 6), or being < 8 weeks post-surgery (n = 30). Those with multiple procedures were excluded due to the heterogeneity of their procedure combinations, and early post-surgery participants were excluded because they were unlikely to have returned to a 'normal' diet since surgery. Potential explanations for the high amount of missing data include the questionnaire length and lack of completion incentive. Data from 206 (53.4%) participants were analysed.

6.4 Results

6.4.1 Participants

Participants were mostly female (94.0%), employed or self-employed full-time (50.3%), married or in a defacto relationship (72.4%), with household income of A$104,000+ per year (39.0%). Ages ranged from 21.8 to 72.4 years. The majority (60.2%) had undergone VSG, and time since surgery ranged from 2.1 to 221.2 months. Most used private health insurance to pay for their surgery (73.3%). Patients with AGB had undergone surgery significantly earlier, and reported significantly poorer excess BMI loss, weight loss, and post-surgical satisfaction than those with RYGB and VSG (Table 6.1).

6.4.2 Pre-surgical expectations of post-surgical eating-related changes

Table 6.2 displays the complete list of patients' pre-surgical expectations of how their eating would change after surgery. Most common was that surgery would help the patient eat less and feel increased satiety (47.0%), followed by expectations of reduced hunger (30.4%), and improved or cured problematic/disordered eating behaviours (30.4%).

Table 6.1. Participant characteristics.

	All participants N = 206	RYGB n = 35 (17.0%)	AGB n = 47 (22.8%)	VSG n = 124 (60.2%)	*p*-value
Months since surgery (M, SD)	31.0 (37.5)	22.8 (36.5)	69.6 (51.0)#	17.8 (15.9)	< .0005*
Previous bariatric surgery (n, %)	33 (16.0%)	16 (45.7%)~	0 (0%)^	20 (13.7%)	< .0005*
Gender (n, %)					
Female	187 (94.0%)	33 (94.3%)	43 (91.5%)	111 (94.9%)	.717
Male	11 (5.5%)	2 (5.7%)	4 (8.5%)	5 (4.3%)	
Other	1 (0.5%)	0 (0%)	0 (0%)	1 (0.9%)	
Age (M, SD)	45.9 (10.0)	47.0 (9.8)	45.7 (10.9)	45.7 (9.7)	.776
Weight (M, SD)					
BMI before surgery	45.9 (7.9)	46.5 (9.0)	45.4 (8.0)	45.9 (7.6)	.818
% excess BMI loss	68.1 (28.0)	77.6 (24.6)	53.1 (29.5)#	71.3 (26.2)	< .0005*
Weight loss (kg)	37.8 (20.0)	44.6 (22.0)	29.3 (23.4)#	39.2 (16.8)	.001*
Mental health (M, SD)					
Before surgery	2.2 (1.1)	2.2 (1.1)	1.9 (0.9)	2.2 (1.2)	.234
Change (current – before)	1.0 (1.1)	1.0 (1.5)	0.9 (1.2)	1.1 (1.1)	.553
Physical health (M, SD)					
Before surgery	1.8 (0.9)	1.8 (0.8)	1.8 (0.7)	1.9 (0.9)	.877
Change (current – before)	1.6 (1.1)	1.9 (1.0)	1.2 (1.3)+	1.6 (1.0)	.012*
Post-surgical satisfaction (M, SD)	3.8 (0.8)	4.0 (0.7)	3.3 (1.1)#	4.0 (0.7)	< .001*

AGB, adjustable gastric banding; BMI, body mass index; M, mean; RYGB, Roux-en-Y gastric banding; SD, standard deviation; VSG, vertical sleeve gastrectomy

* $p < .05$. # AGB vs. VSG and RYGB. + AGB vs. RYGB. ~ over-represented in sample. ^ under-represented in sample.

Table 6.2. Patients' pre-surgical hopes and expectations for how their eating behaviours would change after bariatric surgery (N = 168 coded responses; n = 7 no response; n = 31 irrelevant/not codeable).

Category	*Overall*	*Category description and sample quote*
Eat less and feel increased satiety	*79 (47.0%)*	Longer-lasting satisfaction and fullness after eating a much smaller amount of food than before surgery *"I wanted to be able to eat less and feel satisfied instead of constantly feeling hungry or that I could always eat"*
Reduced hunger	*51 (30.4%)*	Reduction in physical hunger, including decreased/eliminated hunger-related symptoms such as pain and nausea *"I was hoping to reduce the hunger to the point of nausea I was feeling between meals, even if my meal was huge"*
Improved or cured problematic/disordered eating behaviours	*51 (30.4%)*	Improved or eliminated problematic/disordered eating behaviours including emotional eating, night eating, bingeing, grazing, boredom eating, 'head hunger', and mindless eating *"I expected to have a 'round the clock' solution to prevent grazing, emotional eating"*
Surgery would provide assistance and/or punishment to help change eating behaviours	*25 (14.9%)*	Assistance or punishment such as physical restriction on the amount of food able to be eaten, new signals indicating when they had eaten enough, a wish to experience pain or discomfort on overeating, helpful changes to food preferences, and a wish for unpleasant somatic reactions (e.g. dumping, regurgitation) on eating unhealthy foods *"I chose the RNY because I wanted to have repercussions if I chose to eat the wrong foods. For me, I knew I needed to retrain my brain with what I should be eating vs. what I could be eating"*
Changes to what, when, and how individual would eat	*25 (14.9%)*	Helpful and healthy changes to eating habits including eating more slowly, eating less unhealthy and more healthy food, not snacking, and eating smaller meals more frequently *"Choosing healthier meals and foods"*
Decreased problematic food thoughts, focus, and cravings	*20 (11.9%)*	Decreased problematic food-related thoughts including reduced cravings for unhealthy foods, reduced 'constant thoughts' of eating, and no longer being 'controlled' by food *"I was hoping to be rid of the constant thought of food, and what I was eating next"*
Some aspects of eating to remain unchanged	*7 (4.2%)*	Some aspects of eating not to change, such as having no restriction on the types of foods they could eat, being able to eat healthy foods, still eating three meals per day, enjoying food, and still being able to emotionally eat and eat unhealthy foods *"But I knew I would still be able to emotional eat which would be a challenge (slider foods like chocolates and chips)"*
Surgery would be a miracle fix	*7 (4.2%)*	Hopes that surgery would simply 'fix' things, including 'bad eating', 'bad habits', and 'everything', without personal effort *"I probably didn't focus enough […] the fact that it was a tool and not the answer to everything"*

6.4.3 How patients' eating behaviours actually changed after surgery

Positive experiences were common, with 84.9% reporting at least one positive eating-related experience after surgery. Most common were eating less (57.3%) and making better, balanced choices about what, when, and how to eat (41.2%). Negative experiences were reported by 43.7% of participants, with the most frequent being continued or new problematic/disordered eating behaviours (17.1%) and positive post-surgical changes having not been sustained (15.1%; Table 6.3). Overall, 55.4% of patients reported only positive post-surgical eating-related experiences, 13.3% reported only negative experiences, and 31.3% reported both positive and negative experiences.

Table 6.3. Patients' actual experiences of changes to their eating behaviours after bariatric surgery (N = 199 coded responses; n = 6 no response; n = 1 irrelevant/not codeable).

Category	*Overall*	*Category description and sample quote*
'Positive' (healthy, helpful, desired) experiences		
Eating less	*114 (57.3%)*	Eating less overall, smaller portions, and reduced amounts of 'bad' foods *"Even when I'm having a bad day it's still nowhere near as bad as the amount I would eat before the band"*
Making 'better', balanced choices about what, when, and how to eat	*82 (41.2%)*	Improved eating patterns, including eating fewer carbohydrate-heavy foods, less processed sugar and fat, and more protein, eating only when hungry, eating slowly, trying new foods, learning to eat smaller meals, and pre-preparing and planning food *"I now eat largely organic foods. I eat full fat but low sugar. I now rarely eat red meat but fish, chicken and a lot of legumes and veg. I drink a lot less alcohol. I am a lot more informed about what I eat and eat a wide range of food but small portions. I don't count calories or worry if I eat something unhealthy occasionally. I rarely get takeaway because it's a waste of food and money. […] I eat quality not quantity"*
Experiencing weight loss-promoting intolerances or somatic reactions or food preference changes	*45 (22.6%)*	'Helpful' intolerances, somatic reactions, and food preference changes such as no longer enjoying or tolerating the taste of sweet foods, experiencing pain on overeating, enjoying healthy foods, feeling early. obvious, sustained satiety *"I am conscious of feeling satisfied and at that point, although the struggle is still real, I am able to discard excess food on my plate"*
Improved or cured problematic/disordered eating behaviours	*36 (18.1%)*	Improvements or cured problematic/disordered eating behaviours such as binge eating, grazing, snacking, 'head hunger', non-hungry eating, night eating, and emotional eating *"Definitely stopped bingeing because I can't. I have found other ways of coping. Crochet! Stopped emotional eating because I feel that I am not so emotional"*
Reduced hunger	*31 (15.6%)*	Reduced physical hunger, including not feeling hungry, not feeling hungry all the time, and rarely experiencing hunger pangs *"I forget about food if I get busy – I don't have a constant, gnawing hunger whether I've already eaten or not"*
Being more knowledgeable, mindful, and conscious of their own eating	*24 (12.1%)*	Increased knowledge, mindfulness, and being more conscious of their own eating behaviours, including greater understanding and taking more notice of the nutritional value of food, and eating more mindfully *"I am now more mindful and aware of what goes in my mouth"*
Reduced unhelpful/unwanted	*11*	Reduced problematic cravings, including no longer craving junk food or sweet foods, and reduced sugar cravings

food cravings	*(5.5%)*	*"I don't feel attracted to the same junk foods I was pre-surgery"*
Feeling more in control of their eating behaviours	*11 (5.5%)*	Feeling more in control of their eating, including being able to eat a small amount of something rather than the whole thing, being able to discard excess food once satisfied, and eating because of hunger 'rather than sport' *"I hoped this procedure would help me regain control where I previously had none and it has done that"*
Reduced unhelpful food thoughts/focus/obsession	*10 (5.0%)*	Reduced unhelpful food thoughts such as being rid of thoughts related to food, life no longer revolving around food, and not feeling guilt about eating 'treat foods' *"I still think about food all the time but because I physically can't eat the amounts that I did before, I don't let it dictate. It is actually secondary to the things I am doing with my life"*
'Negative' (unhealthy, unhelpful, unwanted) experiences		
Continued or new problematic/disordered eating behaviours	*34 (17.1%)*	Problematic and disordered eating behaviours, such as grazing, obsession with eating, boredom eating, bingeing, emotional and night time eating, and difficulty distinguishing head hunger and physical hunger, that continued or began after surgery *"I am an emotional eater. I hoped it would stop that or curve [sic] the habit but I have realised I probably need counselling to explain why I do it and learn techniques to not get to that point"*
Positive post-surgical changes not sustained	*30 (15.1%)*	Positive early post-surgical changes were not sustained, with patients now experiencing increased hunger, decreased restriction, an ability to eat increasingly-large portions, reduced helpful intolerances and dumping symptoms, and the return of problematic eating behaviours such as compulsive eating, grazing, emotional eating, and night eating *"The first 6months post-op I made all the right food choices and didn't want any of the foods I ate prior to surgery. It was like one morning I woke up and a switch was flicked and I started craving the crappy foods I ate previously like chocolate biscuits chips and deep fried foods. It is a mental struggle every day to try to stick to protein and veg three meals a day and low carb every day is so much harder almost 12 months since surgery. The constant worry of getting fat again enters my mind with every bite. I honestly didn't know the mental battle would be as hard as it is every day. I wish I had known that there would come a time after surgery where your mind would try to take you back to your old habits"*
Little or no reduction in hunger	*20 (10.1%)*	Still experiencing problematic hunger, including getting hungry soon after a meal, getting hungry more often since surgery, and no reduction in hunger *"Hunger never went away"*
Not experiencing hoped-for intolerances, somatic reactions, or food preference changes	*20 (10.1%)*	Not experiencing hoped-for or expected intolerances, somatic reactions, or changes in preferences including still able to eat high fat and sugar foods without issue, not having the wished-for level of restriction, and still enjoying sweets and junk food *"I do not really have the restriction that I thought I would have"*
Unhelpful/unwanted intolerances, somatic	*14*	Unhelpful and/or unwanted intolerances, reactions, or preference changes such as finding unhealthy 'slider' foods (e.g.

reactions, or food preference changes	*(7.0%)*	chocolate, sauces) easiest to eat, not being able to eat healthy foods without pain, and being unable to eat solid foods *"I can eat very unhealthy 'slider foods' like chocolate, ice cream, milkshakes, etc., but when I eat things like a salad it all gets stuck in the band, causes lots of pain and frothy burps and sometimes even comes back up. I refer to my band as a 'medically induced form of bulimia'"*
Continued or new unhelpful eating behaviours	*13 (6.5%)*	New or continued unhelpful eating behaviours such as eating too quickly, not chewing thoroughly, eating excessive amounts of unhealthy foods or carbohydrates, and eating too-large portions when dining out *"I tend not to have a lot of self-control and I buy rubbish a lot"*
New or continued unhelpful/unwanted food cravings	*11 (5.5%)*	Continued or new problem food cravings including junk food, salt, and chocolate cravings and a continued 'sweet tooth' *"I had hoped I would not be as attracted to chocolate like I am – and I seem to crave more sugar than ever before"*
Continued or increased food thoughts/focus/obsession	*5 (2.5%)*	Increased or continued unhelpful food thoughts including life revolving around food more now, no reduced interest in food and eating, counting calories 'religiously', and continued food 'obsession' *"I am still obsessed with food because I am still overweight"*
'Other' experiences		
Experiencing other intolerances, somatic reactions, or food preference changes	*17 (8.5%)*	Intolerances, somatic reactions, and preference changes not described by patients as being either positive/helpful or negative/unwanted, such as now preferring savoury over sweet foods, not being able to eat pasta, and finding meat 'too heavy' *"I can eat more crunchy foods rather than dense foods, e.g. bread. I struggle with milk now and find drinking water extremely difficult"*
Unchanged eating ability, preferences, or behaviours	*16 (8.0%)*	No changes to the individual's eating ability, food and drink preferences, and behaviours, including unchanged tolerances, eating behaviours, and food choices, still eating whatever they wished, and still being able to eat processed and junk foods *"I wish I could say they have changed drastically but they haven't"*

6.4.4 Differences by procedure

Just one procedure-based difference was seen in patients' pre-surgical eating-related expectations: fewer in the RYGB group reported anticipating reduced hunger (3.8%, AGB: 38.5%, VSG: 34.0%; Fisher's exact = 12.39, p = .002). While there were no procedure-based variations in 'positive' post-surgical experiences, differences were seen in 'negative' experiences. Unhelpful and unwanted food intolerances, somatic reactions, or food preference changes were reported by 19.6%, 4.2%, and 0% in the AGB, VSG, and RYGB groups respectively (Fisher's exact = 12.08, p = .001), and little to no reduction in hunger was reported by 14.2% of those with VSG, 6.5% with AGB, and 0% with RYGB (Fisher's exact = 6.76, p = .030). Patients who had undergone RYGB were more likely (15.2%) to report continued or new unhelpful eating behaviours as compared to those with VSG (3.3%) and AGB (8.7%; Fisher's exact = 6.22, p = .028). In 'other' experiences, unchanged eating ability, preferences, or behaviours were more often reported by the VSG group (11.7%) than the AGB (0%) and RYGB groups (6.1%; Fisher's exact = 6.89, p = .024). There were no overall differences in total numbers of positive (F[2, 196] = 1.26, p = .287), negative (F[2, 196] = 0.46, p = .633), or other experiences (F[2, 84.7] = 1.12, p = .329) by procedure.

6.4.5 Differences by time since surgery

At 12-17.9 months, 17.2% reported reduced unhelpful food thoughts, focus, or obsession, compared to 2.7% at 2-11.9 months and 3.2% at 18+ months (Fisher's exact = 7.61, p = .018). Reduced problematic food cravings were reported less often by patients 18+ months post-surgery (0%) and more often at 12-17.9 months post-surgery (13.8%; 2-11.9 months: 8.2%; Fisher's exact = 12.29, p = .001). At 2-11.9, 12-17.9, and 18+ months post-surgery, 6.8%, 17.2%, and 21.3% respectively reported that the positive changes they had experienced after surgery had not been sustained (Fisher's exact = 7.05, p = .029). There was an increase in the total number of negative eating-related experiences reported at 18+ months post-surgery (M = 0.9, SD = 1.1) versus 2-11.9 months (M = 0.5,

SD = 0.8; F[2, 73.5] = 4.20, p = .019). No differences were seen in positive (F[2, 193] = 1.24, p = .292) or other (F[2, 193] = 0.01, p = .988) experiences by time.

6.4.6 Relationships with post-surgical outcomes

A number of positive eating-related experiences were related to improved outcomes, and negative experiences associated with poorer outcomes (Table 6.4). For example, reduced unhelpful food-related thoughts, focus, or obsession was related to significantly greater improvement in mental health, while continued or increased food thoughts, focus, or obsession was associated with significantly lower %EBMIL. The only pre-surgical expectation related to any outcome was that surgery would be a miracle cure was associated with lower post-surgical satisfaction (F[1, 165] = 3.97, p = .048).

Reporting any (one or more) negative eating-related experience was related to poorer post-surgical satisfaction (F[1, 164.1] = 20.75, p < .0005), physical health change (F[1, 191] = 4.12, p = .044), and mental health change (F[1, 191] = 6.85, p = .010), but not %EBMIL. Any positive experience was associated with improved satisfaction (F[1, 33.6] = 9.61, p = .004) and mental health change (F[1, 191] = 7.11, p = .008), but not to physical health or %EBMIL.

Table 6.4. Associations between patient post-surgical eating-related experiences and outcomes.

Category	*Percent excess BMI lost*				*Mental health improvement*				*Physical health improvement*				*Overall satisfaction*			
	Experienced M *(SD)*	*Not experienced* M *(SD)*	F	p-*value*	*Experienced* M *(SD)*	*Not experienced* M *(SD)*	F	p-*value*	*Experienced* M *(SD)*	*Not experienced* M *(SD)*	F	p-*value*	*Experienced* M *(SD)*	*Not experienced* M *(SD)*	F	p-*value*
'Positive' experiences																
Eating less	*68.6 (26.7)*	*68.5 (30.3)*	*0.02*	*.965*	*1.1 (1.1)*	*0.9 (1.2)*	*1.14*	*.287*	*1.7 (1.0)*	*1.5 (1.2)*	*0.81*	*.370*	*3.9 (0.8)*	*3.7 (0.9)*	*5.41*	*.021*[a]
Making 'better', balanced choices about what, when, and how to eat	*72.7 (27.9)*	*65.6 (28.3)*	*2.95*	*.088*	*1.2 (1.0)*	*0.9 (1.2)*	*2.57*	*.110*	*1.9 (1.0)*	*1.4 (1.2)*	*7.69*	*.006*[b]	*4.0 (0.7)*	*3.7 (0.9)*	*7.29*	*.008*[c, 1]
Experiencing weight loss-promoting intolerances or somatic reactions or food preference changes	*72.0 (27.7)*	*67.6 (28.4)*	*0.78*	*.379*	*0.9 (1.1)*	*1.1 (1.2)*	*1.37*	*.243*	*1.9 (1.2)*	*1.5 (1.1)*	*2.73*	*.100*	*4.0 (0.7)*	*3.8 (0.9)*	*2.28*	*.133*
Improved or cured problematic/disordered eating behaviours	*69.4 (33.8)*	*68.4 (27.0)*	*0.03*	*.862*	*1.3 (1.2)*	*1.0 (1.1)*	*2.41*	*.122*	*1.8 (1.0)*	*1.6 (1.1)*	*0.93*	*.335*	*3.9 (0.9)*	*3.8 (0.8)*	*0.19*	*.664*
Reduced hunger	*69.2 (30.3)*	*68.4 (28.0)*	*0.02*	*.900*	*1.0 (0.9)*	*1.1 (1.2)*	*0.23*	*.634*	*1.6 (0.9)*	*1.6 (1.2)*	*0.02*	*.890*	*3.9 (0.7)*	*3.8 (0.9)*	*0.63*	*.430*
Being more knowledgeable, mindful, and conscious of their own eating	*83.2 (29.3)*	*66.4 (27.6)*	*7.68*	*.006*[2]	*1.2 (1.2)*	*1.0 (1.1)*	*0.32*	*.571*	*1.6 (1.0)*	*1.6 (1.1)*	*0.08*	*.930*	*4.3 (0.7)*	*3.8 (0.8)*	*9.15*	*.005*[3]

Reduced unhelpful/unwanted food cravings	*60.5 (26.6)*	*69.1 (28.4)*	*0.96*	*.329*	*1.5 (1.1)*	*1.0 (1.2)*	*1.50*	*.222*	*1.6 (1.0)*	*1.6 (1.1)*	*0.01*	*.927*	*4.3 (0.5)*	*3.8 (0.9)*	*4.39*	*.037**
Feeling more in control of their eating behaviours	*68.1 (36.7)*	*68.6 (27.8)*	*0.02*	*.965*	*0.9 (1.5)*	*1.1 (1.1)*	*0.15*	*.696*	*1.6 (1.0)*	*1.6 (1.1)*	*0.08*	*.927*	*4.2 (0.6)*	*3.8 (0.9)*	*1.96*	*.163*
Reduced unhelpful food thoughts/focus/obsession#	*80.9 (28.4)*	*67.9 (28.2)*	*2.02*	*.157*	*1.9 (1.2)*	*1.0 (1.1)*	*5.99*	*.015*[4]	*1.6 (0.7)*	*1.1 (1.1)*	*0.00*	*.986*	*4.2 (0.4)*	*3.8 (0.9)*	*2.15*	*.144*
'*Negative' experiences*																
Continued or new problematic/disordered eating behaviours	*70.1 (27.7)*	*68.2 (28.5)*	*0.11*	*.738*	*1.0 (1.2)*	*1.1 (1.2)*	*0.15*	*.696*	*1.5 (1.0)*	*1.6 (1.1)*	*0.47*	*.495*	*3.5 (0.7)*	*3.9 (0.8)*	*6.84*	*.010*[5]
Positive early post-surgical changes have not been sustained	*61.3 (29.8)*	*69.8 (27.9)*	*2.15*	*.144*	*0.4 (0.9)*	*1.2 (1.2)*	*10.60*	*.001*[d, 6]	*1.3 (1.1)*	*1.7 (1.1)*	*3.01*	*.084*	*3.2 (1.0)*	*3.9 (0.8)*	*35.14*	*.001*[e,7]
Little or no reduction in hunger	*57.4 (21.3)*	*69.7 (28.7)*	*3.12*	*.079*	*0.6 (1.0)*	*1.1 (1.2)*	*2.68*	*.103*	*1.3 (1.2)*	*1.6 (1.1)*	*1.43*	*.234*	*3.6 (0.8)*	*3.8 (0.8)*	*2.01*	*.157*
Not experiencing hoped-for intolerances, somatic reactions, or food preference changes	*61.2 (28.2)*	*69.4 (28.2)*	*1.45*	*.230*	*0.5 (1.0)*	*1.1 (1.2)*	*5.02*	*.026**	*1.1 (0.9)*	*1.7 (1.1)*	*4.66*	*.032*[8]	*3.2 (0.9)*	*3.9 (0.8)*	*14.23*	*< .0005*[f,9]
Unhelpful/unwanted intolerances, somatic reactions, or food preference changes	*48.0 (33.8)*	*70.2 (27.2)*	*8.28*	*.004*[g]	*0.5 (1.3)*	*1.1 (1.1)*	*3.36*	*.068*	*0.8 (1.6)*	*1.7 (1.1)*	*4.25*	*.058*	*3.3 (1.2)*	*3.9 (0.8)*	*6.20*	*.014**
Continued or new unhelpful eating behaviours	*77.1 (36.2)*	*68.0 (27.7)*	*1.16*	*.283*	*0.3 (1.5)*	*1.1 (1.1)*	*5.78*	*.017*[h]	*1.3 (1.1)*	*1.6 (1.1)*	*0.99*	*.320*	*3.5 (1.0)*	*3.8 (0.8)*	*1.55*	*.214*

Continued or new unhelpful/unwanted food cravings	*72.0 (28.5)*	*68.3 (28.3)*	*0.17*	*.679*	*1.1 (1.0)*	*1.0 (1.2)*	*0.02*	*.884*	*1.7 (1.0)*	*1.6 (1.1)*	*0.14*	*.713*	*3.9 (0.6)*	*3.8 (0.9)*	*0.06*	*.812*
Continued or increased food thoughts/focus/obsession#	*53.0 (5.5)*	*68.9 (28.5)*	*7.51*	*.002*[10]	*1.3 (1.5)*	*1.0 (1.2)*	*0.13*	*.716*	*1.3 (1.3)*	*1.6 (1.2)*	*0.41*	*.521*	*3.2 (0.7)*	*3.8 (0.8)*	*2.50*	*.116*
'Other' experiences																
Other intolerances, somatic reactions, or food preference changes	*68.4 (28.5)*	*69.8 (26.8)*	*0.14*	*.708*	*0.9 (1.0)*	*1.1 (1.2)*	*0.14*	*.708*	*1.3 (0.9)*	*1.6 (1.1)*	*1.78*	*.184*	*3.8 (0.8)*	*3.8 (0.8)*	*0.01*	*.906*
Unchanged eating ability, preferences, or behaviours	*74.3 (30.1)*	*68.1 (28.1)*	*0.68*	*.410*	*0.7 (1.3)*	*1.1 (1.1)*	*1.65*	*.201*	*1.6 (1.0)*	*1.6 (1.1)*	*0.01*	*.944*	*4.1 (0.8)*	*3.8 (0.8)*	*1.32*	*.252*

BMI, body mass index; M, mean; SD, standard deviation

* $p < .05$ in total sample. # not calculated for RYGB subgroup due to $n \leq 1$ reporting experience.

[a] significant at 18+ months post-surgery, F[1, 91]=8.92, p=.004; [b] significant at 2-11.9 months post-surgery, F[1, 68] = 9.73, p = .003; [c] significant at 18+ months post-surgery, F[1, 91] = 5.22, p = .025; [d] significant at 18+ months post-surgery, F[1, 90] = 7.63, p = .007; [e] significant at 12-17.9 months, F[1, 27] = 9.22, p = .005, and 18+ months post-surgery, F[1, 91] = 8.26, p = .005; [f] significant at 18+ months post-surgery, F[1, 91] = 8.24, p = .005; [g] significant at 18+ months post-surgery, F[1, 87] = 6.07, p = .016; [h] significant at 18+ months post-surgery, F[1, 90] = 4.45, p = .038

[1] significant in AGB subgroup, F[1, 44] = 7.06, p = .011; [2] significant in VSG subgroup, F[1, 26.35] = 6.65, p = .005; [3] significant in VSG subgroup, F[1, 42.08] = 19.33, p < .0005; [4] significant in AGB subgroup, F[1, 44] = 4.10, p = .049; [5] significant in VSG subgroup, F[1, 117] = 5.54, p = .020; [6] significant in AGB subgroup, F[1, 44] = 8.95, p = .005; [7] significant in AGB, F[1, 44] = 6.45, p = .015, and VSG subgroups, F[1, 21.95] = 8.44, p = .008; [8] significant in RYGB subgroup, F[1, 31] = 8.40, p = .007; [9] significant in RYGB, F[1, 31] = 20.39, p < .0005, and VSG subgroups, F[1, 117] = 9.80, p = .002; [10] significant in VSG subgroup, F[1, 14.03] = 56.85, p < .0005

6.4.7 Relationships with post-surgical outcomes by procedure

Again, a number of the relationships between eating-related experiences and outcomes in the overall cohort were significant only for particular procedures. For example, reduced unhelpful food thoughts, focus, and obsession were associated with more positive mental health improvement only in AGB, and not experiencing hoped-for intolerances, somatic reactions, or food preference changes were related to poorer overall satisfaction after RYGB and VSG only. The majority of the significant relationships were seen in the AGB and VSG groups. Notations [1-10] in Table 6.4 report all significant relationships.

Reporting any (one or more) positive eating-related experience was associated with greater %EBMIL ($F[1, 43] = 4.21$, $p = .046$), better physical health improvement ($F[1, 44] = 4.68$, $p = .036$), and higher satisfaction ($F[1, 44] = 9.19$, $p = .004$) in patients with AGB, and with better mental health improvement ($F[1, 112] = 6.91$, $p = .010$) in those with VSG, but was not associated with outcomes in RYGB. Reports of any negative eating-related experiences were again not associated with outcomes in RYGB, but were related to poorer mental health improvement ($F[1, 112] = 4.05$, $p = .046$) and lower satisfaction ($F[1, 90.29] = 12.72$, $p = .001$) after VSG, and poorer mental health ($F[1, 44] = 5.73$, $p = .021$) and physical health ($F[1, 44] = 6.09$, $p = .018$) change and lower satisfaction ($F[1, 44] = 6.93$, $p = .012$) in the AGB group.

6.4.8 Relationships with post-surgical outcomes by time since surgery

Relationships between eating-related experiences and outcomes by time since surgery can be seen in notations [a-h] to Table 6.4. Almost all significant associations, including between unhelpful and unwanted intolerances, somatic reactions, or food preference changes and lower %EBMIL, were found at 18+ months post-surgery only. Exceptions were seen in relationships between making better, balanced choices about what, when, and how to eat and both better physical health improvement (2-11.9 months only) and overall satisfaction (12-17.9 months).

Reporting any positive eating-related experience was related to better mental health improvement at 2-11.9 months ($F[1, 68] = 9.58$, $p = .003$), was not associated with any outcomes at 12-17.9 months, and was related to greater satisfaction at 18+ months post-surgery ($F[1, 26.73] = 8.69$, $p = .007$). Similarly, reports of one or more negative eating-related experience at 2-11.9 months post-surgery was associated with poorer satisfaction ($F[1, 71] = 11.63$, $p = .001$), at 12-17.9 months was not related to any outcomes, and at 18+ months was related to poorer mental health change ($F[1, 90] = 8.38$, $p = .005$) and lower satisfaction ($F[1, 91] = 7.59$, $p = .007$).

6.5 Discussion

Though positive eating-related experiences were most common, a large minority (43.2%) of participants reported negative eating-related experiences after surgery. Similar proportions reported that their problematic or disordered eating behaviours had improved or resolved (17.1%) and noted that these issues had persisted or emerged (18.1%) post-surgery. Our findings strengthen previous reports (Benson-Davies et al., 2013; Conceição et al., 2013a; Dodsworth et al., 2010; Hsu et al., 1997; Opozda et al., 2016; Rusch & Andris, 2007; White et al., 2010) that positive eating-related change does not always occur, or last, after bariatric surgery.

While there has been little previous study of patients' self-identified eating behaviour patterns, specific problematic and disordered eating behaviours have been associated with poorer post-surgical outcomes (Conceição et al., 2013a). In this study, both positive and negative post-surgical eating-related experiences were related to outcomes, with patient reports of any (one or more) negative eating-related experience associated with poorer post-surgical satisfaction and physical and mental health change, and any positive eating-related experience related to better satisfaction and mental health change. There is a clear need to monitor and assist patients to develop and maintain healthy, helpful eating behaviours after bariatric surgery.

While total numbers of positive and negative post-surgical eating-related experiences reported did not vary in this study, as per earlier assertions by Herpertz et al. (2003) that "exclusively restrictive surgery procedures such as gastric banding or [vertical banded] gastroplasty have a different impact on eating behaviour compared with bypass procedures such as gastric bypass or biliopancreatic diversion", procedure-based differences were seen in several specific experiences. It was unsurprising that patients who had undergone AGB were more likely to report unhelpful or unwanted food intolerances, somatic reactions, and food preference changes, given previous research demonstrating worse intolerances after AGB than RYGB and VSG (Freeman, Overs, Zarshenas, Walton, & Jorgensen, 2014; Overs et al., 2012). Less easy to interpret, and requiring investigation, were the findings that VSG group participants were more likely to report experiencing little or no reduction in hunger, and those with RYGB were more likely to report continued or new unhelpful eating behaviours such as eating too quickly, too much, or eating excessive amounts of unhealthy foods. Better understanding post-surgical eating-related differences may inform patients' choice of procedure and assist patients and clinicians to anticipate negative eating-related experiences associated with each type of surgery.

Patient reports of any (one or more) positive eating-related experience were related to more positive outcomes, while negative experiences were associated with poorer outcomes, in AGB and VSG. Links between eating-related experiences and outcomes were not seen in RYGB. It may be that the physiological effects of the particular procedure mean that weight loss after RYGB is largely independent of eating behaviour change. However, Miras and le Roux (2013) note that "gastric bypass works by reducing hunger, increasing satiation, changing food preferences, and increasing diet-induced energy expenditure", implying a significant role of eating and hunger-related behaviour change in outcomes. Eating-related factors besides those reported in this study may also have significant effects on outcomes after RYGB. Further study is needed.

While patients' post-surgical eating-related experiences differed by procedure, their pre-surgical eating-related expectations rarely did, suggesting frequent mismatches between expectation and

experience. However, the extent to which inaccurate or unrealistic pre-surgical eating-related expectations may impact on post-bariatric outcomes is unknown. While patients often hold unrealistic pre-surgical expectations of weight loss after bariatric surgery (Fischer et al., 2014), it is unclear whether those expectations have positive, negative, or no effect on outcomes (Gelinas, Delparte, Hart, & Wright, 2013). In this study, just one pre-surgical expectation, that surgery would be a miracle fix, was associated with poorer outcomes (lower post-surgical satisfaction).

The findings of this study also support assertions that one to two years post-surgery is a significant time period for the occurrence or reoccurrence of eating-related difficulties (Engstrom & Forsberg, 2011; Geraci, Brunt, & Marihart, 2014; Hsu et al., 1997). Patients most often reported that initial positive post-surgical changes had not been sustained at 18+ months, and negative eating-related experiences as a whole were reported significantly more often at 18+ months than 2-11.9 months. While improvement in unhelpful food-related thoughts, focus, and obsessions and problematic food cravings was most commonly reported at 12-17.9 months, reports decreased dramatically at 18+ months post-surgery. These findings further accentuate the need for continued care and monitoring of patients' eating behaviours over the longer-term post-surgery, especially as relationships between positive eating-related experiences and improved outcomes, and negative experiences and poorer outcomes, were almost exclusively seen only ≥ 18 months post-surgery.

A potential limitation of this study was the use of retrospective patient responses, which may be influenced by characteristics including treatment expectations, current health difficulties and functioning, experiences that have occurred since pre-surgery, and a patient's beliefs about the effects of their surgery (Lingard, Wright, Sledge, & Kinemax Outcomes Group, 2001; Mancuso & Charlson, 1995). To control for any systematic recall bias, we examined whether pre-surgical expectations differed by the length of time since patients had undergone their bariatric procedure, and found no significant difference. The differing average time since surgery in the AGB group, while consistent with the popularity of AGB at around the time these participants underwent surgery (82.5% of all initial bariatric procedures in the Asia-Pacific region in 2008; Buchwald & Oien, 2009), is a further

potential limitation. Given their high average income and that most self-funded or used private health insurance to pay for their surgery, results may not be generalisable beyond this cohort. Our procedure distribution (VSG 60.2%, AGB 22.8%, RYGB 17.0%) differed from the total surgeries carried out in Australia between July 2013 and June 2016. (VSG 71.7%, AGB 19.4%, RYGB 8.8%; $\chi^2(2) = 20.35$, $p < 0.00005$; Australian Government Department of Human Services, 2017).

This research makes new contributions to the literature regarding bariatric patients' eating-related expectations and experiences. Post-surgical positive eating-related experiences were reported by over eighty percent of patients, but over forty percent also reported negative eating-related experiences. Patients' post-surgical eating-related experiences varied according to the procedure they had undergone, though their pre-surgical expectations of how their eating would change after surgery did not also vary. Negative eating-related experiences were more frequently reported at 18+ months than < 1 year post-surgery. Patients' post-surgical eating-related experiences, and relationships between those experiences and outcomes, varied by time since surgery and differed by procedure. Associations between reporting any (one or more) negative eating-related experience and worse outcomes, and between any positive experience and better outcomes, were found after AGB and VSG, but not RYGB. Reporting any positive or negative eating-related experiences was related to better and poorer outcomes almost exclusively from ≥ 18 months post-surgery. These findings emphasise the importance of continued patient eating-related monitoring and care in the longer-term following bariatric surgery. Additional research comparing the eating-related expectations and experiences of patients who have undergone different bariatric procedures is also needed to assist patients' decision-making and prepare patients and clinicians for potential eating-related difficulties related to the selected procedure.

Chapter 7. Conclusion

Numerous researchers have highlighted the negative implications of disordered eating behaviours and eating disorders for outcomes, and particularly weight loss, after bariatric surgery (Chevallier et al., 2007; Conceição et al., 2015; Conceição et al., 2013a; Franks & Kaiser, 2008; Rusch, Andris, & Wallace, 2009; Sarwer et al., 2004; Sarwer et al., 2011; Sarwer et al., 2005; Sarwer et al., 2008; Sheets et al., 2015; Toussi, Fujioka, & Coleman, 2009). In spite of this, knowledge about disordered eating behaviours in bariatric populations has been lacking, largely because "although a growing literature has investigated this topic, this has occurred in a very heterogeneous group of patients following a variety of weight loss surgery procedures" (Engel et al., 2012, p. 91). Given this significant limitation within the literature, this thesis aimed to investigate individuals with either a current RYGB, AGB, or VSG, at short- to long-term post-surgery. This thesis explored these individuals' expectations and experiences of eating-related change, their disordered eating behaviours, hunger, and appetite, before and after surgery, and their reasons for undergoing their particular bariatric procedure.

Two reviews and an original research study were conducted, resulting in four papers that examined the following key research questions:

1. How prevalent are eating disorders and disordered eating behaviours in pre-bariatric patients?
2. How does bariatric surgery affect eating disorders and disordered eating behaviours from pre- to post-surgery and over time after surgery?
3. Do pre- to post-surgical changes in eating disorders and disordered eating behaviours vary by bariatric procedure?
4. Why do patients undergo one particular bariatric procedure rather than another?
5. What are patients' pre-surgical expectations and post-surgical experiences of eating behaviour change after bariatric surgery?
6. Do patients' eating-related expectations and experiences vary by bariatric procedure?

Paper 1 reviewed the literature on presurgical candidates' eating-related behaviours, disorders, and expectations. The literature indicated that 4-45% of candidates have BED, 20-60% graze, 2-42% have NES, 38-59% emotionally eat, and 17-54% fit criteria for food addiction. A number of studies suggested that BED may be more common in bariatric candidates than in similarly obese nonsurgical populations. Bariatric candidates commonly believe they have lost control over their eating behaviours and ability to reduce their weight, and feel they cannot regain this without the external assistance of surgery. Handing control to a surgeon to change how their body works is viewed as a way to win the struggle against food and weight. Candidates frequently believe surgery will virtually guarantee significantly improved eating behaviours.

Paper 2 was a systematic review of the literature on pre- to postsurgical changes in eating disorders and disordered eating behaviours in patients who had undergone RYGB, AGB, or VSG. Short- to medium-term reductions in BED and related behaviours were commonly noted after RYGB, while reported changes after AGB were inconsistent. Short- to medium-term reductions in emotional eating and short to long-term reductions in bulimic symptoms were reported after RYGB. Reoccurrences and new occurrences of problem and disordered eating, especially BED and binge episodes, were apparent after RYGB and AGB.

In Paper 3, content analysis and quantitative analyses were used to examine patients' reasons for undergoing their particular bariatric procedure and against undergoing others. RYGB was most often chosen because of its *evidence base, success rate, and long-term effectiveness*, a *medical practitioner's recommendation, preference, or choice* was the most common reason for undergoing VSG, and AGB was most often selected because of *characteristics of the procedure* including reversibility and a perception of AGB as less invasive than other procedures. A desire to avoid *postsurgical complications and risks* such as suture line leaks or malabsorption was the most commonly cited reason against both RYGB and VSG, while *information and evidence* from other people's unsuccessful experiences and failure rates was most common against AGB.

Content analysis and quantitative analyses were again used in Paper 4, which investigated patients' presurgical expectations and postsurgical experiences of eating-related behaviour change after bariatric surgery. The most common presurgical expectations were *eating less* and *feeling increased satiety* (47.0%), *reduced hunger* (30.4%), and *improved or cured problematic/disordered eating behaviours* (30.4%). After surgery, patients more often reported 'positive' (84.9%) than 'negative' eating-related experiences (43.7%), with 55.4% reporting only positive experiences, 13.3% reporting only negative experiences, and 31.3% reporting both positive and negative experiences. Disordered eating behaviours *persisted or emerged* in 17.1% and *improved or resolved* in 18.1%. Negative eating-related experiences were more frequently reported at ≥ 18 months than < 1 year. Reporting any negative eating-related experience was related to poorer outcomes, and reporting any positive eating-related experience was related to better outcomes, after VSG and AGB, but not RYGB. Links between negative eating-related experiences and poorer outcomes, and positive experiences and better outcomes, were significant almost exclusively from ≥ 18 months postsurgery.

7.2 Implications

7.2.1 For pre-surgical patient education, assessment, and care

Historically, pre-operative psychological assessments were carried out with the aim of identifying suitable and unsuitable surgical candidates for bariatric surgery. However, given the dearth of clear contraindications for surgery, the focus of these assessments has more recently largely moved towards identifying challenges and risk factors that may impact patients' post-surgical outcomes (Ratcliffe et al., 2014; Sogg & Mori, 2009; Walfish, Vance, & Fabricatore, 2007). Psychological assessments are not standardised and vary by practice and practitioner. The findings of this research emphasise the importance of assessing patients for a range of disordered eating behaviours, including binge eating, bulimic symptoms, emotional eating, grazing, and night eating. Given the significant proportion of candidates experiencing disordered eating behaviours and common pre-surgical beliefs that surgery will always result in long-term, positive changes to eating behaviours, there is a need for eating-

related assessment and education to be incorporated into pre-surgical assessments, consultations, and patient education sessions carried out prior to surgery.

It is important that before deciding whether or not to undergo surgery, patients understand that eating disorders, disordered eating behaviours, and excessive hunger and appetite are not always cured or even improved by bariatric surgery, and that these difficulties may continue, worsen, or even begin de novo after these procedures. Further, initial remissions or improvements may not continue long-term, and bariatric surgery is unlikely to provide a life-long cure for problematic eating issues. While surgery will not necessarily be postponed or contraindicated by the presence of any of these issues, patients are likely to benefit from education and learning strategies to manage these behaviours both before and after surgery (Adami et al., 1995; Ashton et al., 2009; Ashton et al., 2011).

Patients with disordered eating behaviours pre-surgery are at greater risk for their continuation or redevelopment after surgery (Mitchell et al., 2014). However, pre-operative patients with disordered eating behaviours may be less likely to access treatment programs than those experiencing the same issues post-operatively (Leahey et al., 2009). While pre-surgical eating-related assistance may lead to positive outcomes, the most beneficial means of providing services and encouraging attendance have not been established. Further, given that eating-related difficulties may either continue or begin after surgery, the benefits of targeting education and treatment strategies towards all pre-surgical candidates, versus only those with identified pre-surgical eating-related difficulties, is unknown.

7.2.2 For post-surgical patient education, assessment, and care

The results of this research support the implementation of regular eating-related assessment and the availability of appropriate support and assistance from immediately following to more than two years after bariatric surgery. As well as assessing symptoms it is important to speak to patients to gauge their perceptions of their eating-related experiences, which were most frequently linked to positive and negative outcomes from 18 months post-surgery. Though differences between subjective reports

of eating-related experiences and objective reports of eating-related symptoms have not yet been compared, each is likely to be valuable for understanding both distress related to negative eating-related symptoms and experiences, and the impact of eating behaviours on post-surgical outcomes.

Post-operative disordered eating behaviours such as binge eating, uncontrolled eating, and grazing, have been shown to have significant negative effects on weight loss at one year or more after bariatric surgery (Sheets et al., 2015). Many problematic eating behaviours are also related to significant distress, and patients who pre-surgically believe their eating behaviours will be 'fixed' by surgery may be likely to perceive the continuation or reappearance of these behaviours as being their own fault. In contrast, problematic eating disorders after surgery, and especially from one to two years post-surgery, appear to be a relatively frequent occurrence that is unlikely to be caused by any individual wrongdoing. In contrast, patients' qualitative accounts in the current study and others (Ogden et al., 2011; Zijlstra et al., 2009) depict their fears and frequent struggles against returning to unhelpful eating behaviours after surgery.

Based on these findings, there is a need to offer ongoing eating-related assessment and care throughout the post-surgical period. Particular focus should be on screening for disordered eating behaviours, understanding patients' own perceptions of their eating behaviours, supporting and encouraging patients, providing education, and conducting interventions to address unhelpful eating-related behaviours and encourage more positive ones (Sheets et al., 2015).

7.2.3 For the role of mental health practitioners in bariatric care

In the United States, bariatric guidelines (Blackburn et al., 2009) state that mental health resources should be available beyond six months post-surgery, while those from the United Kingdom state that surgery should only be undertaken by a multidisciplinary team that can provide psychological support both before and after surgery (National Institute for Health and Care Excellence, 2014). However, psychological services in bariatric settings are not always available or accessed. One investigation

into the United Kingdom National Health System reported that only 32% of psychologists assessed all of their new patients, though 91% carried out pre-surgical individual interventions for those with difficulties (most often eating-related), and 41% provided pre-surgical groups for patients. None routinely offered post-surgical assessment, but 68% did so on referral, with the onus on other members of the bariatric team to identify and refer patients. Overall, 64% of psychologists believed they needed to provide both pre- and post-surgical care to patients (Ratcliffe et al., 2014). An American survey found that the 41.1% of bariatric patients who had attended group counselling with a psychologist within the first year after surgery had greater weight loss (Peacock & Zizzi, 2012). Finally, a French study found that only 30% of psychologists and psychiatrists in French publicly-funded specialised obesity centres, which are required to provide patients with psychological support, saw all patients before and after bariatric surgery. Care was not systematically offered to post-surgical patients (Lamore et al., 2017). In the sample for this research (N = 236), only 25.4% of respondents had seen a mental health professional and just 4.2% had attended an in-person bariatric support group since surgery.

Conceição et al. (2013a) note that poor outcomes due to patients not developing or maintaining healthy and helpful post-surgical eating behaviours has become "one of the biggest concerns to professionals who work in this area" (p. 275). With substantial rates of disordered eating behaviours and negative eating-related experiences, it is noteworthy that meta-analyses have shown that patients attending post-surgical psychotherapeutic interventions and support groups have greater weight loss than those who do not (Beck, Johannsen, Støving, Mehlsen, & Zachariae, 2012). Given psychologists' specific skills in evaluating behavioural, emotional, and psychosocial variables (Bean, Stewart, & Olbrisch, 2008), and significant rates of post-surgical eating-related difficulties in patients, Ratcliffe et al. (2014) argue that "it should be routine for all post-operative bariatric patients to have psychology follow-up as this would enable early detection of emerging difficulties and rapid intervention" (p. 5). The findings of the current research emphasise the importance of mental health practitioners for patient education and care both before and after bariatric surgery. Post-surgical follow-up should begin early after surgery and continue at regular intervals to well beyond two years post-surgery. With

evidence of higher incidences and consequences related to problematic eating behaviours and negative eating-related experiences at 1-2 years post-surgery, it may be beneficial to pay particular attention to patients at this time period after surgery.

7.2.4 For choice of bariatric procedure

The findings of this research have implications for both referrals to bariatric surgeons and interactions between bariatric surgeons and patients. The influence of medical practitioners' recommendations on patient decisions to undergo VSG, and to a lesser extent, RYGB, was significant in this study. Within Australia, patients are generally referred to see a bariatric surgeon by their general practitioner (GP). However, patients need to be aware that the surgeon to whom they are referred may perform only particular bariatric procedures. Given that GPs may not have specialised bariatric knowledge, their referral of a patient to a particular surgeon may not be based on whether procedures performed by that surgeon are most appropriate for the individual. Patients may also request referral to a particular surgeon or to a surgeon performing a particular bariatric procedure based on the findings of their own research or on their knowledge of other people's success or failure with a particular procedure. Patients' preconceived beliefs about procedures may be incorrect, based on conjecture or inaccuracies, or irrelevant to their own situation. Our findings suggest that patients may also hold unrealistic expectations about the effects of a procedure or their own role in successful outcomes.

Bariatric surgeons should be aware that patients may hold unhelpful, inaccurate, and faulty beliefs about particular procedures, and ensure that patients are objectively educated on the known and potential benefits and risks of each procedure. Where the patient has a choice of procedure, the most suitable bariatric procedure should be recommended based on the individual's circumstances, including their medical concerns and conditions and weight-related goals. While patients may still make decisions about which procedure to undergo based on their own research, beliefs, and desires, it is important that surgeons ensure they have provided accurate, unbiased, and individualised information and recommendations. Where the patient's circumstances and goals do not align with the

procedures performed by the referring surgeon, it is imperative that the surgeon convey this information to the patient and their GP to allow the individual to make an informed decision about their treatment options.

7.3 Research strengths, limitations, and challenges

While various strengths, limitations, and challenges related to the research studies are noted in the papers (Chapters 3-6), a number of significant issues are discussed in further detail below.

7.3.1 Length of follow-up

The duration of follow-up was a limitation in Chapter 4, which systematically reviewed the literature on changes in disordered eating behaviours from pre- to post-surgery, and Chapter 6, which examined patients' eating-related pre-surgical eating-related expectations and post-surgical experiences. Given our findings that one to two years post-surgery is a significant time period for eating-related changes and impacts after bariatric procedures, data collection that concludes at just one or two years after surgery will often report only a short chapter of a longer, more complex story (Meany et al., 2014; Sarwer et al., 2011). The American Society for Bariatric Surgery recommends that ideal follow-up after bariatric surgery be for five years or longer, and discourages reporting weight loss with less than two years of follow up (American Society for Bariatric Surgery Standards Committee, 1997). This seems an appropriate recommendation in relation to the study of eating-related behaviours and experiences. Unfortunately, a weakness of the second study was that only 3 of the 23 reviewed papers on changes in disordered eating reported any assessment beyond two years post-surgery. In the presented paper on eating-related expectations and experiences, patients with VSG had undergone surgery an average of 17.8 months (SD = 15.9) earlier, those with RYGB were an average of 22.8 months (SD = 36.5) post-surgery, and those in the AGB group were an average of 69.6 months (SD = 51.0) post-surgery. While the differing average length of time since surgery in these groups is not

ideal, the findings of this study nonetheless will play a valuable role in expanding the limited literature on eating-related experiences beyond the first year post-surgery.

7.3.2 Use of an online questionnaire

The third study (results in Chapters 5-6) utilised an online questionnaire. Online questionnaires have been shown to lead to lower rates of social desirability bias, more truthful self-reports, higher levels of self-disclosure, and fewer non-responses regarding questions on sensitive or personal topics than in the use of paper-based surveys (Booth-Kewley et al., 2007; Kays et al., 2012; Kiesler & Sproull, 1986). This was relevant as individuals may feel shame and reluctance to disclose disordered eating behaviours.

However, online studies also involve a significant potential for self-selection bias, as they rely on individuals to select themselves to participate. Participants are those who learn about the study, have access to the internet, take the time to visit the study website, and decide to participate. The researcher has little control, beyond choosing where and how to promote the study and implementing inclusion and exclusion criteria (Bethlehem, 2010). Further, issues related to all members of the potential population not having an equal chance of being sampled (Dillman, Smyth, & Christian, 2008) are often exacerbated online due to disparities in internet access and use across varying ethnic, socioeconomic, and age groups (Holloway, 2002).

To avoid participant frustration and non-completion related to poor question wording, confusing questionnaire design, and potential technical issues (Couper, Traugott, & Lamias, 2001; Lumsden, 2007), the study website and questionnaire were pilot-tested by eight individuals from varying educational and demographic backgrounds. Based on their feedback, improvements were made prior to recruitment. No participation incentive was offered. Where possible the shortest and simplest questionnaires were used. However, at an average of around 40 minutes to complete, the length, complexity, and lack of incentive are likely to have impacted participation and completion rates.

7.3.3 Use of retrospectively-collected data

This research collected retrospective data on patients' reasons for undergoing their particular bariatric procedure (Chapter 5) and eating-related expectations (Chapter 6). Expectations about socially-acceptable behaviours may influence recall, particularly over long periods of time, and even if patients are attempting to truthfully report their own behaviours, their recall may not necessarily be accurate (Smyth et al., 2001). Patient recall may be also influenced by characteristics including gender, treatment expectations, current health difficulties and functioning, as well as by experiences that have occurred since pre-surgery and the patient's beliefs about the effects of their surgery (Lingard et al., 2001; Mancuso & Charlson, 1995; Smyth et al., 2001). In a study by Lingard et al. (2001), patients whose functioning had deteriorated at three months after knee arthroplasty and those with poorer mental health recalled having worse pre-surgical functioning. Time since treatment has been shown to have little effect on the accuracy of agreement between prospectively-gathered and recalled information in some studies (Pellisé et al., 2005), though a review of dietary intake studies by Friedenreich, Slimani, and Riboli (1992) showed that recall accuracy appeared to decrease over time between reports.

However, while data based on participant recall may be subject to problematic biases, retrospectively-collected data can provide valuable information as long as the potential limitations of the data, the collection methods, and the study design bias are considered (Pellisé et al., 2005).

7.3.4 Sample representativeness

Attempts were made to check the representativeness of the third study sample against those from reports utilising more diverse or established data collection methods (Pedersen & Kurz, 2016). The Paper 3 study population (N = 236) was compared against the most recent and comprehensive available data on bariatric surgeries within Australia:

- The Australian Bariatric Surgery Registry (ABSR) report (2016), populated with data provided by 94 Australian bariatric surgeons (N = 10570 patients), which presents data both for July to December 2015, and from 2012 onwards. Capture rates for the most recent collection period were 36% of VSG, 62% of AGB, and 47% of RYGB within Australia.
- An earlier Australian Institute of Health and Welfare (AIHW) report (2010) on weight loss surgeries carried out in Australia in July 2007 - June 2008. This report contains data on admissions to almost all hospitals, sourced from the National Hospital Morbidity Database.
- Information from the Medicare Item Reports database (Australian Government Department of Human Services, 2017), a publicly-available anonymised repository of data on medical services provided in Australia under the Medicare Benefits Schedule (medical service fees set by the Australian Government). We examined data on RYGB, AGB, and VSG surgeries carried out in the three years prior to our data collection (June 2013 to July 2016).

Significant differences were noted between the current study and existing report samples. The current study procedure distribution (VSG: 62.3%, AGB: 22.0%, RYGB: 15.7%) differed from the overall ABSR sample (VSG: 50.8%, AGB: 39.6%, RYGB: 9.7%; $\chi^2(2) = 32.62$, $p < .0001$) and three-year Medicare data (VSG 71.7%, AGB 19.4%, RYGB 9.8%; $\chi^2(2) = 16.09$, $p < .0001$), but not from the most recent ABSR data collection, July to December 2015 (VSG: 67.9%, AGB: 20.1%, RYGB: 12.0%; $\chi^2(2) = 3.91$, $p = .141$). Our participants' gender distribution (female: 93.9%, male: 5.7%, other: 0.4%) varied from the overall ABSR sample (female: 78.9%, male: 21.1%, other: 0.03%; $\chi^2(2) = 44.78$, $p < .0001$) and AIHW sample (female: 78.2%, male: 21.8%; $\chi^2(1) = 33.33$, $p < .0001$). Participants' average age (45.5 years, SD = 10.1) did not differ from the overall ABSR sample (average: 44.3 years; SD not reported; $t(225) = 1.79$, $p = .075$). Participants reported a higher pre-surgical BMI (45.5, SD = 8.0) than the ABSR average start (44.1, SD = 8.2; $t(226) = 2.64$, $p = .009$) and day of surgery BMIs (43.1, SD = 7.8; $t(226) = 4.52$, $p < .0001$). Gender, age, and BMI data were not available from Medicare.

It is unclear whether the differences between the thesis study sample and those reported by Medicare and the AIHW and ABSR indicate that the study sample was not representative of the larger population of Australian bariatric patients. The AIHW report describes data that is now ten years old, and it is unclear as to whether the 10570 patients reported on by the ABSR are themselves representative of the bariatric population within Australia. While Medicare provides a complete record of procedures, it does not allow access to patient demographic or health data. There is no recent, complete report of Australian bariatric patients against which to check the study sample's representativeness.

7.3.5 Participant recruitment

The primary recruitment method for the original research study (results in Chapters 5-6) was via messages posted by (or on behalf of) the researcher in 13 Australian Facebook bariatric patient groups, which ranged in size from less than 50 to more than 7000 members. Participants themselves spontaneously promoted the study in several further groups, and several members 'tagged' friends in the promotional posts to draw their attention to the study. Responses to the posts varied from little to no response in some groups, to multiple 'likes' and comments from individuals noting that they had completed the study, asking questions about the research, commenting on the content, and reporting their impressions of participating, on others. Similar messages posted by the researcher in three website forums for Australian bariatric patients (or in sections for Australian patients) generated little interest. Two months after the initial posts, the researcher again posted in each group to put out a 'final call' for participants.

Use of online social networking in clinical research is cost-effective, efficient, and successful in engaging a diverse range of individuals to participate (Ryan, 2013). This may be particularly true in relation to Facebook. Over two-thirds of the almost 80% of Australians who access the internet daily use social networking sites at least once per week, and of those social network users, 93% use Facebook (Sensis, 2015). With approximately 62.5% of the total Australian population having a

Facebook account (Cowling, 2016), this represents rich grounds for attempting to recruit research participants, especially those who may be otherwise difficult to find. Fenner et al. (2012) discussed how Facebook users with specific health-related conditions connect with each other through groups and pages, and emphasised that these online meeting places should be considered when planning recruitment strategies for potentially hard-to-find populations. However, with no available data on the proportion or characteristics of Australian bariatric patients active in Facebook bariatric patient groups, it is difficult to estimate the representativeness of this population.

As such, recruitment via Facebook is best used in combination with other recruitment strategies (Pedersen & Kurz, 2016). Six Australian private practice bariatric clinicians (four surgeons, one GP, one dietitian) from different clinics (four in South Australia, two in New South Wales), each of whom was either known to the researcher, her supervisors, or recruited through a contact, also promoted the study. They assisted in differing ways, including handing study flyers to post-surgical patients attending appointments, keeping flyers and hanging promotional posters in their clinic reception area, promoting the study on their clinic Facebook page and blog, and by promoting the study directly to a bariatric patient support group, and to a dietitians' bariatric surgery special interest group. Other means of promoting the study included a media release from the University of Adelaide (Appendix C) and subsequent media interest (Appendix D), and Tweets promoting the study by one of the researcher's supervisors (GW).

Based on immediate spikes in participation following implementation, the most effective recruitment strategy was the Facebook posts. The media release, inclusion in the University of Adelaide staff newsletter, and Twitter and bariatric website forum posts all seemed to generate little interest. Additional planned recruitment methods, involving clinicians at an Adelaide public hospital bariatric clinic handing flyers to attending post-surgical patients, and sending a promotional email to hospital and health staff, were eventually abandoned due to barriers related to hospital ethics procedures.

7.4 Future research

A number of avenues for further research have been mentioned in the individual research papers. This is a developing area of enquiry and as such, significant further research is needed into patients' disordered eating behaviours and eating disorders before and after bariatric surgery. Past research into these areas have often suffered from methodological issues including use of retrospective reporting of pre-surgical behaviours, lack of consistently defined eating-related variables, and the use of unvalidated and non-replicable assessment methods. Hypothesis-driven, prospective studies of pre-surgical and post-surgical eating-related difficulties to rectify these problems are needed. In particular, further investigation is needed into differences in the motivations, characteristics, and eating-related behaviours of bariatric candidates versus other similarly obese individuals, and into understanding pre-surgical candidates' beliefs about the longevity of any eating-related changes they expect to occur after surgery. Knowledge about the most appropriate timing and methods for providing eating-related education and interventions will be key for reducing distress and improving post-surgical outcomes in those who experience objective or subjective eating-related difficulties after bariatric surgery. Discerning those individuals to target – all patients, only those with pre-surgical eating-related problems, or only those who develop or continue these after surgery – will be similarly vital.

There is a scarcity of high-quality literature on pre- to post-surgical changes in eating disorders and disordered eating after RYGB, AGB, and VSG. Attention should be prioritised toward long-term longitudinal studies investigating when disordered eating behaviours occur, reoccur, or begin after these surgeries and to compare changes in eating behaviours by procedure. However, longitudinal studies in bariatric surgery can be challenging to conduct for a variety of reasons, and procedures change and evolve over time. Studies might also use methodologies including leveraging electronic health records and big data, creating decision support tools, matching patients to treatments in an evidence-based personalised approach, and collaborating with patients and other stakeholders in a participatory approach. Research is also needed into the sources of information and evidence considered by patients in their choice of bariatric procedure and their accuracy and relevance to those

individuals, as well as whether patients feel they have a choice in determining which procedure they undergo. Information is needed on why surgeons make recommendations for and against different procedures. Finally, the match between the patient's expectations of their procedure and their actual experience, and the influence of this on their outcomes, requires investigation.

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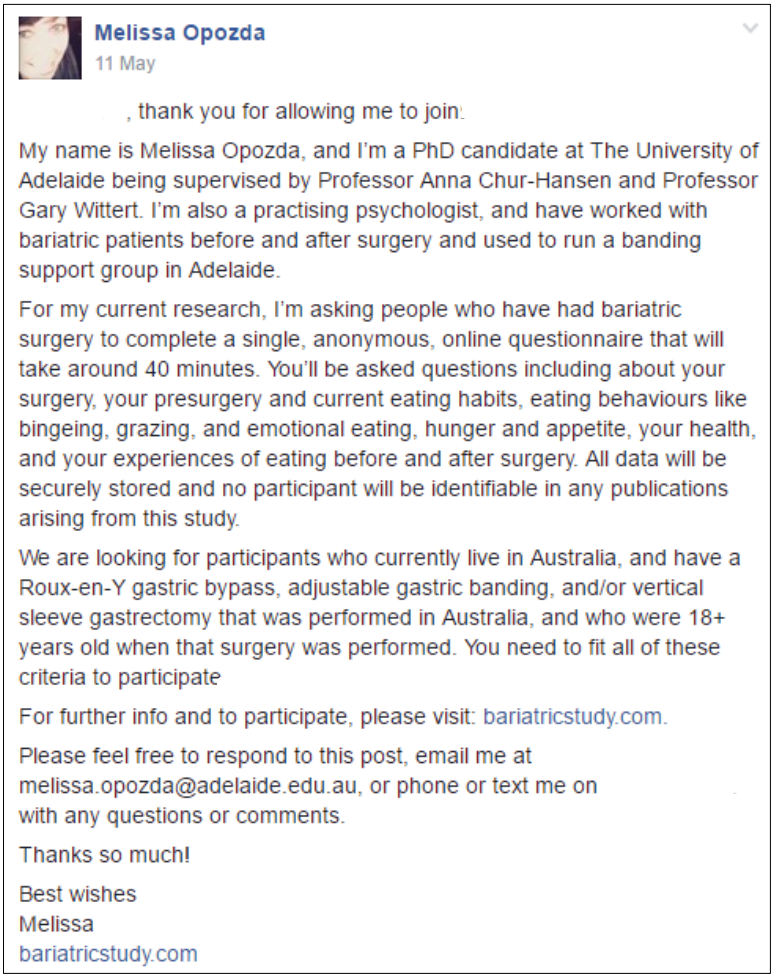
Appendices

Appendix A: Promotion to Facebook groups



Melissa Opozda
11 May

, thank you for allowing me to join.

My name is Melissa Opozda, and I'm a PhD candidate at The University of Adelaide being supervised by Professor Anna Chur-Hansen and Professor Gary Wittert. I'm also a practising psychologist, and have worked with bariatric patients before and after surgery and used to run a banding support group in Adelaide.

For my current research, I'm asking people who have had bariatric surgery to complete a single, anonymous, online questionnaire that will take around 40 minutes. You'll be asked questions including about your surgery, your presurgery and current eating habits, eating behaviours like bingeing, grazing, and emotional eating, hunger and appetite, your health, and your experiences of eating before and after surgery. All data will be securely stored and no participant will be identifiable in any publications arising from this study.

We are looking for participants who currently live in Australia, and have a Roux-en-Y gastric bypass, adjustable gastric banding, and/or vertical sleeve gastrectomy that was performed in Australia, and who were 18+ years old when that surgery was performed. You need to fit all of these criteria to participate

For further info and to participate, please visit: bariatricstudy.com.

Please feel free to respond to this post, email me at melissa.opozda@adelaide.edu.au, or phone or text me on with any questions or comments.

Thanks so much!

Best wishes
Melissa
bariatricstudy.com

Appendix B: Promotional flyer and poster

BARIATRIC EATING EXPERIENCES STUDY 2016

Do you live in Australia and currently have a sleeve, lap-band, or Roux-en-Y gastric bypass that was performed in Australia when you were 18+ years old?

If you do, please complete a 30-40 minute online survey to help University of Adelaide researchers understand changes in eating behaviours after bariatric surgery!

THE UNIVERSITY of ADELAIDE

For further information and to participate, please visit:

BariatricStudy.com

Please contact Melissa Opozda at melissa.opozda@adelaide.edu.au or [redacted] with any questions or comments about this study. All responses will be kept strictly confidential. Approved by the Psychology Human Research Ethics Subcommittee, University of Adelaide.

BARIATRIC EATING EXPERIENCES STUDY 2016

Do you live in Australia and currently have a SLEEVE, LAP-BAND, or ROUX-EN-Y GASTRIC BYPASS that was performed in Australia when you were 18+ years old?

If you do, please help University of Adelaide researchers understand changes in eating behaviours after bariatric surgery!

ONLINE SURVEY

THE UNIVERSITY of ADELAIDE

- ⇒ 30-40 minutes to complete
- ⇒ All responses are anonymous and will be kept strictly confidential
- ⇒ Approved by the Psychology Human Research Ethics Subcommittee, University of Adelaide
- ⇒ Please contact melissa.opozda@adelaide.edu.au or [redacted] with any questions or comments

For further information and to participate, please visit:

BariatricStudy.com

Please tear off a reminder for later (or to give to someone else who might be able to participate!)

Thank you so much for helping with our research!

Bariatric eating study bariatricstudy.com

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Appendix C: Media release

Media Release

www.adelaide.edu.au/news

THE UNIVERSITY of ADELAIDE

Thursday 16 June 2016

Does weight loss surgery help with problem eating habits?

More Australians are turning to surgery to help treat obesity – but once their surgery is over, what impact does it have on patients' eating habits in the long term?

The complex answers to that question are being uncovered by new research from the University of Adelaide. Researchers in the University's Faculty of Health Sciences have just published the findings of a review into weight-loss surgery and changes in eating habits, and are now seeking participants for a new study.

As part of her research, PhD student Melissa Opozda conducted a review of 23 previous studies from 1990-2015. Her findings – published this week in the journal *Obesity Reviews* – have revealed that some types of surgery can have short to medium-term success in changing people's eating habits. The review also found many gaps in the knowledge, highlighting the need for further studies.

Currently 28% of Australians (4.9 million) are obese. Many are turning to bariatric (weight loss) surgery, which is considered to be the most effective available long-term intervention for weight and related health issues.

"Before surgery, people commonly report long-term problem eating patterns, including binge eating disorder, grazing, night eating, and emotional eating. They hope that surgery will lead not only to weight loss but also to better eating habits," Ms Opozda says.

"Despite the large number of surgical procedures being performed each year to treat obesity, there is just not enough research to date to clearly understand the effects of these surgeries on how people eat," she says.

There are three main types of bariatric surgery carried out in Australia: Roux-en-Y gastric bypass, adjustable gastric banding (also known as "lap banding") and vertical sleeve gastrectomy.

"As these surgeries involve very different changes to the body and have different weight and health outcomes, we wanted to look at the evidence on whether they might also have different effects on the problem eating behaviours that we know are common before weight-loss surgery," says one of Ms Opozda's supervisors, Professor Gary Wittert from the University of Adelaide's School of Medicine.

"The review found short and medium-term reductions in binge eating, short to medium-term reductions in emotional eating, and potential short to long-term reductions in bulimic symptoms after gastric bypass. However, there was little research on sleeve gastrectomy, and few consistent findings about gastric banding," Professor Wittert says.

Professor Anna Chur-Hansen from the School of Psychology, another of Ms Opozda's supervisors, says: "The existing research suggests that for some patients, binge eating behaviours may reoccur and even occur for the first time after both gastric bypass and gastric banding. This is a worrying finding that needs further investigation."

People aged 18 and older who have undertaken one of the major forms of weight loss surgery in Australia are invited to take part in the new *Bariatric Eating Experiences Study*, in the form of an online questionnaire.

For further information and to participate in the study, visit: http://bariatricstudy.com

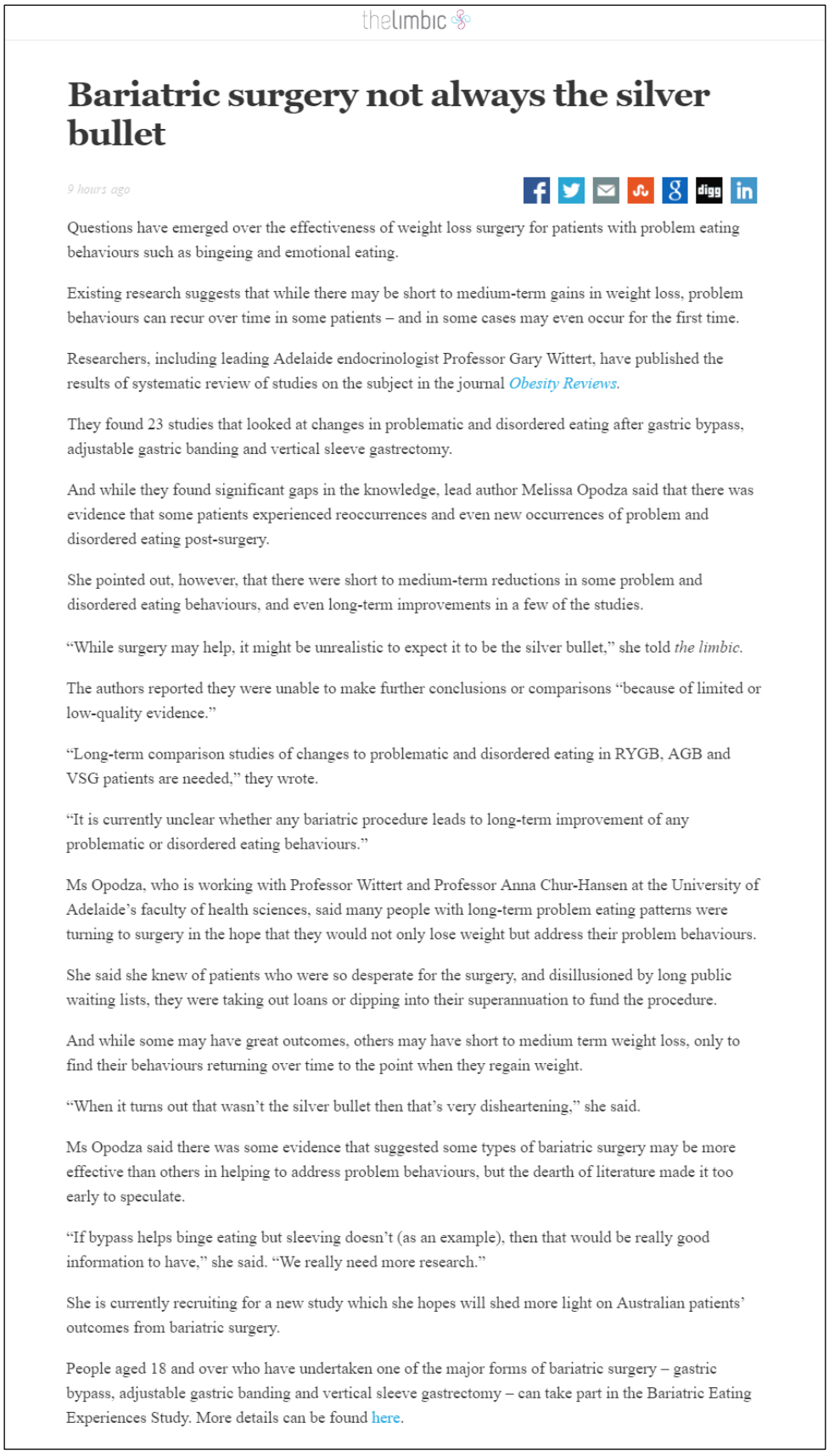
Media Contact:

Professor Gary Wittert, Head, Discipline of Medicine; and Director, Freemasons Foundation Centre for Men's Health, The University of Adelaide, Mobile. , gary.wittert@adelaide.edu.au

David Ellis, Media and Communications Officer, The University of Adelaide , david.ellis@adelaide.edu.au

CRICOS Provider Number 00123M

Appendix D: Selected media coverage



thelimbic

Bariatric surgery not always the silver bullet

9 hours ago

Questions have emerged over the effectiveness of weight loss surgery for patients with problem eating behaviours such as bingeing and emotional eating.

Existing research suggests that while there may be short to medium-term gains in weight loss, problem behaviours can recur over time in some patients – and in some cases may even occur for the first time.

Researchers, including leading Adelaide endocrinologist Professor Gary Wittert, have published the results of systematic review of studies on the subject in the journal *Obesity Reviews*.

They found 23 studies that looked at changes in problematic and disordered eating after gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy.

And while they found significant gaps in the knowledge, lead author Melissa Opodza said that there was evidence that some patients experienced reoccurrences and even new occurrences of problem and disordered eating post-surgery.

She pointed out, however, that there were short to medium-term reductions in some problem and disordered eating behaviours, and even long-term improvements in a few of the studies.

"While surgery may help, it might be unrealistic to expect it to be the silver bullet," she told *the limbic*.

The authors reported they were unable to make further conclusions or comparisons "because of limited or low-quality evidence."

"Long-term comparison studies of changes to problematic and disordered eating in RYGB, AGB and VSG patients are needed," they wrote.

"It is currently unclear whether any bariatric procedure leads to long-term improvement of any problematic or disordered eating behaviours."

Ms Opodza, who is working with Professor Wittert and Professor Anna Chur-Hansen at the University of Adelaide's faculty of health sciences, said many people with long-term problem eating patterns were turning to surgery in the hope that they would not only lose weight but address their problem behaviours.

She said she knew of patients who were so desperate for the surgery, and disillusioned by long public waiting lists, they were taking out loans or dipping into their superannuation to fund the procedure.

And while some may have great outcomes, others may have short to medium term weight loss, only to find their behaviours returning over time to the point when they regain weight.

"When it turns out that wasn't the silver bullet then that's very disheartening," she said.

Ms Opodza said there was some evidence that suggested some types of bariatric surgery may be more effective than others in helping to address problem behaviours, but the dearth of literature made it too early to speculate.

"If bypass helps binge eating but sleeving doesn't (as an example), then that would be really good information to have," she said. "We really need more research."

She is currently recruiting for a new study which she hopes will shed more light on Australian patients' outcomes from bariatric surgery.

People aged 18 and over who have undertaken one of the major forms of bariatric surgery – gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy – can take part in the Bariatric Eating Experiences Study. More details can be found here.

Eating habits and surgery

More data needed on how surgery helps eating habits

- The review found many gaps in the knowledge, highlighting the need for further studies

Tuesday, June 21, 2016 - 11:27
Owen Haskins - Editor in chief, Bariatric News

Research from the Faculty of Health Sciences, University of Adelaide, Australia, has revealed that some types of bariatric surgery can have short to medium-term success in changing people's eating habits. The review also found many gaps in the knowledge, highlighting the need for further studies.

Currently 28% of Australians (4.9 million) are obese. Many are turning to bariatric surgery, which is considered to be the most effective available long-term intervention for weight and related health issues. As part of her research, PhD student Melissa Opozda conducted a review of 23 previous studies from 1990-2015. The findings, 'Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy: a systematic review of pre-post studies', are published in the journal Obesity Reviews.

"Before surgery, people commonly report long-term problem eating patterns, including binge eating disorder, grazing, night eating, and emotional eating. They hope that surgery will lead not only to weight loss but also to better eating habits," said Opozda. "Despite the large number of surgical procedures being

Related stories

Study calls for increase in publicly-funded surgery

Australian government told to fund bariatric surgery

In focus: Obesity in Australia

Bypass patients can teach us how to lose weight

Should metabolically normal obese

Appendix E: Patient information sheet

THE UNIVERSITY of ADELAIDE

BARIATRIC EATING EXPERIENCES STUDY
PARTICIPANT INFORMATION SHEET

Although bariatric (weight loss) surgery is the most effective long-term treatment for severe obesity, changed eating behaviours are critical for success. However, there is little evidence about how various eating behaviours change after bariatric surgery, and whether changes differ according to the particular bariatric surgery a person undergoes. Patients' experiences of eating after surgery are also not well understood. This project aims to look at these issues. It is hoped that this information will help to improve knowledge of eating issues that may occur or reoccur after surgery and assist pre and postsurgical patient services. This is a voluntary research project, and you do not have to be involved.

WHO CAN PARTICIPATE? HOW DO I PARTICIPATE?

This is a study of the eating-related behaviours and experiences of Australian adults who have undergone one of three common bariatric surgeries: Roux-en-Y gastric bypass (aka 'bypass'), adjustable gastric banding (aka 'banding' or 'lap banding'), or vertical sleeve gastrectomy (aka 'sleeve'). We are hoping to recruit bariatric surgery patients from all over Australia to this study. Participation involves filling in a single online questionnaire that will take around 30-40 minutes to complete. You will be asked about your surgery, your eating behaviours (including patterns such as emotional eating and bingeing) and health before surgery and now, and your experiences of eating since surgery.

To participate in this study, please visit:

bariatricstudy.com

If you fit the following criteria, you are eligible to participate:

1) You currently live in Australia, and
2) You have a bypass, band, or sleeve that was performed in Australia, and
3) You were an adult (18+ years) when that surgery was performed.

WHO IS ORGANISING THIS STUDY?

This study is being conducted by researchers from The University of Adelaide, and has been approved by the Human Research Ethics Subcommittee, School of Psychology. Melissa Opozda is a Health Psychologist and PhD candidate with a long interest in bariatric patient care. This study forms part of her PhD. She is being supervised by Prof. Anna-Chur Hansen, Head of the School of Psychology, and Prof. Gary Wittert, Head of the Discipline of Medicine.

CONFIDENTIALITY

Your personal contact details will not be collected for this study. Questionnaires will be securely and confidentially stored. Information obtained in this study will not be disclosed to your bariatric clinic or any other person or organisation. No participant will be identifiable in any publication arising from this study.

RISKS, BENEFITS, & WITHDRAWING FROM THE STUDY

Participants will not be paid for their involvement in this study. While there may be no direct benefit to you from taking part in this study, we hope that the information provided by participants will be useful in increasing knowledge about eating-related issues after bariatric surgery and help to improve patient services. While there are no foreseeable risks or discomforts involved in participating in this project, you will be given a list of organisations which may be able to assist with further eating-related information and assistance. You may withdraw your participation by contacting the University research team at any time. Your bariatric clinic will not be informed. This research will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research, 2007.

PROJECT CONTACTS

For further information or to request a copy of the main findings of this study, please contact Melissa Opozda at melissa.opozda@adelaide.edu.au or on . Alternately, please contact Prof. Anna Chur-Hansen (or anna.churhansen@adelaide.edu.au) or Prof. Gary Wittert (or gary.wittert@adelaide.edu.au).

Appendix F: Downloadable list of support services

THE UNIVERSITY of ADELAIDE

BARIATRIC EATING EXPERIENCES STUDY
FURTHER INFORMATION AND ASSISTANCE

Thank you so much for your participation.

Please speak to your general practitioner (or other medical practitioner) if you have personal concerns about any of the issues investigated in this study. If you would like to learn more about eating-related difficulties or find further assistance (e.g. from a psychologist or dietitian), the following organisations may also be helpful:

National Eating Disorders Collaboration
Information and assistance with eating-related issues
www.nedc.com.au

The Butterfly Foundation Support Line
Mon-Fri 8am to 9pm AEST; confidential support and information for people experiencing disordered eating or body image issues
Ph: 1800 ED HOPE (1800 33 4673)
www.thebutterflyfoundation.org.au

Australian Psychological Society
'Find a Psychologist' service
www.psychology.org.au/findapsychologist or ph: 1800 333 497

Dietitians Association of Australia
'Find an Accredited Practising Dietitian' service
www.daa.asn.au/for-the-public/find-an-apd

beyondblue
'Find a professional' service and information on common mental health difficulties
www.beyondblue.org.au/get-support/find-a-professional
www.beyondblue.org.au

Lifeline
Information, 24 hour urgent psychological assistance (crisis support and suicide prevention), and online crisis support chat
Ph: 13 11 14
www.lifeline.org.au

Appendix G: Patient questionnaire

Q1.1 BARIATRIC EATING EXPERIENCES STUDY

This is an online study of the eating-related behaviours and experiences of Australian adults who have had any of three types of bariatric (weight loss) surgery: Roux-en-Y gastric bypass (aka 'bypass'), adjustable gastric banding ('banding' or 'lap banding'), or vertical sleeve gastrectomy ('sleeve').

The single, anonymous questionnaire will take around 30-40 minutes to complete, and asks about your surgery, eating behaviours, hunger, appetite, and health before surgery and now, and your experiences of eating since your surgery.

You are eligible to participate if: 1) You currently live in Australia, and 2) You have a bypass, band, or sleeve that was performed in Australia, and 3) You were an adult (18+ years old) when your surgery was performed.

If you fit these criteria, we would be very grateful for your participation. We hope to hear about the experiences of lots of people who have had bariatric surgery in Australia!

Please see the following documents:

- Study information sheet: Contains additional information about this study.
- Contacts sheet: Who to contact with study-related questions or concerns.
- Resources and assistance: List of organisations providing information and support for eating-related issues.

Please feel free to contact Melissa Opozda (PhD researcher) at melissa.opozda@adelaide.edu.au or on 04XX XXX XXX with any questions or comments about this study.

Click '>>' in the bottom right corner to continue on to the consent form.

Q2.1 University of Adelaide Human Research Ethics Committee STUDY CONSENT FORM

Please read and indicate your agreement to the following statements by selecting "Yes" below. (If you do not agree to these items or do not wish to participate in this study, simply close your browser window. Thank you for your time.)

1. I have read the relevant Information Sheet (on the previous screen) and agree to take part in the University of Adelaide research project titled "Bariatric eating experiences study".
2. I have had the project, so far as it affects me, fully explained to my satisfaction by the Information Sheet. My consent is given freely.
3. Although I understand the purpose of the research project, it has also been explained that involvement may not be of any benefit to me.
4. I have been informed that, while information gained during the study may be published, I will not be identified and my personal results will not be divulged.
5. I understand that I am free to withdraw from the project at any time.
6. I am aware that I should keep a copy of the Consent Form and Information Sheet.

	Yes
I agree to each of the above statements and consent to participate in this study.	❍

Q2.2 Click '>>' in the bottom right corner to begin the survey.

Q3.1 ELIGIBILITY TO PARTICIPATE

Q3.2 Participants in this study must fit a number of criteria, as outlined on the introduction page of this survey. To check whether you are eligible to take part, please respond to each of the following items.

(If you do not fit criteria to participate in this study, you will be taken to the end of the questionnaire and will not be able to answer any further questions. Thank you very much for taking the time to be part of this study.)

	Yes	No
I live in Australia.	❍	❍
I currently have a Roux-en-Y gastric bypass (aka 'bypass'), adjustable gastric band (aka 'band' or 'lap band'), and/or vertical sleeve gastrectomy (aka 'sleeve').	❍	❍
My bypass, band, and/or sleeve was performed in Australia.	❍	❍
I was 18+ years old at the time my bypass, band, or sleeve was performed.	❍	❍

Q4.1 YOUR BARIATRIC SURGERY OR SURGERIES

Q4.2 Which bariatric procedure or procedures do you currently have in your body? (Please choose one answer.)

- ❍ Roux-en-Y gastric bypass (bypass)
- ❍ Adjustable gastric banding (lap band/band)
- ❍ Sleeve gastrectomy (sleeve)
- ❍ Other (please specify): _____
- ❍ Multiple current procedures (e.g. currently have a sleeve AND a band, or a band AND a gastric balloon; please specify which procedures): _____

Q4.3 Before your current bariatric procedure(s) (the surgery or surgeries you have in your body right now), did you undergo any other weight loss surgeries? (e.g. a procedure that was temporary, or has been removed)

- ❍ No
- ❍ Yes
- ❍ Choose not to answer
- ❍ Unsure

Q4.4 If you underwent previous bariatric procedures, what procedure(s) did you undergo, when was this surgery performed, and why do you no longer have this procedure or device? Please describe in a sentence or two.

Q4.5 Have you had any physical difficulties with your current bariatric surgery or surgeries? (e.g. band slip, sleeve leak, device had to be replaced, severe reflux, etc.) Please describe, or write 'no' if you have had no difficulties.

Q4.6 For what reasons did you have a band, bypass, or sleeve (the procedure or procedures currently in your body), and not a different procedure? (For example, if you have a bypass: Why did you have a bypass, rather than a sleeve or band?)

Q4.7 On what date was your band, bypass, or sleeve performed? (Please format as dd/mm/yyyy) If you currently have more than one of these bariatric procedures, please answer in regard to the most recent one (e.g. if you had a sleeve, then a bypass later, please answer in regard to your bypass).

Q4.8 In which Australian state was your band, bypass, or sleeve carried out? If you currently have multiple bariatric procedures, please answer in regard to your most recent bariatric procedure (e.g. if you had a sleeve, then a bypass later, please answer in regard to your bypass).

- ❍ NSW
- ❍ Victoria
- ❍ Queensland
- ❍ WA
- ❍ SA
- ❍ Tasmania
- ❍ NT
- ❍ Other (please specify) _____

Q4.9 Did you have your bariatric surgery as a public or private patient? If you currently have multiple bariatric procedures, please answer in regard to your most recent bariatric procedure (e.g. if you had a sleeve first, then added a bypass later, please answer in regard to your bypass).

- ❍ Public
- ❍ Private
- ❍ Other (please specify): _____
- ❍ Choose not to answer
- ❍ Unsure

Q4.10 How was your bariatric surgery funded? If you currently have multiple bariatric procedures, please answer in regard to your most recent bariatric procedure (e.g. if you had a sleeve, then a bypass later, please answer in regard to your bypass).

- ❍ Public health system (no cost to you)
- ❍ Private health insurance covered all costs
- ❍ Private health insurance and paid gap
- ❍ Fully self-funded (you paid all costs)
- ❍ Other (please specify): _____
- ❍ Choose not to answer
- ❍ Unsure

Q4.11 Since your current procedure or procedures, what services or practitioners have you accessed for surgery or weight loss-related support?

- ❑ Bariatric surgeon, physician, or general practitioner
- ❑ Dietitian or other eating or diet professional
- ❑ Psychologist, psychiatrist, or other mental health professional
- ❑ Exercise physician or bariatric exercise group
- ❑ In-person weight loss surgery support group
- ❑ Online bariatric surgery support group, forum, page, or similar
- ❑ Other (please specify): _____
- ❑ None
- ❑ Choose not to answer

Q5.1 YOUR THOUGHTS ABOUT YOUR OWN BARIATRIC SURGERY

Q5.2 How satisfied are you with…

	Extremely dissatisfied	Dissatisfied	Neutral	Satisfied	Extremely satisfied	Choose not to answer
…the overall result of your bariatric surgery?	❍	❍	❍	❍	❍	❍
…your weight loss since surgery?	❍	❍	❍	❍	❍	❍
…your current physical appearance?	❍	❍	❍	❍	❍	❍
…your current eating behaviours?	❍	❍	❍	❍	❍	❍
…your physical activity?	❍	❍	❍	❍	❍	❍
…your social support?	❍	❍	❍	❍	❍	❍

Q5.3 Which statement best characterises how you feel about your current weight?

- ❍ I have reached my dream weight, the weight I would choose to be.
- ❍ I am happy with my weight, but ideally, I would like to weigh less.
- ❍ I am not particularly happy with my weight, but it is acceptable since it is less than my pre-surgery weight.
- ❍ I am disappointed with my weight - although it is less than my pre-surgery weight, I do not view it as successful in any way.
- ❍ I am at or above my pre-surgery weight.
- ❍ Choose not to answer

Q5.4 Which statement best describes your current weight stage?

- ❍ I have finished losing weight and I am working to maintain my current weight.
- ❍ I would like to lose more, and I am/have been losing weight.
- ❍ I would like to lose more, but my weight loss has plateaued (I am not really losing nor gaining weight).
- ❍ I would like to lose more, but have been regaining weight that I had previously lost after surgery.
- ❍ I did not lose any weight after my surgery.
- ❍ I have lost too much weight and am trying to regain weight.
- ❍ Choose not to answer

Q5.5 What, if anything, do you like about your current bariatric procedure or procedures? Please write as much or as little as you wish.

Q5.6 What, if anything, do you dislike about your current bariatric surgery procedure or procedures? Please write as much or as little as you wish.

Q5.7 If you could do it over, would you choose to have weight loss surgery again?

- ❍ Definitely not
- ❍ Probably not
- ❍ Unsure
- ❍ Probably
- ❍ Definitely
- ❍ Choose not to answer

Q5.8 If you could do it over and could choose to have any weight loss surgery procedure, which would you have?

- ❍ I probably would not have surgery again
- ❍ Roux-en-Y gastric bypass (bypass)
- ❍ Adjustable gastric banding (band/Lap band)
- ❍ Vertical sleeve gastrectomy (sleeve)
- ❍ Other procedure (please specify): _____
- ❍ Unsure

Q5.9 Before you had surgery, how did you expect or hope your eating behaviours would change after surgery? (e.g. you might have hoped for changes in what or how much you ate, your appetite/hunger, or patterns of eating such as grazing, emotional eating, night eating, or bingeing.) Please write as much or as little as you wish.

Q5.10 How (if at all) have your eating and eating behaviours actually changed since you had bariatric surgery? How have they changed over time since your surgery? How did your expectations compare to what actually happened after surgery? Please write as much or as little as you wish.

Q6.1 The following questions ask about a variety of eating-related issues and behaviours. We are interested in both your eating behaviours now (after surgery), as well as your eating behaviours before you had surgery. For each section, you will be asked first about your eating behaviours before your surgery, THEN you will be asked the same questions again, but about your current eating behaviours. For the questions about your eating behaviours before surgery, please choose a time of 'usual' eating (your everyday eating patterns at that time, whether healthy or unhealthy - not while you were on a pre-surgery diet), say 6-12 months before your surgery, and answer the questions according to your eating behaviours at that time.

Q7.1 FOOD TOLERANCE

Q7.2 Firstly, thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery):

Q7.3 Thinking about the time of 'usual eating' before you had surgery, which of the following meals did you generally eat? Please choose as many as apply.

- ❑ Breakfast
- ❑ Lunch
- ❑ Dinner/tea/supper (evening meal)
- ❑ Choose not to answer

Q7.4 Still thinking about the same time before surgery, did you usually eat between meals?

- ❍ No
- ❍ Yes
- ❍ Choose not to answer

Q7.5 If yes, when did you usually eat between meals? Please choose as many as apply.

- ❑ Morning
- ❑ Afternoon
- ❑ Evening
- ❑ Not applicable
- ❑ Choose not to answer

Q7.6 Before you had surgery, could you eat all types of foods?

- ❍ No
- ❍ Yes
- ❍ Choose not to answer

Q7.7 More specifically, still thinking about the same time period before surgery, how easily could you eat…

	Easily	With some difficulties	I could not eat this at all	Not applicable (e.g. did not eat this)	Choose not to answer
Red meat	❍	❍	❍	❍	❍
White meat	❍	❍	❍	❍	❍
Salad	❍	❍	❍	❍	❍
Vegetables	❍	❍	❍	❍	❍
Bread	❍	❍	❍	❍	❍
Rice	❍	❍	❍	❍	❍
Pasta	❍	❍	❍	❍	❍
Fish	❍	❍	❍	❍	❍

Q7.8 Before you had surgery, did you ever vomit/regurgitate food?

❍ Daily
❍ Often (more than twice a week)
❍ Rarely (up to twice a week)
❍ Never
❍ Choose not to answer

Q7.9 Please rate your overall satisfaction regarding how you could eat before your surgery.

❍ Excellent
❍ Good
❍ Acceptable
❍ Poor
❍ Very poor
❍ Choose not to answer

Q8.1 Thinking about your eating now…

Q8.2 Which of the following meals do you generally eat now? Please choose as many as apply.

❑ Breakfast
❑ Lunch
❑ Dinner/tea/supper (evening meal)
❑ Choose not to answer

Q8.3 Do you eat between meals?

❍ No
❍ Yes
❍ Choose not to answer

Q8.4 If yes, when do you eat between meals?

❑ Morning
❑ Afternoon
❑ Evening
❑ Not applicable
❑ Choose not to answer

Q8.5 Can you eat all types of foods now?

❍ No
❍ Yes
❍ Choose not to answer

Q8.6 More specifically, how easily can you now eat…

	Easily	With some difficulties	I cannot eat this at all	Not applicable (e.g. do not eat this)	Choose not to answer
Red meat	❍	❍	❍	❍	❍
White meat	❍	❍	❍	❍	❍
Salad	❍	❍	❍	❍	❍
Vegetables	❍	❍	❍	❍	❍
Bread	❍	❍	❍	❍	❍
Rice	❍	❍	❍	❍	❍
Pasta	❍	❍	❍	❍	❍
Fish	❍	❍	❍	❍	❍

Q8.7 Do you ever vomit/regurgitate food now?

- ❍ Daily
- ❍ Often (more than twice a week)
- ❍ Rarely (up to twice a week)
- ❍ Never
- ❍ Choose not to answer

Q8.8 Please rate your overall satisfaction regarding how you can eat now.

- ❍ Excellent
- ❍ Good
- ❍ Acceptable
- ❍ Poor
- ❍ Very poor
- ❍ Choose not to answer

Q9.1 EMOTIONAL EATING

Q9.2 Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery): Please respond to each statement.

	Definitely true	Mostly true	Mostly false	Definitely false
I tended to eat when I felt anxious.	❍	❍	❍	❍
When I felt sad, I often ate too much.	❍	❍	❍	❍
When I felt tense or "wound up", I often felt I needed to eat.	❍	❍	❍	❍
When I felt lonely, I consoled myself by eating.	❍	❍	❍	❍
If I felt nervous, I tried to calm down by eating.	❍	❍	❍	❍
When I felt depressed, I wanted to eat.	❍	❍	❍	❍

Q9.3 Thinking about your eating now: Please respond to the same statements.

	Definitely true	Mostly true	Mostly false	Definitely false	Choose not to answer
I tend to eat when I feel anxious.	❍	❍	❍	❍	❍
When I feel sad, I often eat too much.	❍	❍	❍	❍	❍
When I feel tense or "wound up", I often feel I need to eat.	❍	❍	❍	❍	❍
When I feel lonely, I console myself by eating.	❍	❍	❍	❍	❍
If I feel nervous, I try to calm down by eating.	❍	❍	❍	❍	❍
When I feel depressed, I want to eat.	❍	❍	❍	❍	❍

Q10.1 OVEREATING AND URGES

Q10.2 Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery): Please select one statement in each group that best describes how you felt about your eating behaviours at that time before surgery.

Q10.3 Before I had surgery...

- ❍ I didn't feel self-conscious about my weight or body size when I was with others.
- ❍ I felt concerned about how I looked to others, but it normally did not make me feel disappointed with myself.
- ❍ I did get self-conscious about my appearance and weight, which made me feel disappointed in myself.
- ❍ I felt very self-conscious about my weight and frequently felt intense shame and disgust for myself. I tried to avoid social contact because of my self-consciousness.
- ❍ Choose not to answer

Q10.4 Before I had surgery...

- ❍ I didn't have any difficulty eating slowly.
- ❍ Although I seemed to "gobble down" foods, I didn't end up feeling stuffed because I ate too much.
- ❍ At times, I tended to eat quickly and felt uncomfortably full afterwards.
- ❍ I had a habit of bolting down my food without really chewing it, and afterwards I usually felt uncomfortably stuffed because I ate too much.
- ❍ Choose not to answer

Q10.5 Before I had surgery...

- ❍ I was able to control my eating urges when I wanted to.
- ❍ I felt like I failed to control my eating more than the average person.
- ❍ I felt utterly helpless when it came to controlling my eating urges.
- ❍ I felt so helpless about controlling my eating, I became very desperate about trying to gain control.
- ❍ Choose not to answer

Q10.6 Before I had surgery...

- I didn't have a habit of eating when I was bored.
- I sometimes ate when I was bored, but was often able to 'get busy' and get my mind off food.
- I regularly ate when I was bored, but occasionally could distract myself to get my mind off eating.
- I had a strong habit of eating when I was bored, and nothing seemed to help me break that habit.
- Choose not to answer

Q10.7 Before I had surgery...

- I was usually physically hungry when I ate.
- Occasionally I ate something on impulse even though I wasn't really hungry.
- I regularly ate foods that I might not really enjoy, to satisfy a hungry feeling - even though physically, I didn't need the food.
- Even though I wasn't physically hungry, I got a hungry feeling that only seemed to be satisfied by eating foods that filled my mouth.
- Choose not to answer

Q10.8 Before I had surgery...

- I didn't feel any guilt or self-hate after I overate.
- After eating too much, occasionally I felt guilt or self-loathing.
- After eating too much, I almost always experienced strong guilt or self-loathing.
- Choose not to answer

Q10.9 Before I had surgery...

- I didn't lose total control of my eating, even after times when I ate too much.
- Sometimes when I ate a "forbidden food" on a diet, I felt like I "blew it" and ate even more.
- I frequently thought, "I've blown it now, why not go all the way" when I overate - then I ate even more.
- I regularly went on strict diets, but broke those diets by going on an eating binge.
- Choose not to answer

Q10.10 Before I had surgery...

- I rarely ate so much food that I felt uncomfortably stuffed afterwards.
- Usually about once a month, I ate so much food that I ended up feeling very stuffed.
- There were regular times in the month when I ate large amounts of food, either at mealtimes or snacks.
- I regularly ate so much food that I felt quite uncomfortable after eating and sometimes a bit nauseous.
- Choose not to answer

Q10.11 Before I had surgery...

- My level of calorie intake did not go up very high or down very low on a regular basis.
- Sometimes after I overate, I would try to reduce my caloric intake to almost nothing to compensate for the excess calories I ate.
- I had a regular habit of overeating during the night. It seemed that my routine was not to be hungry in the morning, but overeat in the evening.
- I had had week-long periods where I practically starved myself, after periods when I overate.
- Choose not to answer

Q10.12 Before I had surgery...

- I was usually able to stop eating when I wanted to. I knew when "enough is enough."
- Every so often, I experienced a compulsion to eat that I couldn't seem to control.
- I frequently experienced strong urges to eat that I felt unable to control - but at other times I could control those eating urges.
- I felt incapable of controlling my urges to eat. I feared not being able to stop eating voluntarily.
- Choose not to answer

Q10.13 Before I had surgery...

- I didn't have any problem stopping eating when I felt full.
- I could usually stop eating when I felt full, but occasionally overate to the point of feeling uncomfortably stuffed.
- I had a problem stopping eating once I started, and I usually felt uncomfortably stuffed after I eat a meal.
- Because I had a problem with not being able to stop eating, I sometimes had to induce vomiting to relieve my stuffed feeling.
- Choose not to answer

Q10.14 Before I had surgery...

- I seemed to eat just as much when I was with other people as when I was by myself.
- Sometimes when I was with other people, I didn't eat as much as I wanted because I was self-conscious about my eating.
- I frequently only ate a small amount of food when others were present, because I was very embarrassed about my eating.
- I felt so ashamed about overeating that I picked times to overeat when I knew no one would see me. I felt like a "closet eater."
- Choose not to answer

Q10.15 Before I had surgery...

- I ate three meals a day with only an occasional between-meal snack.
- I ate three meals a day, but I also normally snacked between meals.
- When I was snacking heavily, I got in the habit of skipping regular meals.
- There were regular times when I seemed to be continually eating, with no planned meals.
- Choose not to answer

Q10.16 Before I had surgery...

- I didn't think much about trying to control unwanted eating urges.
- At least some of the time, my thoughts were preoccupied with trying to control my eating urges.
- I frequently spent much time thinking about how much I ate or about trying not to eat more.
- It seemed like most of my waking hours were preoccupied with thoughts about eating or not eating. I felt like I was constantly struggling not to eat.
- Choose not to answer

Q10.17 Before I had surgery...

- I didn't think about food a great deal.
- I had strong cravings for food but they lasted only for short amounts of time.
- I had days when I couldn't seem to think about anything but food.
- Most of my days seemed to be preoccupied with thoughts about food. I felt like I lived to eat.
- Choose not to answer

Q10.18 Before I had surgery...

- I usually knew whether or not I was physically hungry. I knew how much food I needed to satisfy me.
- I occasionally felt uncertain about whether or not I was physically hungry. At these times it was hard to know how much food I should take to satisfy me.
- Even though I might have known how many calories I should eat, I didn't have any idea what a "normal" amount of food was for me.
- Choose not to answer

Q11.1 Thinking about your eating now...Please select one statement in each group that best describes how you feel about your current eating behaviours.

Q11.2 Now...

- I don't feel self-conscious about my weight or body size when I'm with others.
- I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.
- I do get self-conscious about my appearance and weight, which makes me feel disappointed in myself.
- I feel very self-conscious about my weight and frequently feel intense shame and disgust for myself. I try to avoid social contact because of my self-consciousness.
- Choose not to answer

Q11.3 Now...

- I don't have any difficulty eating slowly.
- Although I seem to "gobble down" foods, I don't end up feeling stuffed because I ate too much.
- At times, I tend to eat quickly and feel uncomfortably full afterwards.
- I have a habit of bolting down my food without really chewing it, and afterwards I usually feel uncomfortably stuffed because I ate too much.
- Choose not to answer

Q11.4 Now...

- I am able to control my eating urges when I want to.
- I feel like I fail to control my eating more than the average person.
- I feel utterly helpless when it comes to controlling my eating urges.
- I feel so helpless about controlling my eating, I've become very desperate about trying to gain control.
- Choose not to answer

Q11.5 Now...

- I don't have a habit of eating when I'm bored.
- I sometimes eat when I'm bored, but often I'm able to 'get busy' and get my mind off food.
- I regularly eat when I'm bored, but occasionally I can distract myself to get my mind off eating.
- I have a strong habit of eating when I'm bored, and nothing seems to help me break that habit.
- Choose not to answer

Q11.6 Now...

- I'm usually physically hungry when I eat.
- Occasionally I eat something on impulse even though I'm really not hungry.
- I regularly eat foods that I might not really enjoy, to satisfy a hungry feeling - even though physically, I don't need the food.
- Even though I'm not physically hungry, I get a hungry feeling that only seems to be satisfied when I eat foods that fill my mouth.
- Choose not to answer

Q11.7 Now...

- I don't feel any guilt or self-hate after I overeat.
- After I eat too much, occasionally I feel guilt or self-loathing.
- After I eat too much, I almost always experience strong guilt or self-loathing.
- Choose not to answer

Q11.8 Now...

- I don't lose total control of my eating, even after times when I eat too much.
- Sometimes when I eat a "forbidden food" on a diet, I feel like I "blew it" and eat even more.
- I frequently think, "I've blown it now, why not go all the way" when I overeat - then I eat even more.
- I regularly go on strict diets, but break those diets by going on an eating binge.
- Choose not to answer

Q11.9 Now...

- I rarely eat so much food that I feel uncomfortably stuffed afterwards.
- Usually about once a month, I eat so much food that I end up feeling very stuffed.
- There are regular times in the month when I eat large amounts of food, either at mealtimes or snacks.
- I regularly eat so much food that I feel quite uncomfortable after eating and sometimes a bit nauseous.
- Choose not to answer

Q11.10 Now...

- My level of calorie intake does not go up very high or down very low on a regular basis.
- Sometimes after I overeat, I will try to reduce my caloric intake to almost nothing to compensate for the excess calories I ate.
- I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning, but overeat in the evening.
- In my adult years, I have had week-long periods where I practically starve myself, after periods when I have overeaten.
- Choose not to answer

Q11.11 Now...

- I am usually able to stop eating when I want to. I know when "enough is enough."
- Every so often, I experience a compulsion to eat that I can't seem to control.
- I frequently experience strong urges to eat that I feel unable to control - but at other times I can control those eating urges.
- I feel incapable of controlling my urges to eat. I fear not being able to stop eating voluntarily.
- Choose not to answer

Q11.12 Now...

- I don't have any problem stopping eating when I feel full.
- I can usually stop eating when I feel full, but occasionally overeat to the point of feeling uncomfortably stuffed.
- I have a problem stopping eating once I start, and I usually feel uncomfortably stuffed after I eat a meal.
- Because I have a problem with not being able to stop eating, I sometimes have to induce vomiting to relieve my stuffed feeling.
- Choose not to answer

Q11.13 Now...

- I seem to eat just as much when I'm with other people as when I'm by myself.
- Sometimes when I'm with other people, I don't eat as much as I want because I'm self-conscious about my eating.
- I frequently only eat a small amount of food when others are present, because I'm very embarrassed about my eating.
- I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a "closet eater."
- Choose not to answer

Q11.14 Now...

- I eat three meals a day with only an occasional between-meal snack.
- I eat three meals a day, but I also normally snack between meals.
- When I am snacking heavily, I get in the habit of skipping regular meals.
- There are regular times when I seem to be continually eating, with no planned meals.
- Choose not to answer

Q11.15 Now...

- I don't think much about trying to control unwanted eating urges.
- At least some of the time, my thoughts are preoccupied with trying to control my eating urges.
- I frequently spend much time thinking about how much I ate or about trying not to eat more.
- It seems like most of my waking hours are preoccupied with thoughts about eating or not eating. I feel like I'm constantly struggling not to eat.
- Choose not to answer

Q11.16 Now...

- I don't think about food a great deal.
- I have strong cravings for food but they last only for short amounts of time.
- I have days when I can't seem to think about anything but food.
- Most of my days seem to be preoccupied with thoughts about food. I feel like I live to eat.
- Choose not to answer

Q11.17 Now...

- I usually know whether or not I'm physically hungry. I know how much food I need food to satisfy me.
- I occasionally feel uncertain about whether or not I'm physically hungry. At these times it's hard to know how much food I should take to satisfy me.
- Even though I might know how many calories I should eat, I don't have any idea what a "normal" amount of food is for me.
- Choose not to answer

Q12.1 NIGHT-TIME EATING

Q12.2 Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery):

How hungry were you usually in the morning?	❍ Not at all	❍ A little	❍ Somewhat	❍ Moderately	❍ Very	❍ Choose not to answer
When did you usually eat for the first time?	❍ 9am or earlier	❍ 9:01am-12pm	❍ 12:01-3pm	❍ 3:01-6pm	❍ After 6pm	❍ Choose not to answer
Did you have cravings or urges to eat snacks after dinner, but before bedtime?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
How much control did you have over your own eating between dinner and bedtime?	❍ Not at all	❍ A little	❍ Some	❍ Very much	❍ Complete	❍ Choose not to answer
How much of your daily food intake did you consume after dinnertime?	❍ 0% (none)	❍ 1-25% (up to a quarter)	❍ 26-50% (about half)	❍ 51-75% (more than half)	❍ 76-100% (almost all)	❍ Choose not to answer
Did you feel blue or down in the dumps?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely	❍ Choose not to answer

Q12.3 Still thinking about the same time period before surgery, when you felt blue, was your mood lower in the:

❍ Early morning
❍ Late morning
❍ Afternoon
❍ Early evening
❍ Late evening/night
❍ My mood does not change during the day
❍ Not applicable
❍ Choose not to answer

Q12.4 During the same time period before surgery:

How often did you have trouble getting to sleep?	❍ Never	❍ Sometimes	❍ About half the time	❍ Usually	❍ Always	❍ Choose not to answer
Other than to use the toilet, how often did you get up at least once in the middle of the night?	❍ Never	❍ Less than once a week	❍ About once a week	❍ More than once a week	❍ Every night	❍ Choose not to answer

Q12.5 During the same time period before surgery:

Did you have cravings or urges to eat snacks when you woke up at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
Did you need to eat in order to get back to sleep when you woke at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
When you were up in the middle of the night, how often did you snack?	❍ Never	❍ Sometimes	❍ About half the time	❍ Usually	❍ Always	❍ Choose not to answer

Q12.6 During the same time period before surgery:

When you snacked in the middle of the night, how aware were you of your eating?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Completely	❍ Choose not to answer
How much control did you have over your eating while you were up at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much	❍ Complete	❍ Choose not to answer

Q12.7 At that time before surgery, how long had your difficulties with night eating been occurring? (e.g. 8 months)

Q13.1 Thinking about your eating now:

How hungry are you usually in the morning?	❍ Not at all	❍ A little	❍ Somewhat	❍ Moderately	❍ Very	❍ Choose not to answer
When do you usually eat for the first time?	❍ 9am or earlier	❍ 9:01am-12pm	❍ 12:01-3pm	❍ 3:01-6pm	❍ After 6pm	❍ Choose not to answer
Do you have cravings or urges to eat snacks after dinner, but before bedtime?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
How much control do you have over your own eating between dinner and bedtime?	❍ Not at all	❍ A little	❍ Some	❍ Very much	❍ Complete	❍ Choose not to answer
How much of your daily food intake do you consume after dinnertime?	❍ 0% (none)	❍ 1-25% (up to a quarter)	❍ 26-50% (about half)	❍ 51-75% (more than half)	❍ 76-100% (almost all)	❍ Choose not to answer
Are you currently feeling blue or down in the dumps?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely	❍ Choose not to answer

Q13.2 When you are feeling blue, is your mood lower in the:

- ❍ Early morning
- ❍ Late morning
- ❍ Afternoon
- ❍ Early evening
- ❍ Late evening/night
- ❍ My mood does not change during the day
- ❍ Not applicable
- ❍ Choose not to answer

Q13.3 Thinking about now:

How often do you have trouble getting to sleep?	❍ Never	❍ Sometimes	❍ About half the time	❍ Usually	❍ Always	❍ Choose not to answer
Other than to use the toilet, how often do you get up at least once in the middle of the night?	❍ Never	❍ Less than once a week	❍ About once a week	❍ More than once a week	❍ Every night	❍ Choose not to answer

Q13.4 Thinking about now:

Do you have cravings or urges to eat snacks when you wake up at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
Do you need to eat in order to get back to sleep when you wake up at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Extremely so	❍ Choose not to answer
When you are up in the middle of the night, how often do you snack?	❍ Never	❍ Sometimes	❍ About half the time	❍ Usually	❍ Always	❍ Choose not to answer

Q13.5 Thinking about now:

When you snack in the middle of the night, how aware are you of your eating?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much so	❍ Completely	❍ Choose not to answer
How much control do you have over your eating while you are up at night?	❍ Not at all	❍ A little	❍ Somewhat	❍ Very much	❍ Complete	❍ Choose not to answer

Q13.6 How long have your current difficulties with night eating been occurring? (e.g. 8 months)

Q14.1 GRAZING EATING

Q14.2 Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery):

	Never	Rarely	Sometimes	Most of the time	All of the time	Choose not to answer
Did you 'graze' between meals (i.e. repeatedly ate small amounts of food)?	❍	❍	❍	❍	❍	❍
Did you eat more or less continuously throughout the day or during extended parts of the day (e.g. all afternoon)?	❍	❍	❍	❍	❍	❍
Did you find yourself taking extra helpings or picking at extra food once you'd finished your main meal?	❍	❍	❍	❍	❍	❍
Would you describe the way you generally ate as unplanned and repetitious (i.e. eating between planned meals and snacks)?	❍	❍	❍	❍	❍	❍

Did you find yourself picking at or nibbling food continuously?	❍	❍	❍	❍	❍	❍
Did you ever feel compelled or driven to eat, even when not hungry?	❍	❍	❍	❍	❍	❍
Did you ever feel that you were unable to stop 'grazing'?	❍	❍	❍	❍	❍	❍
Did you have a feeling that you had lost control over your eating while 'grazing'?	❍	❍	❍	❍	❍	❍

Q14.3 Thinking about your eating now:

	Never	Rarely	Sometimes	Most of the time	All of the time	Choose not to answer
Do you 'graze' between meals (i.e. repeatedly eating small amounts of food)?	❍	❍	❍	❍	❍	❍
Do you eat more or less continuously throughout the day or during extended parts of the day (e.g. all afternoon)?	❍	❍	❍	❍	❍	❍
Do you find yourself taking extra helpings or picking at extra food once you've finished your main meal?	❍	❍	❍	❍	❍	❍
Would you describe the way you generally eat as unplanned and repetitious (i.e. eating between planned meals and snacks)?	❍	❍	❍	❍	❍	❍

Do you find yourself picking at or nibbling food continuously?	❍	❍	❍	❍	❍	❍
Have you ever felt compelled or driven to eat, even when not hungry?	❍	❍	❍	❍	❍	❍
Have you ever felt that you were unable to stop 'grazing'?	❍	❍	❍	❍	❍	❍
Do you have a feeling that you have lost control over your eating while 'grazing'?	❍	❍	❍	❍	❍	❍

Q15.1 FOOD CRAVINGS

Q15.2 Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery), please indicate how strongly you agree with each statement:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Choose not to answer
When I craved something, I knew I wouldn't be able to stop eating it once I started.	❍	❍	❍	❍	❍	❍
If I ate what I craved, I often lost control and ate too much.	❍	❍	❍	❍	❍	❍
Food cravings invariably made me think of ways to get what I wanted to eat.	❍	❍	❍	❍	❍	❍
I felt like I had food on my mind all the time.	❍	❍	❍	❍	❍	❍
I would find myself preoccupied with food.	❍	❍	❍	❍	❍	❍
Whenever I had cravings, I found myself making plans	❍	❍	❍	❍	❍	❍

to eat.						
I craved foods when I felt bored, angry, or sad.	❍	❍	❍	❍	❍	❍
I had no will power to resist my food cravings.	❍	❍	❍	❍	❍	❍
Once I started eating, I had trouble stopping.	❍	❍	❍	❍	❍	❍
I couldn't stop thinking about eating no matter how hard I tried.	❍	❍	❍	❍	❍	❍
If I gave in to a food craving, all control was lost.	❍	❍	❍	❍	❍	❍
Whenever I had a food craving, I kept thinking about eating until I actually ate the food.	❍	❍	❍	❍	❍	❍
If I was craving something, thoughts of eating it consumed me.	❍	❍	❍	❍	❍	❍
My emotions often made me want to eat.	❍	❍	❍	❍	❍	❍
It was hard for me to resist the temptation to eat appetising foods that were in my reach.	❍	❍	❍	❍	❍	❍

Q15.3 Thinking about your eating now, please indicate how strongly you agree with each statement:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Choose not to answer
When I crave something, I know I won't be able to stop eating it	❍	❍	❍	❍	❍	❍

once I start.						
If I eat what I'm craving, I often lose control and eat too much.	❍	❍	❍	❍	❍	❍
Food cravings invariably make me think of ways to get what I want to eat.	❍	❍	❍	❍	❍	❍
I feel like I have food on my mind all the time.	❍	❍	❍	❍	❍	❍
I find myself preoccupied with food.	❍	❍	❍	❍	❍	❍
Whenever I have cravings, I find myself making plans to eat.	❍	❍	❍	❍	❍	❍
I crave foods when I feel bored, angry, or sad.	❍	❍	❍	❍	❍	❍
I have no will power to resist my food cravings.	❍	❍	❍	❍	❍	❍
Once I start eating, I have trouble stopping.	❍	❍	❍	❍	❍	❍
I can't stop thinking about eating no matter how hard I try.	❍	❍	❍	❍	❍	❍
If I give in to a food craving, all control is lost.	❍	❍	❍	❍	❍	❍
Whenever I have a food craving, I keep thinking about eating until I actually eat the food.	❍	❍	❍	❍	❍	❍
If I am craving something, thoughts of eating it consume me.	❍	❍	❍	❍	❍	❍
My emotions	❍	❍	❍	❍	❍	❍

often make me want to eat. It is hard for me to resist the temptation to eat appetising foods that are in my reach.	❍	❍	❍	❍	❍	❍

Q16.1 STRONGER FOOD CRAVINGS

Q16.2 People sometimes have difficulty controlling their intake of foods such as sweets, starches, salty snacks, fatty foods, sugary drinks, and others. Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery):

	Never	Once a month	2-4 times per month	2-3 times per week	4+ times per week	Choose not to answer
I found myself consuming certain foods even though I was no longer hungry.	❍	❍	❍	❍	❍	❍
I worried about cutting down on certain foods.	❍	❍	❍	❍	❍	❍
I felt sluggish or fatigued from overeating.	❍	❍	❍	❍	❍	❍
I spent time dealing with negative feelings from overeating certain foods, instead of spending time in important activities such as time with family, friends, work, or recreation.	❍	❍	❍	❍	❍	❍
I had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods (not including caffeinated drinks such as coffee, tea, cola, energy drinks, etc).	❍	❍	❍	❍	❍	❍

My behaviour with respect to food and eating caused me significant distress.	❍	❍	❍	❍	❍	❍
Issues related to food and eating decreased my ability to function effectively (daily routine, job/school, social or family activities, health difficulties, etc).	❍	❍	❍	❍	❍	❍

Q16.3 Still thinking about your eating before surgery:

	No	Yes	Choose not to answer
I kept consuming the same types of amounts of food despite significant emotional and/or physical problems related to my eating.	❍	❍	❍
Eating the same amount of food did not reduce negative emotions or increase pleasurable feelings the way it had previously.	❍	❍	❍

Q17.1 Think about your eating now…

	Never	Once a month	2-4 times per month	2-3 times per week	4+ times per week	Choose not to answer
I find myself consuming certain foods even though I am no longer hungry.	❍	❍	❍	❍	❍	❍
I worry about cutting down on certain foods.	❍	❍	❍	❍	❍	❍
I feel sluggish or fatigued from overeating.	❍	❍	❍	❍	❍	❍
I have spent time dealing with negative feelings from overeating certain foods,	❍	❍	❍	❍	❍	❍

instead of spending time in important activities such as time with family, friends, work, or recreation.						
I have had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods (not including caffeinated drinks such as coffee, tea, cola, energy drinks, etc).	❍	❍	❍	❍	❍	❍
My behaviour with respect to food and eating causes me significant distress.	❍	❍	❍	❍	❍	❍
Issues related to food and eating decrease my ability to function effectively (daily routine, job/school, social or family activities, health difficulties, etc).	❍	❍	❍	❍	❍	❍

Q17.2 Still thinking about your eating habits now...

	No	Yes	Choose not to answer
I kept consuming the same types of amounts of food despite significant emotional and/or physical problems related to my eating.	❍	❍	❍
Eating the same amount of food does not reduce negative emotions or increase pleasurable feelings the way it used to.	❍	❍	❍

Q18.1 HUNGER AND APPETITE

Q18.2 On the scales below, please move the slider bar across to the place that best indicates your average appetite and hunger before surgery, and in the past week. For example: If you have not felt very physically hungry recently (in the past week or two), you would move the slider bar for that question towards the left side of that scale (closer to "not at all physically hungry"). A rating of 0 (slider bar all the way to the left) indicates the lowest/least cravings or appetite, and a rating of 10 (slider bar all the way to the right) indicates the greatest/strongest hunger or appetite.

Q18.3 Appetite is the psychological desire, urge, or craving for specific foods. Please move the sliders to indicate your average appetite both before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery) and now (over the past week or two).

_____ Before surgery:
_____ Now/recently:

Q18.4 Hunger is the physical sensations felt inside the body that signal the need to eat. Please move the sliders to indicate your average hunger both before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery) and now (over the past week or two).

_____ Before surgery:
_____ Now/recently:

Q19.1 WHAT YOU EAT

Q19.2 The following questions are about what you eat. Thinking about your eating before surgery (your usual eating behaviours, healthy or unhealthy, say 6-12 months before you had surgery):

Q19.3 On average, before surgery how often did you eat the following foods?

	Never or less than once a month	1-3 times per month	Once a week	2-4 times per week	5-6 times per week	Once a day	2-3 times a day	4-5 times a day	6-7 times a day	8-9 times a day	10+ times a day	Choose not to answer
Meat and fish (includes beef, bacon, sausages, luncheon meats, salami, savoury pies, meat patties, fish, seafood, meat soups or stews, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Breads and savoury biscuits (includes any type of bread or rolls, English muffins, crumpets, roti, naan, pita, crispbread, crackers, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Cereals (includes porridge, Cornflakes, Sultana Bran, muesli,	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

breakfast cereal drinks, etc.)												
Other starches: Potatoes, rice, pasta, and pizza (includes baked or boiled potatoes, hot chips/fries, roast potato, potato salad, any rice, rice salad, risotto, pasta, spaghetti, lasagne, pasta salad, pizza, calzone, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Dairy products, fats, and eggs (includes any type of cheese, butter, margarine, or similar, oils, oil-based dressings, cream, yoghurt, cottage cheese, mayonnaise, eggs as boiled, fried, scrambled, quiche etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sweet snacks, pastries, and spreads (includes sweet biscuits, cakes, pies, buns, donuts, tarts, biscuits/cookies, ice cream, custard, jelly, chocolates, lollies, jams, honey, chocolate spreads, any sugar/sweetener added to hot or cold drinks or cereal, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Savoury snacks, pastries and spreads (includes corn and potato chips, popcorn, nuts, meat pies, pasties, Vegemite, peanut butter,	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

etc.)												
Vegetables (includes fresh, frozen, fermented, or tinned vegetables, tinned tomatoes, baked beans, lentils, beans, peas, vegetable soups, etc.) - do not include potatoes	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Fruits (includes all fresh, frozen, dried, or tinned fruits, sultanas, raisins, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Soy, tofu, and meat replacements (includes tofu, vegetable protein products, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Meal replacement drinks, soups, and bars (includes Optifast, Optislim, protein shakes, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Plain water drinks (includes water, soda or tonic water, unsweetened tea or coffee, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Milk drinks (includes milk alone, milky tea and coffee, sweetened flavoured milk drinks, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Other sweet drinks (includes soft drinks, fruit juice, cordial, fruit drinks, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Alcohol (includes beer, spirits, wine, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q20.1 Thinking about your eating now...

Q20.2 On average, how often do you eat the following foods now?

	Never or less than once a month	1-3 times per month	Once a week	2-4 times per week	5-6 times per week	Once a day	2-3 times a day	4-5 times a day	6-7 times a day	8-9 times a day	10+ times a day	Choose not to answer
Meat and fish (includes beef, bacon, sausages, luncheon meats, salami, savoury pies, meat patties, fish, seafood, meat soups or stews, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Breads and savoury biscuits (includes any type of bread or rolls, English muffins, crumpets, roti, naan, pita, crispbread, crackers, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Cereals (includes porridge, Cornflakes, Sultana Bran, muesli, breakfast cereal drinks, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Other starches: Potatoes, rice, pasta, and pizza (includes baked or boiled potatoes, hot chips/fries, roast potato, potato salad, any rice, rice salad, risotto, pasta, spaghetti, lasagne, pasta salad, pizza, calzone, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Dairy products, fats, and eggs (includes any type of cheese, butter, margarine, or	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

similar, oils, oil-based dressings, cream, yoghurt, cottage cheese, mayonnaise, eggs as boiled, fried, scrambled, quiche etc.)												
Sweet snacks, pastries, and spreads (includes sweet biscuits, cakes, pies, buns, donuts, tarts, biscuits/cookies, ice cream, custard, jelly, chocolates, lollies, jams, honey, chocolate spreads, any sugar/sweetener added to hot or cold drinks or cereal, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Savoury snacks, pastries and spreads (includes corn and potato chips, popcorn, nuts, meat pies, pasties, Vegemite, peanut butter, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Vegetables (includes fresh, frozen, fermented, or tinned vegetables, tinned tomatoes, baked beans, lentils, beans, peas, vegetable soups, etc.) - do not include potatoes	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Fruits (includes all fresh, frozen, dried, or tinned fruits, sultanas, raisins, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Soy, tofu, and meat replacements (includes tofu, vegetable	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

protein products, etc.)												
Meal replacement drinks, soups, and bars (includes Optifast, Optislim, protein shakes, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Plain water drinks (includes water, soda or tonic water, unsweetened tea or coffee, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Milk drinks (includes milk alone, milky tea and coffee, sweetened flavoured milk drinks, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Other sweet drinks (includes soft drinks, fruit juice, cordial, fruit drinks, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Alcohol (includes beer, spirits, wine, etc.)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q21.1 YOUR WEIGHT AND HEALTH

Q21.2 What is your height, in either metres (e.g. 1.75m) or feet/inches (e.g. 5'4")? Please provide your best estimate if unsure:

Q21.3 What is your current weight, in either kilograms (e.g. 140kg), stones (e.g. 15st 10lb), or pounds/ounces (e.g. 264lb)? Please provide your best estimate if unsure:

Q21.4 What has been your lowest weight since your most recent bariatric surgery procedure? Please answer in either kilograms (e.g. 140kg), stones (e.g. 15st 10lb), or pounds/ounces (e.g. 264lb). Please provide your best estimate if unsure:

Q21.5 How long after your most recent surgery were you at that lowest post-surgery weight? (e.g. now, or 18 months after surgery, or 5 years after surgery)

Q21.6 What was your weight before your most recent bariatric surgery, in either kilograms (e.g. 140kg), stones (e.g. 15st 10lb), or pounds/ounces (e.g. 264lb)? Please provide your best estimate if unsure:

Q21.7 For each medical condition listed below, please select the most fitting statement ('diagnosis' refers to diagnosis by a medical or allied health practitioner):

	I have never been diagnosed with this condition	I was diagnosed with this condition earlier in my life, but no longer had it when I had bariatric surgery	I had this condition when I had bariatric surgery, and since my surgery it has gotten much better or has been resolved/ cured	I had this when I had bariatric surgery, and since my surgery I have had little/no change in this condition	I had this when I had bariatric surgery, and since my surgery it has gotten worse	I was diagnosed with this condition after my bariatric surgery	Unsure/ choose not to answer
High cholesterol	❍	❍	❍	❍	❍	❍	❍
Osteoarthritis	❍	❍	❍	❍	❍	❍	❍
Type 2 diabetes	❍	❍	❍	❍	❍	❍	❍
Lymphoedema (accumulation of fluid and swelling, often in arms/legs)	❍	❍	❍	❍	❍	❍	❍
Gout	❍	❍	❍	❍	❍	❍	❍
Cardiovascular (heart) disease	❍	❍	❍	❍	❍	❍	❍
Hypertension (high blood pressure)	❍	❍	❍	❍	❍	❍	❍
Incontinence	❍	❍	❍	❍	❍	❍	❍
Sleep apnoea	❍	❍	❍	❍	❍	❍	❍
Asthma	❍	❍	❍	❍	❍	❍	❍
Infertility or reduced fertility	❍	❍	❍	❍	❍	❍	❍
Gastro-oesophageal reflux disease (GORD)	❍	❍	❍	❍	❍	❍	❍
Gallbladder disease, gallstones	❍	❍	❍	❍	❍	❍	❍
Depression	❍	❍	❍	❍	❍	❍	❍
An anxiety disorder (please specify):	❍	❍	❍	❍	❍	❍	❍

Q21.8 For each health symptom listed below, please select the most fitting statement:

	I have never had this symptom	I had this condition earlier in my life, but not at the time I had bariatric surgery	I had this symptom when I had bariatric surgery, and since my surgery it has gotten much better or has been resolved/ cured	I had this symptom when I had bariatric surgery, and since my surgery I have had little/no improvement	I had this symptom when I had bariatric surgery, and since my surgery it has gotten worse	I began experiencing this symptom after my bariatric surgery	Unsure/ choose not to answer
Low back pain	❍	❍	❍	❍	❍	❍	❍
Joint pain	❍	❍	❍	❍	❍	❍	❍
Indigestion, acid reflux, heartburn	❍	❍	❍	❍	❍	❍	❍
Mobility problems (difficulty with moving around easily)	❍	❍	❍	❍	❍	❍	❍
Skin problems (e.g. inflammation, infections)	❍	❍	❍	❍	❍	❍	❍
Sexual problems (e.g. low sexual desire/libido, erectile dysfunction)	❍	❍	❍	❍	❍	❍	❍
Non-asthma breathing difficulties (e.g. finding it hard to get a full breath)	❍	❍	❍	❍	❍	❍	❍
Excessive tiredness	❍	❍	❍	❍	❍	❍	❍

Q21.9 Please list all medications you are currently taking that have been prescribed for you by a medical practitioner. Please write 'None' if you do not take any:

Q21.10 Please list all over-the-counter (non-prescribed) medications or supplements you currently take (e.g. vitamins, Panadol, cold and flu medication. Please write 'None' or 'N/A' if you do not take any:

Q21.11 In general, would you say your physical health before surgery was:

- ❍ Excellent
- ❍ Very good
- ❍ Good
- ❍ Fair
- ❍ Poor
- ❍ Choose not to answer

Q21.12 In general, would you say your physical health now is:

- ❍ Excellent
- ❍ Very good
- ❍ Good
- ❍ Fair
- ❍ Poor
- ❍ Choose not to answer

Q21.13 In general, would you say your mental health before surgery was:

- ❍ Excellent
- ❍ Very Good
- ❍ Good
- ❍ Fair
- ❍ Poor
- ❍ Choose not to answer

Q21.14 In general, would you say your mental health now is:

- ❍ Excellent
- ❍ Very Good
- ❍ Good
- ❍ Fair
- ❍ Poor
- ❍ Choose not to answer

Q22.1 ABOUT YOU

Q22.2 This information will not be used to identify your responses.

Q22.3 Do you identify as:

- ❍ Male
- ❍ Female
- ❍ Other (please specify): _____
- ❍ Choose not to answer

Q22.4 Your date of birth (please format as dd/mm/yyyy):

Q22.5 Your home postcode:

Q22.6 Your main occupation:

Q22.7 Your current main employment status (please choose one):

- ❍ Employed or self-employed full-time
- ❍ Employed or self-employed part-time
- ❍ Full-time student
- ❍ Unemployed
- ❍ Parent/carer
- ❍ Retired
- ❍ On a government pension, allowance, or benefit (e.g. Disability Support Pension, Workcover)
- ❍ Other (please specify): _____
- ❍ Choose not to answer

Q22.8 Your marital status:

- ❍ Married or defacto relationship
- ❍ Partnered
- ❍ Single
- ❍ Separated or divorced
- ❍ Widow/widower
- ❍ Other (please specify): _____
- ❍ Choose not to answer

Q22.9 Besides you, who else lives in your home? (e.g. husband, daughter, mum, housemate, live alone)

Q22.10 Who buys most of the groceries in your household? (e.g. me, parents, partner, son)

Q22.11 Who does most of the cooking in your household? (e.g. me, parents, partner, son)

Q22.12 Including all income, what is your approximate total household income (before tax and other deductions)?

- ❍ $2000 or more per week ($104,000 or more per year)
- ❍ $1500-1999 per week ($78,000-103,000 per year)
- ❍ $1000-1499 per week ($52,000-77,999 per year)
- ❍ $600-999 per week ($31,200-51,999 per year)
- ❍ $300-599 per week ($15,600-31,199 per year)
- ❍ $1-299 per week ($1-15,599 per year)
- ❍ Nil or negative income
- ❍ Choose not to answer
- ❍ Unsure

Q22.13 What is your highest completed level of education? (e.g. Year 9, finished high school, apprenticeship, Master's degree)

Q23.1 Thank you very much for giving so much time and effort to participate in this study! We really appreciate your help. Please feel free to contact Melissa Opozda at melissa.opozda@adelaide.edu.au or on 04XX XXX XXX with any feedback or questions about this study.

If you would like further information or assistance regarding any of the issues mentioned in this survey, please speak to your GP or refer to the organisations listed on this sheet (click link to save/open).

Appendix H: Paper 1 (Clinical Obesity, 2015) published article

clinical obesity

doi: 10.1111/cob.12104

Review

The eating-related behaviours, disorders and expectations of candidates for bariatric surgery

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Received 25 November 2014; revised 13 May 2015; accepted 21 May 2015

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Summary

It is important that clinicians and researchers understand the possible eating-related difficulties experienced by pre-bariatric surgery candidates, as well as their expectations of how their eating and hunger will change after surgery. This review examines English-language publications related to the eating-related behaviours, disorders and expectations of bariatric candidates. Seventy-five articles related to binge eating disorder, grazing, night eating syndrome, emotional eating, food cravings and addiction, and pre-surgical expectations of post-surgical eating in this population were critically reviewed. A variety of often problematic eating behaviours appear more common in bariatric candidates than in non-obese populations. The literature suggests that 4–45% of candidates may have binge eating disorder, 20–60% may graze, 2–42% may have night eating syndrome, 38–59% may engage in emotional eating and 17–54% may fit criteria for food addiction. Binge eating may also be more prevalent in bariatric candidates than in similarly obese non-surgical individuals. Expectations of surgery are high, with pre-surgical candidates believing their bariatric procedure will virtually guarantee significantly improved eating behaviours. Study replications are needed, and further investigation into prevalence, impacts and candidate characteristics related to disordered eating behaviours, as well as candidates' expectations of eating after surgery, will be important. Further comparisons of bariatric candidates to similarly obese non-bariatric populations will be important to understand eating-related characteristics of candidates beyond those related to their weight. Future research may be improved by the use of validated measures, replicable methodologies, minimization of data collected in circumstances where respondents may been motivated to 'fake good', use of prospective data and consistent definitions of key terminology.

Keywords: Bariatric surgery, candidates, eating, eating disorder.

Introduction

Bariatric surgery is the most effective long-term treatment currently available for severe obesity, resulting in significantly greater, longer-term weight loss than non-surgical interventions such as diets, exercise and pharmacological measures (1). It is recommended for well-informed individuals with a body mass index (BMI) ≥ 40 or 35 to <40 with serious obesity-related comorbidities (2), for whom non-surgical measures have failed to result in significant, sustained weight loss, and as a first-line treatment for adults with a BMI >50 (3).

The most common current bariatric operations are Roux-en-Y gastric bypass (RYGB), laparoscopic adjustable

gastric banding (LAGB) and sleeve gastrectomy (SG). These surgeries either reduce the volume of the stomach to restrict food intake and induce earlier satiety (LAGB, SG, RYGB) or combine this restriction with malabsorption, altering the digestive processes to reduce the body's absorption of calories and nutrients (1). However, the full mechanisms may be much more complex, also potentially involving hormonal, inflammatory, central nervous system and gut microbial factors (4). After bariatric surgery, patients are expected to develop and maintain various recommended eating-related behaviours including eating small portions, chewing food slowly and thoroughly, avoiding carbonated, alcoholic and high-calorie drinks, high-fat, high-sugar and other poorly tolerated foods, increasing their water intake, taking vitamins and avoiding binge eating, grazing or snacking (5,6).

To provide optimal care and education, and improve well-being, it is important that researchers and clinicians understand the potentially distressing and problematic eating-related issues commonly experienced before surgery and bariatric candidates' expectations about how surgery will affect their eating and hunger. The aim of this review is to provide a critical evaluation of current literature on eating-related issues in pre-surgical bariatric candidates.

Method

Relevant English-language research papers, published between January 1960 and October 2014, were identified in PubMed using the string *bariatric* and *eating*, *hunger*, *disorder*, *expectation*, *binge*, '*night eating*', '*emotional eating*', *appetite*, *craving*, *addiction* or *experience*. This initial search found 3238 matches, which decreased to 1541 matches after filtering those results to include only articles from 1960 onwards, English-language publications and adult, human studies. The abstract of each of the 1541 articles was manually checked, with full-text downloaded for appraisal if articles appeared potentially relevant. Articles were included in this review if they reported primary data in a peer-reviewed journal related to bariatric candidates' pre-surgical binge eating, night eating, emotional eating, grazing, food cravings and addiction or pre-surgical eating-related expectations, were English-language publications of human adult participants and presented standalone pre-surgical data (studies including pre-surgical data which could not be interpreted without the context of post-surgical data were not included). Qualitative, quantitative and mixed-method studies were included, and review articles, theoretical papers, meta-analyses, unpublished data, dissertations, studies of post-surgical eating and articles not relevant to the research topic were excluded. Nine articles which appeared relevant based on their abstracts were unable to be retrieved as full-text publications, and therefore were not included. Furthermore, manual searches were performed on article reference lists, journal websites and relevant authors to identify additional articles suitable for inclusion.

A total of 75 articles fitting these criteria were identified and are reviewed in this paper. They are presented in six sections: binge eating disorder (BED), grazing, night eating syndrome, emotional eating, food cravings and addiction, and pre-surgical expectations of post-surgical eating. The tables present information on each article to summarize them and to inform critical analysis, focusing on key methodological issues including sample characteristics, methodology and measures utilized, implications of the study design, and potential biases and generalizability, as well as noting key findings including prevalence, demographic findings and associations with other traits.

Binge eating disorder

A total of 47 articles investigating pre-surgical BED were identified and are presented in Table 1. According to the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (57), a diagnosis of BED requires recurrent (at least once a week for 3 months) episodes of eating, during discrete periods of time, amounts of food definitely larger than most people would eat under similar circumstances and within that amount of time, plus three or more of the following: eating much more quickly than usual, until uncomfortably full, eating large amounts of food when not physically hungry, eating alone because of embarrassment about the amount of food being eaten and feeling disgusted, depressed or very guilty after a binge. The individual must also feel a lack of control over the eating during binges and experience significant related distress. In comparison with prevalence estimates of 1 and 3% in European and US adults (58,59), current BED rates of 4.2 to 44.5% have been reported in pre-bariatric surgery candidates (7,10,11,14–16,18–26,28,30–32,35–38,40,41,44–46,48,53,54). Colles *et al.* (16,18) reported higher rates of binge eating and BED in candidates than in a general community sample of individuals who were not trying to lose weight.

Investigations of BED and binge eating symptoms in bariatric candidates have reported on potential differences related to a variety of demographic characteristics, with mixed findings related to gender (8,34,41,43–47,51,54) and BMI (8,13,31,41,45,47,51,56). However, studies reporting on age (8,31,34,45,47,51) and ethnicity (12,29,42,45) have consistently found no differences related to binge eating, and a single study by Lavender *et al.* also found no difference by candidate education level (34). One investigation found that candidates with BED were more likely to be married or in a *de facto* relationship (45).

A majority of studies comparing BED in bariatric candidates with other population groups have found that

Table 1 Summary of characteristics of included studies on binge eating

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Abiles *et al.* (2013) (7)	110	70.0	41 (9)	49.1 (9.0)	Prospective observational study of consecutive surgery candidates in one hospital, participants underwent psychosocial assessment, before twelve 2-h group CBT sessions (participants had to lose 10% of their initial weight and complete CBT to be accepted for surgery), then additional individual assessment to detect current problematic behaviours/symptoms and 12 months of weekly hour-long sessions and caloric restriction; at this stage, suitability for surgery was assessed	CEDD44-B (stress measure), Abbreviated Scale of Anxiety and Depression, RSE, Quality of Life Index, Family APGAR scale, FCQ-T, EDE-Q	Pre-CBT 44.5% had BED, post-CBT 31.8% had BED; at baseline, candidates with BED had higher BMIs ($P = 0.002$); pre-CBT, those with BED reported greater concern with weight, shape and food than those without BED ($P < 0.005$), post-CBT no differences were found between the groups on any EDE-Q subscale; both before and after CBT, BED candidates made more plans to consume food, were more concerned about food, felt more physiological hunger, fear and guilt, and experienced more eating-related cues compared with non-BED candidates ($P < 0.005$), post-CBT, improvement in all subscales was seen in the overall sample vs. pre-CBT ($P < 0.005$); at baseline, BED patients had greater depression and anxiety and lower self-esteem and quality of life than non-BED patients ($P < 0.05$), differences regarding depression and self-esteem were not seen post-CBT due to improvements among the BED patients, but persisted in anxiety and quality of life
Adami *et al.* (1995) (8)	43 with BED 20 with binge eating syndrome 29 non-binge eaters	74.4 60.0 75.9	38 (2) 38 (2) 36 (2)	46.3 (1.9) 47.6 (1.9) 41.0 (1.8)	Participants bariatric surgery candidates interviewed by trained investigator, completed questionnaires; categorized by binge eating status after assessment	Semi-structured clinical interview designed to Spitzer *et al.*'s (9) criteria for binge eating syndrome and BED, TFEQ, EDI, questions on body weight changes over lifetime	No group age or sex differences; binge groups had higher BMI than non-binge eaters ($P < 0.04$); binge eating syndrome and BED patients had greater history of dieting/weight changes than non-binge eaters ($P < 0.03$, $P < 0.04$); non-bingers had lower disinhibition and hunger than binge eating syndrome ($P < 0.009$, $P < 0.002$) and BED ($P < 0.002$, $P < 0.001$) patients; binge eating syndrome and BED also had higher bulimia-related traits ($P < 0.03$, $P < 0.003$), interoceptive awareness ($P < 0.02$, $P < 0.03$), ineffectiveness ($P < 0.005$, $P < 0.05$) and maturity fears ($P < 0.04$, $P < 0.008$), drive for thinness, body dissatisfaction, perfectionism and interpersonal distrust (statistics not reported for these items)
Adami *et al.* (1999) (10)	63	76.2	37.6 (19–61)	46.9 (not reported)	Structured interview designed by the researchers, administered pre-surgery and at 1, 2 and 3 year follow-ups	BED assessed according to Spitzer *et al.*'s (9) criteria	42.8% met diagnostic criteria for BED

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Allison *et al.* (2006) (11)	210	81.9	44.4 (10.7)	50.4 (8.1)	Measures as part of pre-surgical assessment; those who reported overeating, loss of control and distress underwent a supplemental semi-structured clinical interview by psychologist or psychiatric nurse to ensure participants consumed objectively large amounts of food, met diagnostic frequency criteria and assessed compensatory behaviours; diagnoses confirmed by case review	Self-report WALI, which contains the QEWP-R; participants endorsing binge eating symptoms interviewed to establish diagnosis	By self-report, 16.7% fit criteria for BED; just 4.2% fit criteria when assessed by semi-structured clinical interview
Azarbad *et al.* (2010) (12)	137 Caucasian candidates 212 African American candidates 35 Hispanic candidates	100.0 100.0 100.0	44.6 (10.8) 40.1 (9.9) 39.3 (8.8)	49.0 (8.6) 51.7 (9.7) 47.6 (7.2)	Measures and interview completed as part of pre-surgical psychosocial evaluation	BES to measure severity (severe at score ≥27), plus psychosocial interview including evaluation of binge eating behaviours to establish diagnosis	Caucasian participants were older and average African American BMI was higher than the other two groups; Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV diagnostic criteria met by 15.7% of Caucasians, 11.5% of African Americans, 11.8% of Hispanic women; no group differences found in past ($P = 0.61$) or current BED diagnosis ($P = 0.53$); three groups did not differ in binge eating symptomatology ($P = 0.63$), although Caucasians exhibited more binge eating symptoms than African Americans ($P = 0.045$); no differences (Caucasians: 9.5%, African Americans: 7.5%, Hispanic: 5.7%) in the proportions of severe binge eaters ($P = 0.70$)
Brunault *et al.* (2012) (13)	34	79.4	38.5 (11.0)	55.3 (10.2)	Patients assessed at pre-surgical visit and at 12 months post-surgery	BITE	Preoperative BMI was not associated with binge eating ($P = 0.69$)
Castellini *et al.* (2014) (14)	27 LAGB candidates 30 RYGB candidates 26 biliopancreatic diversion candidates	83.2 93.3 92.3	43.9 (11.4) 43.6 (9.8) 48.8 (8.4)	44.8 (5.3) 49.5 (6.8) 50.6 (6.6)	Patients interviewed pre-surgery as part of routine clinical assessment and again at 12 months post-surgery	BES	26.5% had BED; no difference in binge eating severity by forthcoming type of bariatric surgery

Castellini *et al.* (2014) (15)	394 surgical candidates 683 non-surgical weight loss treatment clinic patients	73.4 80.1	44.9 (11.4) 46.7 (13.8)	44.6 (8.3) 37.8 (6.9)	Diagnosis and clinical assessments were part of routine clinical assessments; patients interviewed by clinician using the SCID to assess lifetime BED and Axis I disorders and number of weekly objective and subjective binge episodes using questions from EDE-I and DSM-5; BED diagnosis made using DSM-5 criteria	SCID, EDE-Q, BES	31.8% of surgical candidates, 25.5% of non-surgical weight loss patients had BED ($P < 0.05$); surgical candidates had more objective and subjective binge eating episodes per month than non-surgical patients (both $P < 0.01$); subjective binge eating associated with higher emotional eating in the surgical ($P < 0.01$) and non-surgical groups ($P < 0.001$); even after adjusting for BMI, subjective binge eating episodes associated with emotional eating in the overall sample
Colles *et al.* (2007) (16)	180 surgical candidates 93 members of a non-surgical weight loss group 158 community respondents	78.3 91.4 78.5	44.8 (11.2) 55.1 (12.4) 41.3 (13.5)	44.5 (6.8) 32.7 (7.3) 24.8 (5.1)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group and bariatric surgery candidates; candidates screened for binge and night eating behaviours, then interviewed by non-blinded clinician if behaviours detected; binge eating classified if ≥1 binge per week plus distress related to loss of control	NES measure constructed using Stunkard et al. (17) criteria, QEWP-R to assess BED, semi-structured interview for all surgical candidates and those other respondents reporting binge or night eating characteristics	After confirmatory interview, 24.4% of surgical candidates were binge eaters, 5.4% in the support group, 1.9% in the community sample; rates significantly different between all groups ($P < 0.001$); 4.4% had comorbid NES and binge eating
Colles *et al.* (2008) (18)	180 surgical candidates 93 members of a non-surgical weight loss group 158 community respondents	78.3 91.4 78.5	44.8 (11.2) 55.1 (12.4) 41.3 (13.5)	44.5 (6.8) 32.7 (7.3) 24.8 (5.1)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group, and bariatric surgery candidates; candidates screened for binge eating behaviours and then interviewed by non-blinded clinician if behaviours detected; BED diagnosed at ≥2 objectives binges per week plus significant distress related to loss of control	QEWP-R plus semi-structured interview using DSM-IV criteria to confirm diagnosis	Highest proportion with BED in surgical group (17.8%), followed by support group members (3.2%), and community respondents (1.9%; $P < 0.001$)

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Collies *et al.* (2008) (19)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into bariatric surgery programme invited to participate; prospective observational data collected pre- and 12 months post-surgery	QEWP-R plus semi-structured clinical interviews for confirmation, TFEQ, CCV-FFQ, BDI, MBSRQ	BED diagnosed in 14.0% of candidates; those with BED had higher depressive symptoms ($P = 0.033$), appearance dissatisfaction ($P = 0.05$), dietary disinhibition ($P < 0.001$), hunger ($P < 0.001$), more frequent eating ($P = 0.001$), greater energy intake ($P = 0.023$), higher proportion of fat in their diet ($P = 0.006$)
Crowley *et al.* (2012) (20)	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluation for bariatric surgery including semi-structured clinical interview and questionnaires; also assessed by dietitian	FCQ-T; interviewed about past and present binge eating behaviours – 'specific questions differed according to clinician but generally included questions like, [. . .] "Has there ever been a time when you've eaten a large quantity of food in a short period of time with a sense of loss of control?" (p. 368)	12.3% engaged in binge eating behaviours; binge eaters had more intentions/plans to eat craved foods ($P = 0.01$), felt less control over their eating ($P = 0.003$), experienced more physiological hunger ($P = 0.03$), felt greater emotion before or during cravings or eating ($P = 0.005$), felt more guilt related to having/giving into cravings ($P = 0.008$); no group differences in cues triggering food cravings, food preoccupation, or anticipation of positive or relief from negative states/feelings from eating
de Man Lapidoth *et al.* (2008) (21)	54 surgical candidates 46 non-surgical weight loss patients	75.9 67.4	40.3 (9.1) 45.3 (12.9)	46.7 (5.9) 39.3 (6.5)	Participants informed about study at last pretreatment assessment, asked to complete and return questionnaires before treatment; participants classified as having BED if ≥1 objective binge episode per week during the previous 3 months	EDO questionnaire, SF-36, CPRS-S-A	Surgical patients were younger ($P = 0.032$) and heavier ($P < 0.001$) than non-surgical patients; no difference in proportion of binge eating in surgical (13.0%) vs. non-surgical (26.1%) patients
de Zwaan *et al.* (2003) (22)	110	87.3	39.6 (19–62)	48.4 (35.4–86.9)	Consecutive candidates for RYGB were sent questionnaires before being scheduled for a pre-surgery evaluation	Eating Disorders Questionnaire, EDE-Q, QEWP-R, TFEQ, RSE, Inventory of Depressive Symptoms, IWQOL-Lite	17.3% fit criteria for BED, none were male; candidates with BED did not differ from those without BED on BMI, but more saw themselves as 'extremely' fat (90 vs. 54%; $P = 0.04$) and had a lower desired weight ($P = 0.001$); those with BED had greater eating ($P < 0.001$), shape ($P = 0.01$), and weight ($P = 0.03$) concern and disinhibition and hunger (both $P < 0.001$), but were no different in dietary or cognitive restraint, self-esteem and depressive symptoms

Diaz *et al.* (2013) (23)	45	71.4	40 (11)	44.4 (4.6)	Patients underwent routine pre-surgical assessment and were assessed for BED during their postsurgical hospital stay; patients classified as no binge eating if they had no BED or <1 binge episode/week, or as having BED if they had at least one binge/week; patients reassessed at 6, 12, 18 and 12 months post-surgery	Participants completed the QEWP-R on their third day after surgery	21.4% ($n = 9$) were identified as having BED; 5 patients binge ate twice a week, 4 reported binge eating once a week
Dymek-Valentine *et al.* (2004) (24)	168	85.9	39.5 (9.3)	50.8 (9.2)	Measures administered within psychological portion of pre-surgical evaluation	QEWP-R, eating disorders module of the SCID administered by clinical psychologist	BED diagnosed in 26.8% of candidates using the QEWP-R and 14.3% using the SCID; 56.0% denied binge eating behaviours with the QEWP-R, 67.9% denied this with the SCID
Elder *et al.* (2006) (25)	249	82.7	43.5 (10.6)	51.4 (10.6)	Study comparing QEWP-R and EDE-Q for assessing binge eating in bariatric candidates; measures completed within routine pre-surgery assessment; 'recurrent' binge eating classified at ≥1 objective binge per week	QEWP-R, EDE-Q, BSQ, BDI, RSE	Measures identified similar number of patients with recurrent binge eating: EDE-Q: 20.7%, QEWP-R: 23.2%, but agreement was modest ($k = 0.26$); at ≥2 binges/week, agreement was poor ($k = 0.05$, EDE-Q: 8.9%, QEWP-R: 13.9%); those identified on either or both measures as recurrent binge eaters reported greater psychopathology; recurrent binge eaters on the EDE-Q but not QEWP-R reported greater eating, weight, and shape concern and global disordered eating, body dissatisfaction, and depression; QEWP-R only recurrent binge eater group found greater eating and weight concern and global disordered eating only
Friedman *et al.* (2008) (26)	94	73.4	47.8 (11.8)	47.8 (8.0)	Completed measures and interview as part of pre-surgical evaluation; diagnoses made after interview based on DSM-IV criteria	Stigmatizing Situations Inventory, BDI, RSE, BES, SCL-90-R, BSQ, plus semi-structured clinical interview by psychologists or interns	25% met criteria for current BED; weight stigmatization associated with a current diagnosis of BED ($P = 0.027$)

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Gradaschi *et al.* (2013) (27)	75 surgical candidates 75 non-surgical treatment seekers	60.0 66.7	42.7 (11.3) 50.9 (14.5)	40.2 (4.1) 40.2 (4.6)	Comparison of bariatric surgery candidates and non-surgical (weight loss programme) treatment seekers; no group differences in mean weight and BMI	'Each patient was regarded as having a binge eating disorder when clinically meeting the standard diagnostic criteria' (9); 'subjects were requested to state whether they have emotional eating or tend to lose control over food intake' (p. 35)	Surgical candidates (22.7%) more likely than those beginning a non-surgical weight loss programme (6.7%) to have BED ($P = 0.004$)
Hayden *et al.* (2014) (28)	204	82.4	45.2 (11.5)	42.7 (6.1)	Consecutive eligible bariatric candidates invited to take part, emphasized this would not affect their medical treatment/surgery; attended face-to-face interview assessment with trained researcher or psychologist an average 4.6 weeks before surgery and 101.2 weeks post-surgery	SCID for DSM-IV	13.7% had a lifetime history of BED, 13.6% fit criteria for current BED diagnosis
Hood *et al.* (2011) (29)	142 RYGB candidates 130 LAGB candidates	83.1 88.5	44.0 (11.4) 44.7 (10.2)	50.1 (8.9) 47.1 (6.6)	Patients assessed during routine pre-surgical evaluation by a psychologist	BES, BDI	RYGB candidates had higher BMI and fewer years of education than LAGB candidates ($P < 0.05$); RYGB candidates had more binge eating symptoms than LAGB candidates, and African American RYGB candidates reported more binge eating symptoms than African American LAGB candidates (no differences in Caucasian candidates), but differences were not significant after controlling for higher BMI and lower education in RYGB candidates
Jones-Corneille *et al.* (2012) (30)	44 with BED 61 without BED	78.7 77.3	44.7 (9.9) 47.9 (10.0)	50.4 (7.2) 49.1 (7.4)	Comparison of candidates with and without BED, recruited by QEWP pre-surgery assessment result	QEWP, EDE-I administered by blinded assessors to assess BED, then SCID by telephone to assess Axis I disorders	34.4% (62 of 180 who completed the EDE) had BED; candidates with BED more likely than those without BED to have a current (27.3% vs. 4.9%, $P = 0.002$) or lifetime (52.3% vs. 23.0%, $P = 0.003$) mood disorder, or current (27.3% vs. 8.2%, $P = 0.014$) or lifetime (36.4% vs. 16.4%, $P = 0.019$) anxiety disorder; also had greater depressive symptoms and lower self-esteem

Kalarchian *et al.* (1998) (31)	64	76.6	Not reported for overall sample	52.0 (36.6–73.7)	Measures completed within initial pre-surgical appointment; binge eating classified using a cut-off of ≥1 binge per week	BDI, TFEQ, EDE	39.1% of candidates classified as binge eaters, no significant differences were seen in age, current BMI, or depressive symptoms (all $P > 0.05$); binge eaters reported greater pre-surgical disinhibition ($P < 0.003$) and hunger ($P < 0.004$) than non-binge eaters; on the EDE, binge eaters reported less eating restraint ($P < 0.005$), greater food/eating preoccupation ($P < 0.04$), fear of losing control ($P < 0.002$), weight dissatisfaction ($P < 0.02$), desire to lose weight ($P < 0.003$), and shape dissatisfaction ($P < 0.01$), and more social eating ($P < 0.002$); using cut-off of ≥2 binges per week, 25.0% were binge eaters
Kalarchian *et al.* (2007) (32)	288	83.3	46.2 (9.4)	52.2 (9.7)	Data collected pre-surgery, independent of preoperative screening/approval	Interviews by psychologists using the SCID	Current BED in 16.0% of candidates, lifetime BED diagnosis in 27.1%
Larsen *et al.* (2004) (33)	93	82.8	39 (22–59)	46.5 (37–67)	Cross-sectional comparison of patients pre-surgery ($n = 93$), and less ($n = 48$) and greater than ($n = 109$) two years after LAGB; participants completed questionnaires	BES (patients scoring >17 considered to have binge eating, researchers found moderate [k = 0.59] agreement with diagnoses based on EDE-I in pilot interviews)	55.9% of pre-surgical patients 'manifested binge eating'
Lavender *et al.* (2014) (34)	68	89.7	42.9 (10.7)	46.5 (6.1)	Participants recruited from those in a previous related study; completed self-report measures and computerized cognitive battery test ≤30 days of surgery and 12 months post-surgery; medical characteristics gathered via self-report and medical record review	SCID, tests of cognitive function (IntegNeuro cognitive test battery), attention/executive function (digit span total, attention switching on computerized Trail Making Test, verbal interference, computerized Austin Maze), memory (verbal list learning), and language (letter/animal fluency)	29.4% had a lifetime diagnosis of BED; no significant differences between those with and without a history of BED in age ($P = 0.89$), gender ($P = 0.07$), education ($P = 0.28$), hypertension ($P = 0.68$), type 2 diabetes ($P = 0.71$), sleep apnoea ($P = 0.14$), hyperlipidaemia ($P = 0.22$) and COPD ($P = 0.35$); participants with history of BED were more likely to have a history of depression ($P = 0.01$); controlling for depression, no difference found between BED and no BED history participants in attention ($P = 0.80$), executive function ($P = 0.83$), memory ($P = 0.64$) or language ($P = .99$)

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Lent and Swencionis (2012) (35)	97 (52 considering surgery, 29 met with doctor/surgeon about surgery, 16 scheduled for surgery)	85.6	41.0 (11.3)	45.2 (8.0)	Participants recruited through advertisements on social networking sites and a website for bariatric surgery candidates, completed questionnaires online	EPQ-R Addiction Scale, Overeating Questionnaire, QEWP-R, Eating Behaviors and Attitudes Questionnaire	22.7% met criteria for BED; participants with BED 'displayed addictive personality scores comparable with individuals addicted to substances' (p. 67)
Lier *et al.* (2013) (36)	127	74.0	41.3 (10.3)	45.3 (5.2)	Assessed within pre-surgical psychiatric evaluation and again at 1-year post-surgery	MINI, SCID-II	10.2% had pre-surgical BED
Lin *et al.* (2013) (37)	455 surgical 386 non-surgical	70.5 67.1	34.1 (10.8) 37.2 (12.4)	39.5 (8.3) 31.2 (7.3)	Comparison of surgical and non-surgical treatment seekers at an obesity treatment centre, review of pretreatment screening data	Psychiatrist interview using the SCID if above cut-off on Taiwanese Depression Questionnaire or Chinese Health Questionnaire	BED diagnosed in 10.3% of candidates; surgical candidates more likely than non-surgical treatment seekers (4.4%) to have BED ($P = 0.001$)
Marek *et al.* (2013) (38)	982	67.0	46.0 (11.6)	49.2 (11.3)	Retrospective review of data collected within routine pre-surgical assessments	MMPI-2-RF plus eating measures including those of BED diagnosis, subjective binges per week, BES and the presence of NES 'using research-based criteria' (p. 1866)	22.1% met criteria for BED; BED diagnosis and more severe binge eating associated with greater emotional/internalizing dysfunction, thought dysfunction, demoralization, low positive emotions, antisocial behaviour, ideas of persecution, dysfunctional negative emotions, aberrant experiences, self-doubt, inefficacy, stress/worry , family problems (all $P < 0.001$), behavioural/externalizing dysfunction, malaise, suicidal/death ideation, substance abuse ($P < 0.05$, $P < 0.001$); more severe binge eating only associated with somatic complaints, cynicism (both $P < 0.001$), hypomanic activation ($P < 0.05$)
Marek *et al.* (2014) (39)	297 with BED 289 BMI-matched controls without BED	71.7 73.4	45.2 (11.7) 45.5 (11.1)	51.1 (11.9) 51.1 (11.6)	Retrospective review of data collected as part of standard pre-surgical procedures; BED diagnosis based on DSM-IV criteria	MMPI-2-RF, BES	Those with BED had greater emotional/internalizing dysfunction ($P < 0.001$), behavioural/externalizing dysfunction ($P < 0.05$), demoralization ($P < 0.001$), low positive emotions ($P < 0.001$), antisocial behaviours ($P < 0.001$), dysfunctional negative emotions ($P < 0.01$), malaise ($P < 0.05$), cognitive complaints ($P < 0.001$), self-doubt, inefficacy, stress/worry, anxiety (all $P < 0.01$), anger-proneness ($P < 0.05$), juvenile conduct problems ($P < 0.001$), substance abuse ($P < 0.01$), family problems ($P < 0.001$), social avoidance, shyness, negative emotionality/neuroticism (all $P < .01$), introversion/low positive emotionality, and binge eating severity (both $P < .001$)

Marek *et al.* (2014) (40)	341		71.6	45.4 (11.8)	50.9 (11.7)	Review of data collected during pre-surgical psychiatric evaluation; every patient reporting a binge eating episode but not diagnosed with BED was coded to determine whether they met DSM-5 diagnostic criteria	MMPI-2-RF, BES	23.2% had BED based on DSM-IV criteria; an additional 3.4% of candidates met diagnostic threshold for BED when using the DSM-5 criteria, overall BED rate increased to 26.6% ($P < 0.001$); DSM-5 diagnosed had more years of education than DSM-IV diagnosed, but did not differ on any other demographic variables; both groups had greater binge eating severity scores and had 'similar' MMPI-2-RF profiles
Mauri *et al.* (2008) (41)	282		79.8	42.1 (11.4)	43.5 (7.0)	Data collected during pre-surgical psychiatric assessment	SCID, BITE	11.0% had a lifetime BED diagnosis, 6.7% had a current diagnosis; BED prevalence did not differ by gender ($P = 0.49$) or BMI class ($P = 0.66$)
Mazzeo *et al.* (2005) (42)	148 African American women 240 Caucasian women	100.0 100.0	37.2 (9.5) 41.5 (11.3)	48.9 (7.6) 47.2 (8.0)		Review of archival data from patient pre-surgical assessments	QEWP, BDI, BES, RSE	33.3% of African American women, 38.6% of Caucasian women, met criteria for BED ($P > 0.05$); no difference in likelihood of having severe binge eating symptoms ($P > 0.05$); depression and self-esteem accounted for significant total and unique variance in BES (binge severity) scores for both groups (both $P < 0.05$); no racial differences found in relationships among depression, self-esteem and binge eating ($P > 0.05$)
Mazzeo *et al.* (2006) (43)	487		84.0	39.9 (11.2)	48.3 (8.2)	Review of archival data from patient pre-surgical assessments	QEWP, BES	No difference in male and female BED rates, assessed by QEWP (26.4% vs. 25.4%, $P > 0.05$); equal likelihood of being classified as severe binge eaters based on BES scores >27 ($P > 0.05$)
Mitchell *et al.* (2012) (44)	199		46.0 (37.5–53.0)	44.9 (median; SD not reported)		Participants from a previous related study were invited to take part; interviewed independent of normal pre-surgical assessments and told data would not be shared with their surgical team	EDE-BSV, IWQOL-Lite, SF-36, BDI	10.1% had current BED (10.3% of females, 8.8% of males), 13.1% had a lifetime BED diagnosis (13.3% of females, 11.8% of males)

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Mitchell *et al.* (2014) (45)	2266	78.6	46 (18–78)	45.9 (median; 33.0–94.3)	Participants in a large multicenter study of bariatric surgery (LABS-2); patients had already been cleared for surgery; baseline data collection ≤30 days before surgery, independent of surgical care; study formulated before DSM-5 finalized, so prior 6 months instead of 3 months assessed as per DSM-IV, but DSM-5 cut-off of one binge/week used; NES diagnosed if evening hyperphagia or nocturnal eating reported	Items in larger survey used to determine BED and NES, BDI, SF-36, IWQOL-Lite, Psychiatric and Emotional Test Survey and Medication Form	15.7% fit criteria for BED; no difference in BED status by sex ($P = 0.36$), age ($P = 0.22$), race/ethnicity ($P = 0.29$), BMI ($P = 0.44$) or smoking status ($P = 0.29$), but those with BED more likely to be married/de facto ($P < 0.01$); participants with BED were more likely to eat when not hungry or when full (both $P < 0.001$), eat more restaurant ($P < .001$) and fast food ($P < 0.01$) meals per week, more likely to have had counselling for emotional/psychiatric problems in past year ($P < 0.001$), to be currently taking medication for emotional/psychiatric problems ($P < 0.001$), and to be treated for depression ($P < 0.001$); those with BED also reported receiving less interpersonal support ($P < 0.001$), had more depressive symptoms ($P < 0.001$) and worse physical ($P < 0.01$) and emotional ($P < 0.001$) quality of life; participants with BED were more than twice as likely to have NES symptoms (31.1% vs. 14.7%, $P < 0.001$)
Muhlhans *et al.* (2009) (46)	146	71.9	38.7 (10.0)	49.3 (7.8)	Psychological assessments up to 6 months before surgery, independent of surgical eligibility assessment	Interviews conducted by psychologists using the SCID and EDE	Current BED in 23.3% of candidates; no significant difference between female (29.5%) and male (7.3%) rates
Müller *et al.* (2012) (47)	22 with BED 68 without BED	77.3 70.6	35.8 (11.2) 38.6 (11.2)	48.4 (7.8) 50.1 (10.3)	Participants asked to participate during routine pre-surgical assessment, assured responses would not influence their surgical candidacy	EDE-Q, BIS/BAS, Effortful Control Scale, PHQ depression scale, Wender Utah Rating Scale for Attention Deficit Hyperactivity Disorder (ADHD)	No differences regarding BMI, age, gender, adult ADHD, anxiety and impulsivity and restraint eating ($P > 0.05$); candidates with BED had greater eating ($P < 0.01$), weight ($P < 0.05$) and shape ($P < 0.05$) concerns, depression symptoms ($P < 0.01$) and lower levels of effortful control ($P < 0.01$)
Noll *et al.* (2010) (48)	150	64.7	42 (11)	46.6 (10.4)	Comparison of candidates and post-surgical patients; all underwent an eating and behaviour interview by a trained investigator	Patients classified as having BED if they fit Spitzer et al. (49) criteria (>2 episodes of binge eating/week for the past 6 months with marked related distress and no purging)	16.0% had BED

Rutledge *et al.* (2011) (50)	70 non-surgical weight loss patients 25 bariatric surgery candidates	16.0 25.7		51.3 (8.7) 53.6 (10.9)	42.0 (6.0) 42.0 (6.0)	Participants were 95 consecutive veterans completing an intake class required for entry into weight control clinic (surgical and non-surgical) services	Single item on binge frequency in MOVE! Questionnaire: 'On average, how often have you eaten extremely large amounts of food at one time and felt that your eating was out of control at that one time?'	88.0% of surgical candidates vs. 82.3% of non-surgical patients engaged in binge eating at least once a week ($P > 0.05$)
Sallet *et al.* (2007) (51)	216	82.4		36.3 (9.6)	45.9 (6.0)	Prospective, longitudinal cohort study; pre-surgical candidates invited to take part in programme of clinical, psychological, physical training and dietary assistance; classified according to lifetime BED: no binge eating, subclinical binge eating (<2 binge episodes per week), BED (≥2 binges per week)	BED assessed via semi-structured interview using SCID for DSM-IV, participants also completed the BSQ, BDI, HAM-A	20.4% had lifetime history (current or past episodes) of BED; no difference in lifetime BED by sex ($P = 0.21$), age ($P = 0.20$), BMI ($P = 98$), or body image distress ($P = 0.34$); BED and subclinical BED groups had significantly higher depression ($P = 0.002$, $P = 0.012$) and anxiety ($P = 0.001$, $P = 0.042$) than the no BED group; BED group had higher anxiety than the subclinical BED group ($P = 0.038$), no difference in depression ($P = 0.20$)
Sandberg *et al.* (2013) (52)	18 with BED 20 with sub-diagnostic' BED 99 without any eating disorder	Not reported		39.8 (8.4) 35.5 (10.1) 42.1 (10.2)	47.2 (6.2) 48.3 (6.2) 47.8 (5.9)	Pre-surgical patients mailed questionnaires; classified BED according to DSM-IV criteria, either no eating disorder, 'subthreshold BED' (not fulfilling one required DSM-IV criterion, either by reduced binge frequency, only having two required additional features, or not feeling related depression/guilt) or BED	EDO questionnaire, SF-12	Mental health-related quality of life significantly lower in those with BED ($P = 0.027$) or subthreshold BED ($P = .016$) than those without an eating disorder; no difference between mental health-related quality of life in those with BED and subthreshold BED; no group differences related to physical health-related quality of life
Sansome *et al.* (2008) (53)	121	86.0		44.6 (11.8)	47.2 (9.7)	Participants recruited to project by surgical programme social worker (convenience sampling); study data collected separate to surgical assessment	BED-related items from QEWP-R, 'included a list of exclusionary purging behaviors' (p. 199)	6.5% prevalence of BED (6 of the 92 who completed the QEWP-R)
Sarwer *et al.* (2004) (54)	90	82.2		43.4 (10.5)	54.9 (11.7)	Review of data from patient pre-surgical psychological evaluations	QEWP	BED in 26.7% of candidates; males (50.0% BED) more likely than females (21.6%) to have BED ($P = 0.013$); an additional 15.6% met subthreshold BED criteria (binge ate <2 times per week)

Table 1 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD)	Methodology	Relevant measure(s)	Relevant outcome(s)
Stout *et al.* (2007) (55)	76 in a weight loss surgery programme 101 in a residential cognitive-behavioural weight loss programme	84% 67%	43.5 (9.1) 48.3 (13.0)	47.6 (6.9) 45.8 (9.0)	All individuals seeking obesity treatment from a therapy-based weight loss programme or a surgical weight loss programme (only those with BMI ≥35) within a specified time period were included	BES	Non-surgical group was significantly older than surgical group ($P < 0.01$); surgical group had significantly more binge eating symptoms ($P < 0.01$)
White *et al.* (2006) (56)	139	89.2	42.4 (10.2)	51.7 (7.9)	Participants invited to participate in research study, completed questionnaires; informed participation would not influence provided care	EDE-Q, BSQ, BDI, RSE	60.4% did not binge eat, 15.8% binged <1 time per week, 13.7% binged 1 to <2 times per week, 10.1% binged ≥2 times per week; no difference in BMI by binge frequency; regular bingers (≥1 per week) had greater depression ($P < 0.001$) and lower self-esteem ($P = 0.001$) than non-bingers (no difference between infrequent and non-bingers); infrequent (<1 per week) and regular binge eaters had more body dissatisfaction ($P < 0.001$, $P = 0.003$) and higher eating concern (both $P < 0.001$), shape concern ($P = 0.004$, $P < 0.001$), and weight concern ($P = 0.003$, $P = 0.002$) than non-binge eaters; no differences between infrequent vs. regular bingers on any variables

BDI, beck depression inventory; BES, binge eating scale; BIS/BAS, behavioural inhibition system and behavioural activation system; BITE, bulimic inventory test, edinburgh; BMI, body mass index; BSQ, body shape questionnaire; CBT, cognitive behavioural therapy; COPD, chronic obstructive pulmonary disease; CPRS-S-A, comprehensive psychopathological rating scale self-rating scales for affective syndromes; EDE-BSV, eating disorders examination – bariatric surgery version; EDE-I, eating disorders examination – interview; CCV-FFQ, cancer council victoria food frequency questionnaire; EDE-Q, eating disorder examination – questionnaire; EPQ-R, eysenck personality questionnaire – revised; FCQ-T, food craving questionnaire – trait; HAM-A, hamilton rating scale for anxiety; IWQOL-Lite, impact of weight on quality of life questionnaire – lite; LAGB, laparoscopic adjustable gastric banding; MBSRQ, multidimensional body self-relations questionnaire; MINI, mini international neuropsychiatric interview; MMPI-2-RF, minnesota multiphasic personality inventory-2 restructured form; NES, night eating syndrome; PHQ, patient health questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; RSE, rosenberg self-esteem scale; RYGB, Roux-en-Y gastric bypass; SD, standard deviation;; SCID, structured clinical interview for DSM-IV; SCL-90-R, symptom checklist-90-revised; SF-12, short-form health survey; SF-36, short form 36 health survey; TFEQ, three-factor eating questionnaire.

bariatric candidates are more likely to have a diagnosis of BED or more severe binge eating symptoms than similarly obese non-surgical individuals. Castellini *et al.* (15) reported that bariatric surgery candidates had more objective and subjective binge eating episodes per month than non-surgical weight loss patients, Colles *et al.* (16,18) found greater proportions of binge eaters in bariatric candidates than in non-surgical weight loss support group members and Stout *et al.* (55) found that pre-surgical candidates reported significantly more severe binge eating symptoms than individuals in a residential therapy-based weight loss programme. Furthermore, Gradaschi *et al.* (27) noted that surgical candidates were significantly more likely than individuals in a non-surgical weight loss programme to have BED and Lin *et al.* (37) reported significantly higher rates of BED in bariatric candidates than in obese non-bariatric treatment seekers. However, two further comparisons of surgical candidates and non-surgical weight loss patients found no differences in the proportions of those with binge eating symptoms (21) and those who reported engaging in binge eating behaviours at least once a week (50).

Many studies have linked BED in pre-bariatric populations with other eating, psychosocial and mental health difficulties. For example, Jones-Corneille *et al.* (30) reported that candidates with BED were more likely to have a mood or anxiety disorder and lower self-esteem than those without BED, and Colles *et al.* (19) found that those with BED had more problematic issues including depressive symptoms, appearance dissatisfaction, subjective hunger and had a higher energy intake than those without BED. Dymek-Valentine *et al.* (24) reported that candidates with BED more often viewed themselves as being 'extremely' fat (although their average BMI did not differ from those without BED), had a lower desired weight and also had greater eating, shape and weight-related concern, and greater dietary disinhibition and hunger. However, there were no differences related to self-esteem or depressive symptoms. Similarly, Adami *et al.* (8) found that those with BED reported greater disinhibition and hunger, perfectionism, drive for thinness and body dissatisfaction, and White *et al.* (56) reported that candidates who were 'regular bingers' (at least one bingeing episode per week) had more severe depressive symptoms, lower body satisfaction and felt more concern about their own eating, shape and weight.

Mitchell *et al.* (45) also found that candidates with current BED were more likely to report problematic eating behaviours, including non-hungry eating, night eating and eating more fast-food meals, were more likely to have undergone recent counselling or medication for an emotional problem, felt they had less interpersonal support, reported more severe depressive symptoms and had worse quality of life. Binge eating has also been linked to more problematic food cravings, including feeling less control over eating, greater bodily hunger and more negative craving-related emotion in a study by Crowley *et al.* (20), while Kalarchian *et al.* (31) also reported more problematic symptoms, including greater disinhibition, hunger, fear of losing control over eating and weight and shape dissatisfaction, in binge eaters, but found no difference in depressive symptoms. In contrast, Mazzeo *et al.* (42) found that depression and lower self-esteem each accounted for significant variance in binge eating severity. Lavender *et al.* (34) found that candidates with a lifetime history of BED were more likely to also have a history of depression, but after controlling for depression found no difference in attention, executive function or language functioning related to lifetime BED status. Friedman *et al.* (26) linked current BED diagnosis with recent experiences of weight stigmatization in bariatric candidates.

Sandberg *et al.* (52) found that mental health-related quality of life, but not physical health-related quality of life, was worse in candidates with BED. Müller *et al.* (47) again found that candidates with BED had greater depression symptoms, as well as greater eating, weight and shape concerns, but found no differences related to adult ADHD, anxiety, impulsivity or restraint eating. Similarly, Sallet *et al.* (51) also noted that bariatric candidates with BED had more severe depression and anxiety symptoms than those without BED, but found no difference in body image distress. Two studies by Marek *et al.* (38,39) linked BED and greater BED severity with a variety of undesirable personality variables including emotional/internalizing dysfunction, antisocial behaviours, self-doubt and family problems and Lent and Swencionis (35) noted that candidates with BED 'displayed addictive personality scores comparable to individuals addicted to substances' (p. 67).

While validated questionnaires and interview schedules such as the self-report Questionnaire on Eating and Weight Patterns – Revised (QEWP-R) (49) and Structured Clinical Interview for DSM Disorders (SCID) (60) are available for use in research and practice, tools using the same diagnostic criteria may yield differing results. Dymek-Valentine *et al.* (24) found much higher rates of BED diagnoses using the QEWP-R than the SCID, which the researchers suggested was due to overestimation by the QEWP-R, while Elder *et al.* (25) noted that agreement between the Eating Disorder Examination – Questionnaire and QEWP-R was 'modest' when identifying those engaging at least one binge eating episode per week, but 'poor' when identifying those with two or more episodes per week. Interpretation of the BED literature is also made more difficult due to the varying criteria previous researchers have used to examine binge eating in candidates. The DSM-IV BED criteria required two binge eating episodes per week in the preceding 6 months for diagnosis (along with additional other diagnostic criteria such as loss of control and marked

related distress continued in the DSM-5), rather than the DSM-5 criteria of one per week over the preceding 3 months. Even before publication of the DSM-5, a number of researchers had suggested that once a week binge episode frequency was a more clinically significant cut-off, questioning the twice weekly frequency criterion (25,56).

Accordingly, researchers have used various methods and criteria to assess BED and binge eating symptoms in candidates (see Table 1). Some used a cut-off of one binge episode per week, others diagnosed BED at two or more binges per week and a number compared both cut-offs. Other researchers compared 'full' BED with concepts such as 'binge eating syndrome' described by Adami *et al.* (8) as 'frequent binge eating episodes plus at least two behavioral indicators or loss of control' (p. 46) or 'subdiagnostic BED' (52), which required participant endorsement of one less criterion than required for diagnosis under the DSM-IV criteria – either reduced binge frequency, endorsing only two behavioural criteria, or not feeling depressed or guilty about binges. Marek *et al.* (40) investigated the potential impact of the differing DSM-IV and DSM-5 criteria on BED diagnostic rates, finding that an additional 3.4% of candidates in their sample would have received a BED diagnosis using DSM-5 criteria. Utilizing multiple methods to assess BED, including a standardized clinical interview to confirm diagnosis, may be advisable (19). Future research will also be improved with consistent use of replicable, validated, consistent methods. For example, while Adami *et al.* (10) used existing criteria to diagnose BED, their questions were 'asked with the most appropriate methodology according to the subject's personal background and the clinical sensitivity and experience of the interviewer' (p. 366). Assessment protocol standardization is important.

Attention should also be paid to ensuring that blinded, appropriately trained assessors assess candidates and all attempts should also be made to minimize candidates 'faking good'. If questioned as part of their pre-surgical eligibility assessment, candidates may feel the need to downplay their symptoms to appear a better candidate for surgery. This bias may be able to be minimized via methodologies such as those used by Muhlhans *et al.* (46) and Kalarchian *et al.* (32), who, among other researchers listed in Table 1, collected their data separate to candidates' pre-surgical assessments and emphasized that their answers would not influence their eligibility for surgery, or Colles *et al.* (19), who invited candidates who had already been assessed and accepted for bariatric surgery to participate in their study. Additionally, the particular mode of questioning may also have an influence on whether or how much candidates underreport symptoms and should be considered, with Dymek-Valentine *et al.* (24) suggesting that candidates may feel more pressure to appear 'psychologically healthy' during a face-to-face interview with a psychologist than when filling in questionnaires by themselves, even if both are used to assess a candidate's suitability for surgery. Studies utilizing pre-surgical assessment data may need to account for these potential sources of bias.

Grazing

As shown in Table 2, seven publications were identified that had investigated grazing (defined by Colles *et al.* (19) as continuous consumption of small amounts of food over an extended period of time, resulting in subjective overconsumption) in bariatric candidates. Grazing has received minimal research attention to date and little is known about its incidence and impact (65). The literature suggests that 19.5 to 59.8% of bariatric candidates may graze (19,61–63,65), although no studies were found to have compared grazing in candidates to grazing in other populations. Mazzeo *et al.* (43) found no difference in the proportion of male and female candidates who grazed, while Colles *et al.* (19) noted that pre-surgical grazing was associated with lower dietary restraint, greater disinhibition and hunger, and Saunders *et al.* (63,66) linked grazing to severe binge eating behaviours.

Interestingly, Conceicao *et al.* (65) have suggested that grazing may not actually be a disordered eating issue, noting that 'the evidence points to this being a rather common eating behavior that tends to interfere with weight control in specific populations, but there are no clear data to suggest that it should be considered a psychopathological behavior' (p. 980). Further investigation into prevalence, patterns and impacts of pre-bariatric grazing will be an important step to understand the potential importance of this eating behaviour.

Grazing is not listed in the DSM, and until recently, the only identified, published assessment measures were the Eating Disorder Examination (67), which contains one item about 'picking' or 'nibbling' between meals and snacks, and the Structured Interview for Anorexia and Bulimia (68), containing items assessing grazing as a form of binge eating, labelled 'atypical binges extending over a larger period of time' (69). The assessment methods used to date in bariatric candidate grazing research can be seen in Table 2, and have often comprised single items composed by the researchers, added to existing measures of disordered eating. This lack of consensus in definition and assessment of grazing to date has been problematic for understanding this behaviour and may have contributed to the limited research attention to date (69,70). However, two research teams have recently developed new measures of grazing (69,70) with both aiming to assess multiple aspects of grazing identified as important in the literature. The measures differ slightly, with Lane and Szabo (69) including a sense of loss of control and Conceicao *et al.* (70) proposing two distinct grazing subtypes: one compulsive, characterized by a lack of control over the eating, and

Table 2 Summary of characteristics of included studies on grazing

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Burgmer *et al.* (2005) (61)	149	68.5	38.8 (10.3)	50.9 (8.1)	Assessments before surgery, after admission to hospital, and 12 months post-surgery	SIAB, short version, administered by trained, monitored professionals	Current grazing rate of 19.5%, lifetime prevalence 24.2%
Busetto *et al.* (2002) (62)	280	72.3	37.6 (10.8)	46.6 (7.1)	Eating behaviours assessed in pre-surgical suitability assessment; patients followed-up (eating not reassessed) to 3 years post-surgery	Evaluated by internist or psychologist, classified nibbling 'if patient 'ate small quantities of foods repetitively between meals, typically triggered by inactivity and/or loneliness' (p. 84)	Current 'nibbling' rate of 42.7%
Colles *et al.* (2008) (19)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into bariatric surgery programme invited to participate; prospective observational data collected pre- and 12 months post-surgery	QEWP-R, one item on grazing based on Saunders (63,64) definition, plus semi-structured clinical interviews for confirmation of behaviours, CCV FFQ, TFEQ, BDI, MBSRQ	26.4% grazed; grazing related to lower dietary restraint ($P = 0.025$) and greater dietary disinhibition ($P < 0.001$) and hunger ($P = 0.034$)
Conceicao *et al.* (2014) (65)	61 (pre-surgical sample)	Not reported	Not reported	44.5 (5.3)	Cross-sectional study of LAGB and RYGB candidates pre-surgery, and 6, 12, and 24 months post-surgery	Diagnostic items in the EDE-BSV, administered by trained therapists	29.5% had 'picking or nibbling' behaviours
Mazzeo *et al.* (2006) (43)	487	84.0	39.9 (11.2)	48.3 (8.2)	Review of data from pre-surgical assessments	QEWP and BES; unspecified measure of grazing	No sex difference in grazing ($P > 0.05$)
Saunders *et al.* (1998) (66); Saunders *et al.* (1999) (63)	125	88.8	39.4 (10.4)	49.3 (7.8)	Self-report measures completed at initial pre-surgery appointment	One item on grazing was added to the QEWP by the researchers, BES	59.8% grazed in previous 6 months; grazing related to severe binge eating ($P < 0.01$) as assessed by the BES; 49.3% grazed 2–3 days per week

BDI, beck depression inventory; BES, binge eating disorder; BMI, body mass index; CCV FFQ, cancer council victoria food frequency questionnaire; EDE-BSV, eating disorder examination – bariatric surgery version; LAGB, laparoscopic adjustable gastric banding; MBSRQ, multidimensional body-self relations questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, Roux-en-Y gastric bypass; SD, standard deviation; SIAB, structured interview for anorexia and bulimia nervosa; TFEQ, three factor eating questionnaire.

one non-compulsive, involving more distracted eating. These measures will require further investigation, comparison and validation in populations including bariatric patients, but are likely to play a vital role in better understanding of grazing in bariatric candidates.

Night eating syndrome

Twelve studies examining night eating syndrome (NES) in bariatric candidates were identified and are summarized in Table 3. NES was newly included in the DSM-5 under the category of 'other specified feeding or eating disorder' and is described as recurrent episodes of night eating, either after waking from sleep during the night or excessive food consumption after dinner, which the individual is aware of and can recall, and which cause significant distress or impairment (57). In comparison with general population prevalence estimates of 1.5% (77), studies have found that between 1.9 and 41.7% of bariatric candidates have current NES (10,11,16,19,38,45,71–75). It is unclear whether NES rates differ between bariatric candidates and other populations, with Colles *et al.* (16) finding higher NES rates in bariatric candidates than in a weight loss support group and a community sample, while Ronchi *et al.* (76) noted no difference between the night eating traits of bariatric candidates and non-surgical (behavioural) weight loss patients.

The comorbidity of NES and BED in bariatric candidates has been highlighted in several investigations. Colles *et al.* (19) reported a significant positive correlation between these eating patterns, Adami *et al.* (10) found that all of the 7.9% of candidates in their study who had NES also had BED, Colles *et al.* (16) noted 4.4% comorbidity of the two issues and Mitchell *et al.* (45) reported that those with BED were more than twice as likely to have NES symptoms. Investigation into potential implications of this comorbidity is needed. Attention should also be paid to studying demographic characteristics related to NES in candidates, as only Colles *et al.* (19) have done so to date, noting that male candidates were more likely than female candidates to have NES. Just one study was found to have investigated relationships between NES and personality, with Marek *et al.* (38) finding that NES diagnosis was associated with increased dysfunctional thinking, somatic complaints and aberrant experiences. Additional research links with other psychological and eating-related issues and traits will be an important step in understanding NES and its comorbidities and impacts in bariatric candidates.

Understanding of NES in candidates has also been impeded by problematic variations in definition, assessment and non-replicable methodologies. As noted, retrospective ratings of pre-surgical eating may be subject to recall bias, and the two studies, both by Hsu *et al.* (73,74), which used candidates' post-surgical recollections of their own pre-surgical night eating symptoms for diagnosis, found the highest rates of pre-surgical NES (33.3% and 41.7%). However, these publications also did not specify their particular methods used to assess NES. In addition, a number of studies (11,38,72,75) used data collected as part of pre-surgical psychological assessments, which may be influenced by candidates' conscious or unconscious attempts to appear 'psychologically well' in the hope of qualifying for surgery. All of these potential biases make interpretation and comparison within the literature difficult. In addition, there were small actual numbers of candidates with NES in all of the identified studies, and although potentially challenging, future studies containing larger samples of individuals with NES will be important for better understanding this issue.

A further difficulty in interpreting the existing literature lies in the fact that definitions of NES have varied by researcher and over time, with little consensus. NES was not included in the DSM prior to the recent DSM-5. As Table 3 shows, the majority of researchers in the pre-surgical literature to date either constructed their own unspecified measures of NES based on the Stunkard *et al.*'s (17) criteria (10,16,19) or used other unspecified questions (73,74) or unreferenced questionnaires (75).

However, two recent developments are likely to assist consistent assessment of NES. First is the publication of the Night Eating Questionnaire (NEQ), a measure developed and evaluated by Allison *et al.* (71,72) in populations including bariatric candidates to measure the severity of NES symptoms. However, the authors note that assessments of actual food intake (24-h recall and/or use of food diaries) may be a necessary adjunct to improve the validity of symptom assessment when using the NEQ (71,72). Second is the recent publication of a consensus paper (78) outlining core diagnostic criteria for NES: consumption of >25% of daily food intake after the evening meal in the evening and/or night-time, at least twice a week, with awareness and recall of the eating episodes and distress or impairment of functioning, plus at least three of the following: lack of desire to eat in the morning >4 times per week, the strong urge to eat between dinner and sleep onset and/or during the night, sleep onset and/or maintenance insomnia >4 nights per week and a belief that the individual must eat to initiate or return to sleep. Symptoms must be present for at least 3 months. This set of criteria will be invaluable for standardizing definition and improving assessment in research into NES in pre-bariatric populations.

Emotional eating

Fourteen studies were identified that had investigated the emotional eating behaviours of pre-bariatric patients (Table 4). Emotional eating, defined by van Strien *et al.* (87) as 'a tendency to overeat in response to negative

Table 3 Summary of characteristics of included studies on night eating syndrome

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline body mass index (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Adami *et al.* (1999) (10)	63	76.2	37.6 (19–61)	46.9 (not reported)	Structured interview designed by the researchers, administered pre-surgery and at 1, 2, and 3 year follow-ups	Assessed night eating syndrome (NES) using Stunkard et al. (17) criteria, binge eating disorder (BED) assessed according to Spitzer *et al.*'s (9) criteria	7.9% ($n = 5$) of candidates had NES; all with NES also had BED
Allison *et al.* (2006) (11)	210	81.9	44.4 (10.7)	50.4 (8.1)	Part of pre-surgical assessment; those reporting consuming >25% of calories after dinner or waking to eat in the night (on Night Eating Questionnaire [NEQ]) interviewed in semi-structured interview by psychologist or psychiatric nurse about food intake/night eating and food diaries assessed; diagnoses confirmed by review	WALI containing the NEQ and QEWP-R; participants endorsing night eating or binge eating symptoms were further interviewed to establish diagnosis	Using the strictest criteria (interview; calculations confirming evening hyperphagia and night eating criteria), 1.9% fit criteria for NES and 8.9% 'fell on the NES spectrum' (p. 80S)
Allison *et al.* (2008) (71)	147	70.1	43.6 (11.5)	50.5 (9.4)	Candidates completed measure within their pre-surgery psychological assessment	NEQ, within the WALI	7.5% ($n = 11$) met all three key criteria for NES identified in this study: nocturnal eating and/or evening hyperphagia, initial insomnia and night awakenings
Allison *et al.* (2008) (72)	194	82.5	44.0 (10.7)	50.4 (8.0)	Candidates undergoing routine pre-surgical evaluations completed measure	WALI, containing the NEQ; participants endorsing night eating symptoms interviewed with unpublished Night Eating Syndrome History and Inventory to establish diagnosis	9.8% ($n = 19$) were diagnosed with NES
Colles *et al.* (2007) (16)	180 surgical candidates	78.3	44.8 (11.2)	44.5 (6.8)	Cross-sectional study, data obtained from community members not trying to lose weight, individuals attending a weight-loss support group, and bariatric surgery candidates; candidates screened for night and binge eating behaviours and then interviewed by non-blinded clinician if behaviours detected	NES measure constructed using Stunkard et al. criteria (17), QEWP-R, semi-structured interview for all participants reporting binge or night eating characteristics; TFEQ, BDI, MBSRQ, SF-36	After confirmatory interview, 19.4% of surgical candidates had NES, 4.3% in support group, 5.7% in the community sample; rates were significantly different between all groups ($P < 0.001$); 4.4% had comorbid NES and binge eating (classified as ≥1 binge per week plus distress related to loss of control)
	93 members of a non-surgical weight loss group	91.4	55.1 (12.4)	32.7 (7.3)			
	158 community respondents	78.5	41.3 (13.5)	24.8 (5.1)			
Colles *et al.* (2008) (19)	129	79.8	45.2 (11.5)	44.3 (6.8)	Participants already accepted into surgical programme invited to participate; prospective observational data collected pre- and 12 months post-surgery	NES measure constructed using Stunkard *et al.*'s criteria (17), plus semi-structured clinical interviews for confirmation	17.1% ($n = 22$) had NES; NES was related to BED ($P = 0.048$), men were more likely than women to have NES ($P = 0.008$)

Table 3 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline body mass index (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Hsu *et al.* (1996) (73)	24	100.0	37.8 (8.5) at pre-surgery	48.8 (8.1) at pre-surgery	Retrospective reporting of pre-surgical and current (past 4 weeks) behaviours by patients who had undergone vertical banded gastroplasty in previous 3.5 years	EDE, plus unspecified questions about night eating	41.7% (n = 10) retrospectively reported having preoperative NES; 'frequency of night eating varied from several times a year to three times a night' (p. 28)
Hsu *et al.* (1997) (74)	27	100.0	38.7 (10.1) at pre-surgery	48.8 (8.6) at pre-surgery	Retrospective reporting of pre-surgical and current behaviours at an average of 20.8 months post-bypass	EDE, with unspecified 'supplemental questions' on NES	33.3% (n = 9) retrospectively reported having pre-surgical NES
Marek *et al.* (2013) (38)	982	67.0	46.0 (11.6)	49.2 (11.3)	Retrospective review of data collected within routine pre-surgical assessments	MMPI-2-RF plus eating measures including items on NES 'using research-based criteria' (p. 1866)	3.4% had NES; NES diagnosis was associated with thought dysfunction, somatic complaints, and aberrant experiences (all $P < 0.05$) but no other MMPI specific problem or clinical scales
Mitchell *et al.* (2014) (45)	2266	78.6	46 (18–78)	45.9 (median; 33.0–94.3)	Participants in large multicenter study of bariatric surgery; patients had already been cleared for surgery; baseline data collection ≤30 days before surgery, independent of surgical care; study formulated before DSM-5 finalized, so BED criteria of prior 6 months assessed as per DSM-IV, but DSM-5 cut-off of e ≥ 1 binge per week used	Items in larger survey used to determine BED as per DSM criteria, NES diagnosed if participant reported evening hyperphagia or nocturnal eating, BDI, SF-36, IWQOL-Lite, Psychiatric and Emotional Test Survey and Medication Form	17.7% considered to have NES; participants with BED were more than twice as likely to have NES symptoms (31.1% vs. 14.7%, $P < 0.001$)
Powers *et al.* (1999) (75)	116	82.8	39.6 (9.3)	53.4 (10.9)	Evaluations pre-surgery, followed-up periodically to an average 5.5 years post-surgery	'The Eating Disorder Questionnaire' (not referenced), which 'elicits epidemiological and clinical data including specific questions about symptoms of NES' (p. 295)	10.3% (n = 12) met criteria for current NES
Ronchi *et al.* (2008) (76)	50 surgical candidates 50 behavioural weight loss programme patients	76 70	42.6 (22–58) 40.8 (24–65)	44.5 (8.5) 40.7 (8.8)	Interviews by trained dietitian with surgical candidates and patients enrolling in behavioural weight loss programme; 'the interviewer carried out the interviews according to the patient's personal background and in a clinically sensitive manner' (p. 146)	Questions on eating including about night eating; participants considered night eaters 'if they reported sleep disturbances – frequent waking in the night to eat – or consuming food after the evening meal' (p. 146)	No significant difference in night eating traits of surgical candidates and non-surgical weight loss patients

BDI, beck depression inventory; DSM, diagnostic and statistical manual of mental disorders; EDE, eating disorder examination; IWQOL-Lite, impact of weight on quality of life – lite questionnaire; MBSRQ, multidimensional body-self rating questionnaire; MMPI-2-RF, minnesota multiphasic personality inventory-2 restructured form; NEQ, night eating questionnaire; QEWP-R, questionnaire on eating and weight patterns – revised; SD, standard deviation; SF-36, short form 36 health survey; TFEQ, three factor eating questionnaire; WALI, weight and lifestyle inventory.

Table 4 Summary of characteristics of included studies on emotional eating

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Castellini *et al.* (2014) (15)	394 surgical candidates	73.4	44.9 (11.4)	44.6 (8.3)	Assessed as part of routine clinical assessments; participants completed measures, interviewed by clinician using SCID to assess lifetime binge eating disorder (BED)/Axis I disorders and number of weekly objective/subjective binges using to the EDE-I and DSM-5; BED diagnosis made with DSM-5 criteria	SCID for DSM-IV, EDE-Q, BES	Subjective binge eating was associated with higher emotional eating for both the surgical ($P < 0.01$) and non-surgical groups ($P < 0.001$); after adjusting for BMI, greater subjective binge eating episodes were still associated with higher levels of emotional eating in the whole sample
	683 non-surgical weight loss treatment clinic patients	80.1	46.7 (13.8)	37.8 (6.9)			
Castellini *et al.* (2014) (14)	27 LAGB candidates	83.2	43.9 (11.4)	44.8 (5.3)	Patients interviewed pre-surgery as part of routine clinical assessment and at 12 months post-surgery	EES	No difference in emotional eating by forthcoming type of bariatric surgery
	30 RYGB candidates	93.3	43.6 (9.8)	49.5 (6.8)			
	26 biliopancreatic diversion candidates	92.3	48.8 (8.4)	50.6 (6.6)			
Claes *et al.* (2013) (79)	102	100.0	36.4 (10.9)	40.7 (4.2)	Screened within pre-surgical psychological assessment	DEBQ, NEO FFI	Emotionally dysregulated/undercontrolled personality subtype ($n = 58$) reported greater emotional eating symptoms than resilient/high functioning type ($n = 44$; $P < 0.01$)
Crowley *et al.* (2012) (20)	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluation for bariatric surgery conducted by psychologist, included semi-structured clinical interview and questionnaires; also assessed by dietitian	FCQ-T; interviewed about past and present emotional eating behaviours; 'specific questions differed according to clinician but generally included questions like "Do you ever find yourself eating when you're bored? Angry? Upset? Or some other emotion?"' (p. 368)	58.7% reported emotional eating; emotional eaters had more intentions/plans to eat craved foods ($P = 0.01$), more often anticipated positive reinforcement ($P = 0.01$) and relief from negative states and feelings ($P = 0.02$) as a result of eating craved foods, felt less control over their eating ($P = 0.01$), were more preoccupied with food ($P = 0.005$), felt greater emotion before or during cravings or eating ($P < 0.001$) and experienced more cues triggering food cravings ($P = 0.001$); no group differences in physiological hunger or guilt related to having/giving into cravings

Table 4 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Fischer *et al.* (2007) (80)	144	80.6	40.3 (not reported)	54.2 (34.9–81.4)	Utilized data from pre-surgical assessments and follow-up assessments an average of 8 months post-surgery	EES, BDI, TFEQ, QEWP/QEWP-R	High emotional eaters (top EES quartile) had more frequent binge ($P < 0.001$) and extreme weight control episodes ($P < 0.05$), more depressive symptoms ($P < 0.001$), and greater eating disinhibition ($P < 0.001$) and hunger ($P < 0.001$) than low (bottom quartile) emotional eaters; no difference in BMI or cognitive restraint ($P > 0.05$)
Gade *et al.* (2014) (81)	102	67.6	42.6 (9.8)	43.5 (4.9)	Data collected online during hospital visit 4 months prior to surgery	TFEQ-R21, NEO PI-R, HADS	Female candidates reported significantly more emotional eating symptoms than male candidates ($P < 0.001$); emotional eating positively correlated with neuroticism, anxiety, and depression, and negatively correlated with conscientiousness (all $P < 0.001$)
Gradaschi *et al.* (2013) (27)	75 surgical candidates 75 non-surgical treatment seekers	60.0 66.7	42.7 (11.3) 50.9 (14.5)	40.2 (4.1) 40.2 (4.6)	Comparison of bariatric surgery candidates and non-surgical (weight loss programme) treatment seekers; data collected within pre-surgical/pre-weight loss programme evaluations; no group differences in mean weight/BMI	'Subjects were requested to state whether they have emotional eating or tend to lose control over food intake' (p. 35)	38.7% reported emotional eating; no difference between rates in surgical candidates (38.7%) and non-surgical treatment seekers (33.3%)
Guerdjikova *et al.* (2007) (82)	178	74.2	Not reported for total sample	Not reported for total sample	Reviewed pre-surgery psychological evaluations of consecutive patients and data from 6 month follow-up (emotional eating assessed pre-surgery only)	Patients asked in evaluation whether 'they considered themselves "emotional eaters," e.g. if they would eat for any reason other than true physical hunger, such as for situational triggers, or negative or positive emotions' (p. 1092)	38.7% reported emotional eating
Miller-Matero *et al.* (2014) (83)	142	81.0	46.3 (11.7)	49.1 (9.6)	Reviewed pre-surgery psychological evaluations (semi-structured interviews) of consecutive patients	EES	38.1% reported emotional eating; 25.4% ate in response to anger/frustration, 40.7% in response to anxiety, 38.4% in response to depression
Noll *et al.* (2010) (48)	150	64.7	42 (11)	46.6 (10.4)	Study comparing candidates and post-surgical patients; all underwent an eating and behaviour interview by a trained investigator	Patients labelled emotional eaters 'when being used to eat specifically in response to anxiety, boredom, and to positive and/or negative emotions' (p. 617)	50.6% had pre-surgical emotional eating

Ronchi *et al.* (2008) (76)	50 surgical candidates 50 behavioural weight loss programme patients	76 70	42.6 (22–58) 40.8 (24–65)	44.5 (8.5) 40.7 (8.8)	Interviews by trained dietician with surgical candidates and patients enrolling in a behavioural weight loss programme; 'the interviewer carried out the interviews according to the patient's personal background and in a clinically sensitive manner' (p. 146)	Assessment of issues including emotional eating ('if they usually ate to cope with negative emotions or if they increased food intake in response to psychological distresses, such as depression or anxiety' (p. 146)	Surgical patients had higher BMI ($P < 0.003$) and body weight ($P < 0.009$); more behavioural programme patients than surgical patients reported a 'tendency toward' emotional eating, though no significant difference was found ($P \geq 0.05$)
Walfish (2004) (84)	122	100.0	37.9 (21–59)	49.3 (30.8–97.9)	Pre-surgical psychological evaluations conducted by the author	WALI Section H – candidates rated how much eating in response to each of six emotions had contributed to their weight gain	40% 'considered emotional eaters'; 22% said eating when tired contributed a 'large' or 'the greatest' amount to their weight gain; 29% said this for eating when anxious, 31% when angry, 44% when depressed/upset, 45% when bored, 49% when stressed; 38% said none of these emotions contributed in this way to their weight gain
Zijlstra *et al.* (2012) (85)	102 bariatric candidates 102 matched general population controls	100.0 100.0	46 (10) 45 (11)	Not reported for each group	Patients already screened for surgery were sent invitation/ questionnaires; control group selected from sample of general population women (not from a health care setting) who were controls in an earlier study; controls matched on age and education	DEBQ (completed by bariatric candidates only), PANAS	After adjusting for other eating behaviours, emotional eating was associated with increased negative affect ($P = 0.002$) in bariatric candidates
Zimmerman *et al.* (2007) (86)	500	81.4	41.5 (10.1)	Not reported for total sample	Reviewed pre-surgery patient evaluations and outcomes	Surgery clearance form data: whether patient was cleared for surgery; if not, psychiatrist's reason(s)	Most common reason for not clearing individuals for surgery (62.0% of those with a reason recorded) was 'overeating to cope with stress or emotional distress'

BDI, beck depression inventory; BES, binge eating scale; BMI, body mass index; DSM, diagnostic and statistical manual of mental disorders; DEBQ, dutch eating behavior questionnaire; EDE-I, eating disorder examination – interview; EDE-Q, eating disorder examination – questionnaire; EES, emotional eating scale; FCQ-T, food craving questionnaire – trait; HADS, hospital anxiety and depression scale; LAGB, laparoscopic adjustable gastric banding; NEO FFI, NEO *five* factor inventory; NEO PI-R, NEO personality inventory – revised; PANAS, positive and negative affect schedule; QEWP, questionnaire on eating and weight patterns; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, Roux-en-Y gastric bypass; SCID, structured clinical interview for DSM disorders; SD, standard deviation; SF-36, short form 36 health survey; TFEQ, three-factor eating questionnaire; TFEQ-R21, three-factor eating questionnaire-r21; WALI, weight and lifestyle inventory.

emotions such as anxiety or irritability' (p.782), is commonly viewed as being a risk factor for poorer post-surgical outcomes. This was demonstrated by Zimmerman *et al.* (86), who found that their most common reason for exclusion from bariatric surgery was candidates 'overeating to cope with stress or emotional distress' (p. 1560). With prevalences of 38.1 to 58.7% (20,27,48,82–84) reported in bariatric candidates, emotional eating appears common in this population.

Few studies have reported data related to emotional eating by population or demographic characteristics. Both Ronchi *et al.* (76) and Gradaschi *et al.* (27) found that bariatric candidates were no more likely than obese individuals beginning a non-surgical weight loss programme to emotionally eat; Castellini *et al.* (14) noted no difference in the emotional eating symptoms reported by candidates for LAGB, RYGB and biliopancreatic diversion. Just one study reported any demographic characteristics related to emotional eating, with Gade *et al.* finding that female candidates reported significantly more emotional eating symptoms than male candidates (81).

However, several studies have reported links between emotional eating and other potentially problematic eating-related issues. Fischer *et al.* (80) reported that candidates' emotional eating was associated with more frequent episodes of bingeing and other extreme weight control behaviours, depression and greater eating disinhibition and hunger. Castellini *et al.* (15) found that emotional eating was associated with greater subjective binge eating episodes, and Crowley *et al.* (20) linked higher emotional eating to stronger food-related cravings, including greater intention to eat, anticipating more positive reinforcement and relief from negative states after eating and experiencing greater food preoccupation and less perceived control over eating.

Emotional eating has also been associated with undesirable personality traits and psychological difficulties in several studies. Claes *et al.* (79) found that candidates with an emotionally dysregulated/undercontrolled personality reported more emotional eating symptoms than those with a resilient/high functioning personality. Gade *et al.* (81) found that emotional eating was associated with higher levels of neuroticism, anxiety and depression and lower levels of conscientiousness, while Zijlstra *et al.* (85) noted an association between emotional eating and negative affect. Further research is needed into the patterns, characteristics and clinical implications of emotional eating in bariatric candidates. If associated with significant distress or other negative impacts, consideration should be paid to the potential benefit of evidence-based therapeutic interventions for affected candidates.

Once again, the majority of studies (14,15,20,27,79, 80,82–84) of emotional eating utilized pre-surgical assessment data which may be influenced by candidates 'faking good' for surgery. Furthermore, methods of assessing emotional eating have varied widely and use of unvalidated, non-replicable assessment methods and varying definitions of emotional eating makes interpreting some findings difficult. For example, Guerdjikova *et al.* (82) asked their participants to define themselves as emotional eaters 'if they would eat for any reason other than true physical hunger, such as for situational triggers, or negative or positive emotions' (p.1092), a definition seemingly more appropriate for broader concepts of 'non-hungry eating' than emotional eating, while Noli *et al.* (48) and Crowley *et al.* (20) included positive and negative emotions in their definitions and Gradaschi *et al.* (27) reported only that 'subjects were requested to state whether they have emotional eating . . .' (p. 35). Use of validated, replicable measures based on consistent definitions of emotional eating is vital. Miller-Matero *et al.* (83), Fischer *et al.* (80) and Castellini *et al.* (14) measured emotional eating with the Emotional Eating Scale (88), which asks respondents to indicate the extent to which each of a series of mainly negative emotions lead them to feel an urge to eat. Other widely used measures follow this pattern. The Dutch Eating Behavior Questionnaire (DEBQ) (89) measures the desire to emotionally eat, while the Three-Factor Eating Questionnaire (90) contains a combination of items about 'feeling the need' to eat and actually engaging in emotional eating. It is worth noting that feeling an urge to emotionally eat will not necessarily result in that individual actually emotionally eating.

In comparison with those experiencing control conditions and self-identified non-emotional eaters, Evers *et al.* (91) found that individuals who self-reported as emotional eaters on the DEBQ did not actually increase their food intake during emotional encounters in a laboratory setting. The researchers suggested cautious interpretation of results from emotional eating scales, hypothesizing that self-reported emotional eating may be either a reflection of beliefs about emotional eating, rather than behaviour, or that answers may be influenced by difficulties recalling, assessing and reporting one's own motivations for eating and the links between emotional state and food intake (91). Questions of what is being assessed by various definitions and measures of emotional eating and the most appropriate ways to investigate emotional eating in bariatric candidates require further consideration.

Food cravings and addiction

Ten articles examining bariatric candidate food cravings and addiction were identified (Table 5). Two studies of food cravings have suggested that these may be stronger and more problematic in bariatric candidates than in normal weight individuals. Abiles *et al.* (92) noted that

Table 5 Summary of characteristics of included studies on food cravings and addiction

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Abiles *et al.* (2010) (92)	26 candidates with type III obesity 24 candidates with type IV obesity 25 normal-weight controls	77.0 79.2 64.0	39.3 (8.7) 38.5 (8.3) 40.7 (12.4)	45.0 (3.0) 55.9 (5.5) 23.6 (2.2)	Prospective observational comparison of bariatric candidates and normal-weight controls with 'similar' age, education, cultural, and socioeconomic characteristics	FCQ-T, EDE-Q	Obese candidates made more plans and had greater intention to eat craved foods, more often anticipated relief from negative feelings by eating, felt they had lost control over eating, had cravings triggered by external cues, felt cravings as hunger and due to emotions, were more preoccupied with food, and felt more guilt about cravings and eating (all $P < 0.05$); no difference in anticipated positive reinforcement from eating ($P = 0.15$); types III and IV obesity patients differed only in anxiety (lower in type IV patients) and tough-mindedness (higher in type IV patients; both $P < 0.05$), not on variables including cravings, eating disorders, depression, self-esteem
Clark and Saules (2013) (93)	67	62.7	42.7 (25–73) at time of data collection	Not reported for pre-surgery	Participants recruited from previous studies and an online support group completed an online survey on their current and pre-surgical (retrospective data collection) behaviours	YFAS	53.7% retrospectively reported meeting criteria for pre-surgical food addiction
Crowley *et al.* (2012) (20)	138	78.3	46.7 (12.8)	50.0 (10.8)	Part of evaluations for bariatric surgery conducted by psychologist involving semi-structured clinical interview and questionnaires; also assessed by dietitian	FCQ-T, CES-D 10, BAI	Higher depression was related to greater intentions/plans to consume craved foods ($P = 0.001$), anticipation of positive reinforcement ($P = 0.009$) and relief from negative states and feelings ($P = 0.001$) from eating craved foods, lack of control over eating ($P = 0.01$), food preoccupation ($P = 0.006$), greater emotion before or during cravings ($P = 0.037$), and feeling guilt about having/giving into cravings ($P = 0.003$); no relationship between depression and hunger or cues that may trigger cravings; greater anxiety was associated only with feeling guilt from having/giving into cravings ($P = 0.023$)
Engstrom and Forsberg (2011) (94)	16	75.0	36.8 (24–44)	56.0 (not presented)	Qualitative interviews at pre-surgery and 1 and 2 years post-surgery, focusing on changes from pre- to post-surgery	Pre-surgical open-ended questions on expectations of surgery and how obesity effected the individual; similar questions at post-surgery	'Many informants viewed their relationship to food as an abuse and some drew analogies to alcoholism. 'I view this as an addiction. In the same way as alcoholism is an addiction, I am addicted to food'' (p. 4)
Leahey *et al.* (2012) (95)	32 surgical candidates 20 normal-weight controls	87.5 90.0	47.9 (10.6) 47.9 (9.2)	Not reported for total surgical sample 22.5 (1.3)	Comparison of candidates/patients and normal-weight controls, assessed up to 6 weeks before surgery and at 3 and 6 months post-surgery	FCI	Before surgery, candidates reported more overall cravings, more cravings for high-fat and fast food (all $P < 0.02$) and were more likely than controls to consume craved high-fat foods ($P = 0.04$)

Table 5 *Continued*

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
Meule *et al.* (2012) (96)	96	65.6	39.9 (11.5)	50.6 (9.0)	Cross-sectional study; participants approached in bariatric clinic but told participation would be unrelated to surgical eligibility	YFAS	41.7% ($n = 40$) received a food addiction diagnosis
Meule *et al.* (2014) (97)	38 with food addiction 56 without food addiction	65.6 (not reported by group)	39.3 (9.8) 40.4 (12.7)	50.9 (8.1) 50.6 (9.7)	Cross-sectional comparison study; candidates approached in bariatric clinic, told participation would be unrelated to surgical eligibility	YFAS, FCQ-T, EDE-Q, Barratt Impulsiveness Scale – Short Form, AUDIT, CES-D Scale	40.4% had a food addiction; those with and without food addiction did not differ by gender, age, or BMI; food addiction group had higher depression scores ($P < 0.001$) and higher trait ($P < 0.001$) but not state cravings; also had greater eating ($P < 0.001$), weight and shape (both $P < 0.01$) concerns, reported more binge days ($P < 0.001$), and had higher attentional impulsivity ($P < 0.05$); no difference in motor, non-planning, or overall impulsivity by diagnosis
Miller-Matero *et al.* (2014) (83)	142	81.0	46.3 (11.7)	49.1 (9.6)	Retrospective analysis of pre-surgery evaluations (semi-structured interviews) of consecutive patients	YFAS	16.9% met criteria for food addiction diagnosis
Ogden *et al.* (2006) (98)	15	93.3	41.1 (25–50)	47.5 at pre-surgery (39.5–58.0)	Interviews with patients who had surgery in previous four years, data analysed using Interpretative Phenomenological Analysis	Open-ended questions including reasons for having surgery, whether surgery changed how the patient felt about food and self	'Many described how before the surgery they had been quite preoccupied with food and many used words such as "addiction" and "obsession"' (p. 285)
Pepino *et al.* (2014) (99)	14 with food addiction 30 without food addiction	88.6 (not reported by groups)	43.2 (11.1) 42.6 (10.9)	47.5 (8.0) 48.2 (8.2)	Patients scheduled for surgery completed questionnaires both before surgery and after losing ≥15% of their initial body weight after surgery, on return for follow-up	YFAS, DEBQ, FCI	31.8% of candidates met criteria for food addiction; no group differences by body weight or BMI; candidates with food addiction more frequently craved foods in general, and particularly starches and fast foods (all $P < 0.05$) than those without food addiction; no differences in sweet or high-fat cravings; those with food addiction reported more external and emotional eating (both $P < 0.05$), but restrained eating did not differ

AUDIT, alcohol use disorders identification test; BAI, beck anxiety inventory; BMI, body mass index; CES-D, center for epidemiological studies depression scale; CES-D 10, center for epidemiological studies short depression scale; DEBQ, dutch eating behaviour questionnaire; EDE-Q, eating disorder examination – questionnaire; FCI, food craving inventory; FCQ-T, food craving questionnaire – trait; SD, standard deviation; YFAS, yale food addiction scale.

bariatric candidates experienced stronger, more intense food cravings which were more often triggered by their environment, were more likely to plan to consume craved foods, more often sought and anticipated relief from negative feelings by eating, felt more guilt as a result of having and giving into cravings, believed they had less control over their eating and were more preoccupied with food. Leahey *et al.* (95) found that bariatric candidates had more food cravings, both overall and for high-fat and fast foods, and were also more likely to actually consume the high-fat foods they craved. Crowley *et al.* (20) found links between common mental health issues and cravings in candidates, reporting that experiencing greater depressive symptoms was associated with stronger craving-related symptoms including greater intention to eat craved foods, anticipating more positive reinforcement and relief from negative feelings from eating, feeling a lack of control over cravings, greater food preoccupation, feeling more emotion related to cravings and feeling depression and anxiety symptoms were related to more craving-related guilt. Demographic characteristics related to food cravings, especially those comparing cravings in bariatric candidates to those of similarly obese individuals, including associations between experiencing food cravings and actually eating as a result of cravings require further study, along with the impact of cravings on food consumption and preparation for surgery and the utility of intervention to manage cravings.

Beyond cravings, bariatric candidates in several qualitative studies have described their own pre-surgical eating as an 'addiction' or 'obsession' (94,98). In recent years, a 'food addiction' model of overeating and obesity has been widely debated, with the recognition of similarities between addictive disorders such as alcohol or tobacco addiction and the excessive consumption of calorie-dense, hyperpalatable foods. These similarities have been noted as both neurobiological, including increased dopamine and opioid neural circuitry, and behavioural, with cravings triggered by cues, consumption in spite of negative consequences and a desire to cut down and loss of control over the behaviour (100,101). However, the concept of food addiction remains highly controversial (102). The 2009 publication of the Yale Food Addiction Scale (YFAS) (103), modelled on the DSM-IV criteria for substance use disorder, provided a standardized assessment tool and has spurred research into food addiction. The YFAS has been validated in a bariatric candidate population (96), and as shown in Table 5, all of the identified quantitative studies of food addiction in candidates utilized the YFAS as their sole measure of food addiction. These investigations into food addiction in bariatric candidates reported prevalences from 16.9 to 53.7% (83,93,96,97,99).

Two studies, by Meule *et al.* (97) and Pepino *et al.* (99), have further examined characteristics and correlates of food addictions in bariatric candidates, finding no difference related to a food addiction diagnosis in terms of gender, age (97), BMI (97,99) or weight (99). Both research teams also examined links between food addiction and food cravings, with Meule *et al.* (97) finding that those with food addiction had more trait food cravings, but not state food cravings, while Pepino *et al.* (99) noted that candidates with food addiction craved foods both in general, and particularly starches and fast foods, more often than those without food addiction. This was not the case for sweet and high-fat foods. Candidates with food addiction were also found to experience more days of binge eating, greater depression symptoms, more eating, weight and shape-related concerns (97), and more external and emotional eating, but no more restrained eating, than those without a food addiction (99).

Positively, attempts to avoid possible recall and 'faking good' biases were noted in several investigations of candidate food addiction, with methodologies used including emphasizing that candidates' responses would have no influence on their surgical eligibility (96,97) and recruiting patients who had already completed their pre-surgical assessment and were scheduled for surgery (99). It is interesting to note that the only publication that used retrospective data collection, by Clark and Saules (93), reported the highest prevalence of food addiction, while the single study utilizing data from pre-surgical candidate assessments, by Miller-Matero *et al.* (83), noted the lowest prevalence (see Table 5).

No studies to date have compared the prevalence or characteristics of bariatric candidates' food addiction to those of similarly obese individuals not undergoing bariatric surgery. This would be useful information. Qualitative and mixed-method research will be valuable to assist our understanding of candidates' experiences and understandings of food addiction, how these relate to the symptoms assessed by the YFAS and the relation of a perceived or diagnosed food addiction to candidates' expectations of their upcoming bariatric surgery. Research is also needed to identify the differences and similarities between cravings and food addictions, their impacts and correlates, especially in relation to psychosocial functioning and distress, and the potential efficacy of therapeutic interventions for these issues.

Pre-surgical expectations of eating after surgery

Five studies (Table 6) on bariatric candidates' pre-surgical expectations of whether and how their eating behaviours will change after surgery were identified. Interviews with bariatric candidates suggest they commonly believe that they have lost control over their own diet and ability to lose weight and feel that this control cannot be regained internally. Choosing to undergo bariatric surgery is seen as a

Table 6 Summary of characteristics of included studies on candidate expectations of post-bariatric surgery eating

Author (year)	*N*	% female	Mean age, years (SD or range)	Baseline BMI (SD or range)	Methodology	Relevant measure(s)	Relevant outcome(s)
da Silva and Maia (2012) (104)	30	66.7	39.2 (8.8)	47.5 (8.2)	Pre-surgery interviews with surgical candidates	Open-ended questions including living with weight gain, reasons for choosing surgery, relationship with food, expectations of life after surgery	'Bariatric surgery emerges as the only treatment for obesity, and participants highlight this moment as the beginning of a new life where health professionals have the main role. Bariatric surgery candidates see their eating behaviour as out of their control, and to commit to its demands is seen as a big sacrifice. For these patients, surgery is understood as a miracle moment that will change their lives without requiring an active role or their participation' (p. 1714)
Engstrom *et al.* (2011) (105)	23	60.9	40.9 (21–62)	52.2 (38.4–67.6)	Interviews with bariatric surgery candidates, phenomenological hermeneutic approach to data analysis	Open-ended questions including reasons for choosing surgery, expectations, patients' views of themselves and their body, eating behaviours, and relationship to food	'Several of the informants [. . .] desired a mechanism in their body that could help them control their eating behaviour. "I need this superior person telling me what to do. I view the operation as a superior person, since it will make my bowel smaller, thus I have to eat less. It may sound strange, but somehow my stomach will set the limit. Now my stomach tells me to eat more and more. I won't be like that after the operation . . ."' (p. 3) '. . . They desired a mechanism in their body to help them control their eating behavior' (p. 6)
Engstrom and Forsberg (2011) (94)	16	75.0	36.8 (24–44)	56.0 (not presented)	Interviews pre-surgery and at 1 and 2 years post-surgery, focus on changes from pre- to post-surgery	Pre-surgically, open-ended questions about expectations of surgery and how obesity affected the individual, similar questions at post-surgery	'Hoping to have some quality of life, [. . .] become more physically active and being able to keep or receive a job as well as becoming happier. Having a well-functioning social situation in the family, with friends, and playing an active part in society was something that the informants were hoping to achieve with help from the surgery and the weight loss . . .' (p. 6) '. . . Many patients described how they realized that they were not going to lose weight on their own and stated how they wanted to hand over control and responsibility for their weight loss to someone else' (p. 280)
Ogden (2006) (98)	15	93.3	41.1 (25–50)	47.5 at pre-surgery (39.5–58.0)	Interviews with patients who had undergone surgery in past 4 years, data analysed using Interpretative Phenomenological Analysis	Open-ended questions including reasons for having surgery and whether surgery changed how the individual felt about food and self	
Wolfe and Terry (2006) (106)	93	87.1	42.1 (10.4)	52.5 (10.1)	Reviewed medical charts and mailed surveys to all patients who had undergone first-time RYGB prior to April 2003	Researcher-created survey on pre-surgical (retrospectively reported) and current weight, physical health, dietary patterns, exercise, relationships, mood, and eating behaviours	'Pre-RYGBP patients invariably express hope and expectation that the physical changes imposed by the surgery will cause them to develop distaste for sweets and become satisfied with less food, consequently assuring great weight loss' (p. 1627) 'While most patients expected surgically-induced weight loss to increase their ability and desire to exercise, few talked about it causing them to increase their desire to self-monitor food intake' (p. 1627)

BMI, body mass index; RYGB, Roux-en-Y gastric bypass; SD, standard deviation.

way to end the never-ending, unwinnable struggle with food and weight, and hand control over to a surgeon, who candidates believe will release them from obesity by changing how their body works. This will change the individual's eating habits, causing them to lose weight (94,98,104,106). Engstrom *et al.* (105) reported that candidates were looking for a new bodily mechanism to help them to control their eating, as they believed their mind was no longer able to do so.

Analyses of candidate narratives also indicate that pre-surgical expectations may be very high. Da Silva *et al.* (104) found that candidates often saw their upcoming surgery as 'the miracle that will solve all life's problems' (p. 1721), believing it would lead to significant, long-term weight loss, resolution of health, employment, family, romance, self-esteem and social difficulties, and increased independence and happiness (94,98,104,105). Candidates may also see themselves as passive elements in their forthcoming surgery, with Engstrom *et al.* (105) noting that very few candidates 'spoke about their own part in this treatment and of losing weight after surgery' (p. 6). One quantitative study by Wolfe and Terry (106) examined procedure-specific expectations of post-surgical eating, finding that RYGB candidates expected the physiological changes of their surgery would virtually guarantee large amounts of weight loss by leading the individual to dislike sweets and feel satisfied with less food. Most also expected that weight loss from their surgery would increase their ability and desire to engage in exercise.

With few studies having examined candidate experiences of eating and their eating-related surgical expectations, investigation is needed into how bariatric candidates believe their upcoming bariatric surgery procedure will affect their eating behaviours, disordered eating, appetite, hunger, cravings and food addictions, whether candidate expectations are realistic regarding their particular procedure and the impacts of realistic and unrealistic expectations about anticipated changes in eating behaviours. Qualitative research will be especially important to provide rich, in-depth data regarding candidates' real-life experiences and expectations.

Discussion

The literature indicates that patterns of eating including BED, emotional eating, grazing, NES and food cravings and addiction are common in bariatric candidates, and often more so than in the general or non-obese populations. In addition, studies have suggested that there may be a number of common 'clusters' of problematic eating-related issues experienced by candidates, with the most commonly reported between NES and BED. Investigations into the prevalence, characteristics, experiences and impacts of individual and comorbid disordered eating patterns in pre-surgical candidates are needed.

A number of studies have suggested that BED may be more common in bariatric candidates than in similarly obese non-surgical populations. To better understand this potentially important difference between bariatric candidates and other similarly obese individuals, further investigation of this finding and longitudinal studies of its causation are required: are individuals with BED more likely to opt for bariatric surgery than those without these behaviours, and if so, why, or, do bariatric candidates develop these behaviours after choosing to undergo bariatric surgery? Is there another explanation? This investigation may assist in understanding the unique experiences of bariatric candidates and their reasons for undergoing bariatric surgery.

More generally, to understand the specific motivations, characteristics and needs of bariatric candidates, significant further research is needed into the differences in eating habits, expectations and disordered eating patterns of those who choose to undergo bariatric surgery, compared with those engaged in non-surgical weight loss strategies, and similarly obese individuals who are not attempting to lose weight. In comparisons of bariatric candidates with normal weight individuals, it is difficult to infer whether any observed differences or common experiences are related to an individual's status as a bariatric candidate or are instead related to their obesity or obesity-related factors. To address this, investigations comparing bariatric candidates to other similar-weight individuals should be prioritized to facilitate better understanding of the characteristics, correlates and motivations for undergoing bariatric surgery of this population, beyond obesity.

In this rapidly expanding research field, it is to be expected that further investigation and replication of existing findings will be required. However, this review has identified common limitations in the existing literature and a number of distinct areas for improvement in further studies. The research to date has in places suffered from potential methodological weaknesses including possible biases of candidates 'faking good' in their pre-surgical assessments, as well as the use of post-surgical retrospective reporting of pre-surgical behaviours. Lack of consistent definitions of key variables and use of unclear, unvalidated, non-replicable assessment methods are also significant limitations (19,70,107). These methodological issues prevent understanding of the clinical significance of potential eating-related issues and are problematic for cross-study comparisons, generalization and attempts to build on existing findings. Hypothesis-driven, prospective studies of eating-related issues, clearly, consistently and accurately defining variables, using validated, accurate measures and replicable methodologies are needed in future research and will be invaluable for advancing the literature. Evaluation

of the circumstances under which patients attempt to appear psychologically well and the effect of this on responses and the impact of using retrospective data vs. prospective data to assess pre-surgical eating-related issues are also needed.

Attention should be paid to investigating the experiences of individuals not fitting the 'typical' bariatric candidate characteristics. The vast majority of investigations into eating in bariatric candidates have studied samples overwhelmingly comprised of middle-aged, female candidates. Although this is largely representative of those undergoing bariatric surgery in many Western countries (108,109), it will also be important to understand the eating-related behaviours and stories of demographic groups often underrepresented in bariatric surgery populations, including men, younger and older patients, and candidates with very high BMIs. While a number of studies have investigated eating behaviours in samples solely comprised of female candidates and several compared disordered eating of candidates with different racial backgrounds, there has been little focus on other specific demographic groups within the larger bariatric candidate population. Both qualitative and quantitative research methodologies will assist in beginning to understand their experiences, needs and expectations.

As surgery is often considered by bariatric candidates as the only viable option to change their eating and weight, expectations are very high, and candidates commonly hope their surgical procedure will cause positive changes in their eating, give them back control over their behaviour, and virtually guarantee weight loss and other positive health and psychosocial outcomes. Further research is needed into how pre-surgical candidates expect their eating to be affected by the particular bariatric surgery they are scheduled to undergo and the accuracy of these expectations, candidates' beliefs about the longevity of the anticipated surgery-related changes to their eating and their understanding of the mechanisms of weight loss related to their particular surgery. The effects of expectations need to be further understood, with consideration given to assessing the potential benefits of counselling and education for candidates with highly unrealistic expectations.

With problematic eating patterns before bariatric surgery often related to significant candidate distress and an increased likelihood of various other undesired consequences, detailed pre-surgical assessments provide an important opportunity to identify these issues and consider further assistance. Identification of symptoms or indications of eating-related distress should be followed by thorough and compassionate exploration, assessment of psychosocial and eating-related comorbidities and consideration of referral to appropriate medical or allied health services. However, additional research will be vital to understand whether surgical candidates with disordered eating may benefit from assistance prior to surgery to reduce their disordered eating behaviours as well as potentially related consequences such as depression, distress and reduced quality of life (30). Several studies have reported on the impact of pre-surgical interventions on binge eating, with Abiles *et al.* (7) reporting a 12.7% reduction in BED prevalence in their sample after twelve 2-h group cognitive-behavioural sessions that were not specifically focused on binge eating treatment. Ashton *et al.* (110,111) found both a significant reduction in candidate binge eating episodes after only four 90-min group cognitive-behavioural therapy sessions for binge eating and later noted that patients who had responded positively to this intervention had also lost significantly more weight at both 6 and 12 months after bariatric surgery. Further investigation of the longevity of any eating and well-being-related improvements, longitudinal studies of the impact of pre-surgery eating-related treatments on both pre-surgical and post-surgical outcomes, and examinations of pre-surgical programmes for problematic eating behaviours beyond binge eating will be of significant interest. Further consideration will also be needed into the optimal timing of any eating-related intervention. For example, Leahey *et al.* (112) found that pre-surgical candidates were less likely to initiate treatment, attended fewer sessions and were less likely to complete an intervention for problematic eating than post-operative patients. The authors suggested that treatment 'ought to consider balancing the needs of the preoperative patients presenting with maladaptive eating behavior with the likelihood of them participating in a behavioral intervention before surgery' (p. 99).

While much of the existing bariatric research is focused on important questions around whether pre-surgical eating behaviours, disorders, hunger, appetite, experiences and expectations are related to suboptimal post-surgical eating-related behaviours and poorer outcomes, Jones-Corneille *et al.* (30) provide an important reminder that 'the amelioration of patient suffering – from depression, anxiety, and other conditions – is a critical objective in itself, regardless of whether the preoperative amelioration of psychopathology improves the outcome of bariatric surgery' (p. 395) and highlights the important point that regardless of the impact on post-surgical outcomes, understanding the eating-related motivations, concerns, disorders, behaviours, expectations and perspectives of individuals before bariatric surgery is likely to be vital for providing appropriate support, care and education, and to reduce distress and discomfort.

Conflict of Interest Statement

No conflict of interest was declared.

Author contributions

MO conceived and produced the drafts of this paper and was responsible for the overall publication, with AC-H and GW contributing to the concept and content. All authors were involved in revisions and gave final approval for the submitted and published version.

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Appendix I: Paper 2 (Obesity Reviews, 2016) published article

obesity reviews doi: 10.1111/obr.12425

Obesity Treatment/Comorbidity

Changes in problematic and disordered eating after gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy: a systematic review of pre-post studies

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Received 18 March 2016; revised 15 April 2016; accepted 18 April 2016

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[Corrections added on 12 July 2016, after first online publication: All five tables have been corrected.]

Summary

Despite differences in their mechanisms and outcomes, little is known about whether postsurgical changes in eating behaviours also differ by bariatric procedure. Following a systematic search, 23 studies on changes in binge eating disorder (BED) and related behaviours, bulimia nervosa and related behaviours, night eating syndrome, grazing and emotional eating after Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB) and vertical sleeve gastrectomy (VSG) were reviewed. Significant methodological problems and a dearth of literature regarding many behaviours and VSG were seen. Regarding BED and related behaviours, although later re-increases were noted, short to medium-term reductions after RYGB were common, and reported changes after AGB were inconsistent. Short to medium-term reductions in emotional eating, and from a few studies, short to long-term reductions in bulimic symptoms, were reported after RYGB. Reoccurrences and new occurrences of problem and disordered eating, especially BED and binge episodes, were apparent after RYGB and AGB. Further conclusions and comparisons could not be made because of limited or low-quality evidence. Long-term comparison studies of changes to problematic and disordered eating in RYGB, AGB and VSG patients are needed. It is currently unclear whether any bariatric procedure leads to long-term improvement of any problematic or disordered eating behaviours.

Keywords: Eating, eating disorder, problematic eating, bariatric surgery.

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Introduction

Bariatric surgery is the most effective long-term treatment currently available for severe obesity (1). The most commonly performed bariatric procedures worldwide are currently Roux-en-Y gastric bypass (RYGB; 45% of worldwide), vertical sleeve gastrectomy (VSG; 37%) and adjustable gastric banding (AGB; 10%), although their relative popularity varies by country and region (2). These surgeries were designed to either reduce the volume of the stomach to restrict food intake and induce earlier satiety (AGB and VSG), or combine restriction with food malabsorption to also reduce the body's absorption of calories and nutrients (RYGB) (1). However, their mechanisms are now understood to be much more complex than initially believed, with changes seen in hunger, food preferences, intolerances and taste, food-related rewards, energy expenditure, vagal and hypothalamic signalling,

gut–brain signals and gut microbial factors, and the levels, types and circulation of bile acids in the gut (3,4). The role and influence of these varies by procedure. Outcomes also often differ by surgery, with the majority of the literature suggesting greatest average weight loss after RYGB, followed closely by VSG, and superior remission and improvement of conditions including Type II diabetes, dyslipidaemia and hypertension in RYGB patients compared with VSG or AGB (5–7).

A substantial proportion of presurgical bariatric patients experience often significant, long-standing disordered eating patterns, with our recent review (8) showing that 4–45% may have binge eating disorder (BED), 20–60% graze, 2–42% have night eating syndrome (NES), 38–59% emotionally eat and 17–54% fit the criteria for food addiction. While significant research attention has focused on whether these problematic and disordered eating behaviours persist or disappear after bariatric surgery, as a whole, in spite of significantly their differing physiological alterations, mechanisms of change, and weight and health-related outcomes, just one research team (9) has reviewed whether the varying 'anatomical realities' of different bariatric procedures may 'lead to differing consequences for eating behaviour' (p. 1308). In this paper, Herpertz *et al.* (9) compared studies with ≥1 year follow-up on changes in binge eating disorder and behaviours, eating disorder scores, general eating behaviours, and the acceptability and variability of foods in patients who had undergone restrictive procedures, gastric bypass or biliopancreatic diversion. They found significant procedure-based differences, concluding that 'exclusively restrictive surgery procedures such as gastric banding or [vertical banded] gastroplasty have a different impact on eating behaviour compared with bypass procedures such as gastric bypass or biliopancreatic diversion' (p.1310–1311). Despite this, subsequent reviews of problematic and disordered eating behaviours in current bariatric procedures have either focused on a single bariatric procedure (10) or have examined multiple procedures together under the larger banner of 'bariatric surgery' (11–13).

Method

This study aims to systematically review and compare the literature on presurgery to postsurgery changes in the following problematic and disordered eating behaviours after RYGB, AGB and VSG: binge eating disorder and associated behaviours (e.g. binge episodes and uncontrolled eating); bulimia nervosa and associated behaviours; emotional eating; night eating syndrome; and grazing.

Inclusion/exclusion criteria

All included studies were original English-language research papers, either published, in-press or in-process in a peer-reviewed journal between 1 January 1990 and 22 May 2015. Studies were considered for inclusion if they reported data on adult participants who had undergone RYGB, AGB or VSG, were pre-post studies with at least one assessment presurgery and postsurgery, and reported comparable presurgery and postsurgery current/recent (not lifetime) prevalence or changes in any of the target eating variables.

Studies were excluded if they reported only the lifetime prevalence of a disordered eating behaviour, focused on child or adolescent patients (studies including a small proportion of participants under 18 years old were not excluded), utilized only retrospective measurement of presurgical eating behaviours or if the bariatric intervention was not specified or data from multiple bariatric procedures were combined. Studies of specific interventions for disordered eating before and/or after surgery were excluded, although studies in which some patients may have utilized an offered or available intervention, treatment, support group or similar (but where this assistance was not the research focus) were considered for inclusion. As this review aims to investigate *changes* in prevalence and characteristics from presurgery to postsurgery and does not seek to establish the prevalence of these disorders in bariatric populations, studies comprising participants who all had a particular disordered eating behaviour, or which compared eating behaviour changes in groups with differing characteristics (e.g. in those who had successful and unsuccessful weight loss), were not excluded on that basis.

To facilitate a manageable review of changes in eating disorders, symptoms and problematic eating behaviours, studies of changes in additional potentially important related eating-related variables including food cravings and addiction, cognitive restraint, disinhibition, sweet eating, dietary changes, eating patterns, nutrients, hunger, appetite, satiety, self-efficacy, eating-related quality of life, changes in taste and preference, and food aversions and intolerances were not included in this review.

Search strategy and study selection

The review was conducted and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta Analyses statement (14). Initial limited database searches, conducted to identify key terms, were followed by full searches using identified keywords and index terms in Medline, PsycINFO, Embase and the Cochrane Central Register of Controlled Trials. Studies published, in-press, and in-process were sought, and to avoid false exclusion of relevant articles, the only database search limits used (where relevant) were articles in English, from 1 January 1990 to 22 May 2015. The specific variables to be reviewed in this paper were finalized after the initial database searches.

Each database was searched using similar terms, modified as needed to fit the particular system. In Medline, the

following search was conducted: (1) bariatric surgery[mh] OR gastric bypass[mh] OR bariatric[tiab] OR gastric bypass[tiab] OR RYGB[tiab] OR lap band*[tiab] OR LAGB[tiab] OR gastric band*[tiab] OR sleeve gastrectomy [tiab] OR gastric sleeve[tiab] OR VSG[tiab] AND (2) feeding behaviour[mh] OR diet[mh] OR food preferences [mh] OR eat[tiab] OR eating[tiab] OR food*[tiab] OR diet[tiab] OR diets[tiab] OR dietary[tiab] OR taste[tiab] OR eating disorders[mh] OR eating disorder*[tiab] OR disordered eating[tiab] OR binge*[tiab] OR bulimia[tiab] OR anorexia[tiab] OR night eating[tiab] OR emotional eating[tiab] OR grazing[tiab] OR uncontrolled eating[tiab] OR loss of control [tiab] OR restraint[tiab] OR disinhibition [tiab] OR satiation[mh] OR hunger[mh] OR appetite[mh] OR satiation[tiab] OR satiety[tiab] OR hungry[tiab] OR hunger[tiab] OR appetite[tiab] OR behaviour, addictive[mh] OR craving[mh] OR addict*[tiab] OR craving*[tiab] (3) NOT rat[tiab] NOT rats[tiab] NOT porcine[tiab] NOT mouse[tiab] NOT mice[tiab] NOT swine[tiab] NOT pig[tiab] NOT canine[tiab] NOT dogs[tiab] NOT cats[tiab] NOT feline[tiab] NOT rodent[tiab].

After excluding duplicates using Endnote and manual searches, each record was manually screened for initial suitability based on its title and abstract. The full text of each potentially suitable article was obtained, and the complete article content assessed for eligibility against the review inclusion and exclusion criteria. The reference lists of eligible articles were also manually searched to identify additional relevant articles.

Data extraction

Data related to study characteristics, methodology, and relevant results were extracted by the first reviewer (MO) using standardised data extraction parameters. In studies comparing a bariatric surgery of interest to an excluded procedure, data related only to the surgery of interest was extracted for review. The authors of two articles were contacted for clarifications: one regarding a misprinted number (S. Scholtz, email communication, 14 July 2015), the other about sample overlap (M. White, email communication, 6 January 2016). The results are described using narrative summary. Meta-analytic techniques were not used because of the broad range of outcomes under review and their differing methods of assessment.

Methodological quality assessment

An existing NIH tool designed to assess the quality of non-control group pre-post studies (15) was used to assess the methodological quality of each included study (Table S1), with additional items from the Joanna Briggs Institute appraisal checklists for 'cohort/case control studies' and 'studies reporting prevalence data' (16,17) added to ensure all relevant methodological aspects were covered. The complete list of items was finalized through discussion by all authors. MO carried out the initial quality assessment and methodological design ratings, with assistance from GW and discussion with ACH to achieve consensus on ambiguous items. As the NIH tool was 'not designed to provide a list of factors comprising a numeric score', checklist items were used to consider and rate each study's overall risk of bias related to flaws in study design or implementation. 'Good' studies have the lowest risk of bias and results considered valid, a 'fair' study suggests some bias considered insufficient to invalidate its results, and a 'poor' rating suggests significant risk of bias.

Results

A total of 3,963 papers were identified from database searches. After removing duplicates and excluding papers based on their title and abstract, 65 articles (including four identified from the reference lists of retrieved articles) were closely examined. Forty-one did not fit the inclusion criteria or fit exclusion criteria, leaving 24 articles in the review. Two of these (18,19) were grouped together as they reported the same relevant finding from the same sample, leaving a final 23 separate studies from 24 articles. Two articles by White *et al.* (20,21) used overlapping samples, with their 2006 study participants merged with a separate sample for their 2010 study, but are reported separately here. Figure 1 illustrates this process.

Study characteristics

Details of the 23 studies included in this review are shown in Table 1. Sixteen studies investigated RYGB patients (20–35), with a total *N* of 1,244 (excluding White *et al.* [2006], $N = 139$, as these participants were also in White *et al.* [2010]; $M = 82.9$ participants per study, range: 9–361), six examined AGB patients (total *N*: 335, $M = 55.8$ per study, range: 27–129) (18,19,25,36–39) and two looked at disordered eating in VSG patients (total *N*: 156, $M = 78.0$ per study, range: 46–110) (40,41). One paper investigated multiple procedures, comparing RYGB and AGB patients (25); another utilized a non-obese reference group for comparison with RYGB patients (30); and another compared groupings of patients who had been assessed at differing timepoints after surgery (41). All other studies assessed a single bariatric sample before and after surgery. Every study reported on a predominantly female sample, and three reported on wholly female samples (29,34,35). Participants' ages ranged from 31.4–45.2 years, and presurgical body mass indexes (BMIs) ranged from 43.0–56.7.

Postsurgical follow-up periods ranged from 3 months to 8 years, with final assessment most often carried out at 12 months postsurgery (11 studies). Only three studies

Table 1 Characteristics of the included studies

Author (year)	Surgery	N % female M age (SD) M presurgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
Alfonsson (2014) (22)	RYGB	129 78.2% 42.8 (10.5) 43.0 (4.0)	Sweden	Yes	NR; participants recruited among patients eligible for Roux-en-Y gastric bypass surgery at a university hospital	NR beyond measures used	5 months before surgery (M = 153 days; SD = 10.5) and 12 months after surgery (M = 370 days; SD = 77.3)	Changes over time via repeated-measures ANOVA	177 patients approached; number completed baseline NR; complete data from 129 analysed	Fair
Boan (2004) (23)	RYGB	40 85.0% 41.2 (9.1) 52.9 (8.9)	USA	NR	NR; 'sample consisted of 40 morbidly obese patients [...] who underwent evaluation for RYGBP'	Participants completed written measures at time of presurgical medical assessment and 'again 6 months postoperatively'	Before surgery and 6 months postsurgery	Paired *t*-tests for comparisons	Number approached, retained NR	Fair
Bryant (2013) (24)	RYGB	12 75.0% 36 (2) 45.3 (1.9)	Sweden	Yes	NR (all patients nondiabetic but unclear whether diabetes was an exclusion criteria; no further details on criteria or recruitment)	Participants completed measure on morning of each in-person test day (study also involved in-lab eating and blood collection)	Before surgery and 3 days postsurgery, 2 months postsurgery, and 1 year postsurgery	Repeated-measures ANOVA to investigate changes	Number approached to participate NR; 12 of 14 recruited provided complete data (86%)	Fair
Castellini (2014) (25)	RYGB	30 93.3% 43.6 (9.8) 49.5 (6.8)	Italy	Yes	Recruited from 133 consecutive first-time clinic referrals and bariatric candidates; patients allocated to surgery (RYGB, AGB or BPD) based on BMI or metabolic criteria; inclusion criteria: 18–65 years, BMI > 40 or >35 with significant related issues, >5 years obese, previous weight loss failure, no past bariatric surgery, understand surgery and risks; exclusions: intellectual disability, illiteracy, high surgical risk, current severe mental disorder	Face to face interviews by two psychiatrists who were unaware of surgery type, on first day of admission (before evaluation of inclusion/exclusion criteria for surgery) and a year postsurgery during a 'control visit'; all assessments part of routine clinic assessment	Before surgery (M = 21.2 weeks before; SD = 14.8) and 1 year postsurgery	Linear mixed models to analyse repeated-measures data (controlling for BMI and age)	133 initially included; 42 excluded (37 did not meet inclusion; 5 refused surgery); 8 enrolled but not available at follow-up (3 AGB, 1 RYGB, 4 BPD); final sample of 83 (91%)	Good
	AGB	27 83.2% 43.9 (11.4) 44.8 (5.3)								
Colles (2008) (36)	AGB	129 79.8% 45.2 (11.5) 44.3 (6.8)	Australia	Yes	Severely obese persons accepted to bariatric surgery programme at The Avenue Hospital, Melbourne, August 2004–December 2005 invited to participate if 18–65 years old; exclusion criteria: previous bariatric surgery	Self-report questionnaires with interview confirmation if applicable; any reported binge eating behaviours confirmed by semistructured clinical interview at baseline, and semistructured phone interview at 12 months; interviews performed by single 'experienced' clinician)	Before surgery and 12 months (M = 12.3; SD = 1.1) postsurgery	Changes over time analysed using *t*-tests (continuous variables) and chi-square (categorical)	173 of 180 recruited at baseline were eligible to participate (1 died, 6 did not have surgery); 129 of 173 returned both surveys (75%)	Fair
De Panfilis (2007) (37)	AGB	35 88.6% 41.2 (8.3) 45.5 (4.8)	Italy	NR	Study recruitment procedure NR; sample was patients accepted (after physical, surgical, and anesthesiologic examination and psychiatric assessment) for and who underwent LAGB at Parma University Hospital, Italy, March 2002–April 2004	Assessed as part of presurgical psychiatric assessment and again at postsurgery with same instruments (by psychiatrist or experienced psychiatric resident)	Before (approximately 1 month prior to) surgery and 12 months postsurgery	Changes analysed using chi-square with Fisher's exact test; *t*-test for symptom changes	30 of 65 recruited not accepted for or refused surgery; all 35 who were accepted for and underwent AGB also completed 1 year follow-up (100%)	Fair

(*Continues*)

Table 1. (Continued)

Author (year)	Surgery	N % female M age (SD) M presurgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
de Zwaan (2010) (26)	RYGB	59 84.7% 44.5 (9.9) 51.3 (9.0)	USA	Yes	Candidates recruited prior to surgical evaluation; selection procedure and inclusion/exclusion NR beyond fulfilling criteria for surgery	At presurgery, questionnaire to assess current disordered eating; at postsurgery, interview used to retrospectively assess presurgical BED, then assess current (past 6 months) disordered eating	3–6 months before surgery and 2 years (mean = 1.9; SD = 0.4) postsurgery	Proportion meeting diagnostic criteria as percentages; no statistical tests on this data	23 of 119 recruited did not have surgery; 28 of 96 who had surgery could not be contacted for or declined follow-up (71%); further 9 excluded from analyses as ≤1 year after surgery	Fair
Dymek (2001) (27)	RYGB	32 81% 39.1 (6.5) 56.7 (11.5)	USA	NR	Patients had qualified for surgery (BMI > 40 or >35 with related comorbidities, approved after multidisciplinary evaluation including medical exam by surgeon, nutritional evaluation by dietitian, psychological evaluation by psychologist); sample was 32 consecutive patients who underwent RYGB at University of Chicago Hospitals, Nov 1998–Mar 1999	Questionnaires completed at presurgical assessment, at first clinic appointment postsurgery, and at a later routine appointment	Before surgery, 1–3 weeks postsurgery and approximately 6 months postsurgery	Repeated-measures ANOVA for change over time with post hoc paired samples *t*-tests	32 patients had surgery and completed the presurgery and first postsurgery assessment; 20 of the 32 completed all 3 assessments (63%)	Poor
Kalarchian (1999) (28)	RYGB	50 76.0% 38 (19–66) 52.8 (10.4)	USA	NR	132 consecutive candidates for surgery at Robert Wood Johnson University Hospital, New Jersey, approached to participate; all participants had failed at previous weight loss attempts and were ≥45.4 kg above ideal	Interviewed pre and postsurgery – at presurgery, regarding the past 3 months, at postsurgery, regarding past 28 days	Before surgery and 4 months (M = 3.8; SD = 0.9) postsurgery	Proportion reporting binge episodes (objective bulimic episodes and subjective bulimic episodes) as percentages; no statistical tests on this data	106 of 132 approached completed presurgery assessment; those who had surgery were reassessed 4 months postsurgery; 50 of first 62 to have surgery (81%) completed follow-up	Fair
Kruseman (2010) (29)	RYGB	80 100% NR for *N* = 80 45.9 (7.6)	Switzerland	Yes	Study dietitians not involved in usual care extracted existing data from baseline and 1 year postsurgery visit casenotes of 141 patients, then contacted each by phone to ask them to return for a final appointment	Presurgical eating behaviour assessed by psychologist as part of usual presurgical assessment, patients saw dietitian and surgeon at routine postsurgical follow-up (unclear who administered measures). 8 year postsurgery assessments carried out by study dietitians	Before surgery, 1 year postsurgery, and a mean of 8 years (SD = 1.2) postsurgery	Comparisons using paired *t*-tests	135 of 141 patients who underwent RYGB were followed-up at 1 year; 80 of those (59%) were reassessed at 8 years postsurgery	Good
Lang (2002) (38)	AGB	66 87.9% 38.1 (11.2) 48.1 (6.2)	Switzerland	NR	NR ("66 selected morbidly obese patients […] who underwent LAGB with the Lap-Band and were followed during 1 year")	Completed questionnaires at home after presurgery examination (before surgery), and then every 3 months postsurgery to 1 year	Before surgery and 3, 6, 9 and 12 months postsurgery	Repeated-measures ANOVA for changes over time; McNemar test for significance of change	66 of 97 assessed at baseline completed all 4 assessments (68%)	Fair
Laurenius (2012) (30)	RYGB	43 72.1% 42.6 (9.7) 44.5 (4.9)	Sweden	Yes	Participants on waiting list for laparoscopic RYGB invited to participate, April 2004–April 2008; inclusion criteria: BMI 35–50, exclusion criteria: inability to understand	Participants completed questionnaires and experimental meals at each assessment point; a non-obese "reference group" (*n* = 31) was assessed by the same method at one time point	Before surgery, and 6 weeks postsurgery, 1 year postsurgery, and 2 years postsurgery	Kolmogorov–Smirnoff test for normal distribution, one-way ANOVA, Pearson's correlation for associations	50 patients recruited; of 47 enrolled, 2 excluded presurgery for very high daily energy intake, 2 after surgery after developing appetite-effecting illnesses; of 43 included, one (unclear whether same	Good

(*Continues*)

Table 1. (Continued)

Author (year)	Surgery	N % female M age (SD) M presurgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
					Instructions, insulin-treated diabetes				participant each time) missed assessment at each postsurgery point	
Malone (2004) (31)	RYGB	109 83.5% NR for *N* = 109 (Non-binge eaters: 46 [10], moderate binge eaters: 44 [12], severe binge eaters: 45 [8]) NR for *N* = 109 (Non-binge eaters: 47.7 [19.8], moderate binge eaters: 47.5 [15.3], severe binge eaters: 48.1 [14.7])	USA	Yes	Part of ongoing prospective longitudinal study initiated in 1997; patients 18+ years old scheduled for RYGB within Division of Clinical Nutrition, Albany Medical College, invited to participate	Questionnaires completed before surgery and at annual follow-up outpatient appointments	1–4 weeks before surgery and 1 year postsurgery	Repeated-measures ANOVA of data for *n* = 56	Number eligible NR; 109 baseline participants; 56 of 76 with 12 month weight data also completed 12 month questionnaires (51% of baseline participants; 74% of those with 12 month weight data)	Fair
Matini (2014) (32)	RYGB	67 94.0% 36.8 (8.5) 48.8 (4.7)	Iran	Yes	Patients enrolled to study by 'convenient sampling' before surgery; assured participation would not influence medical care; exclusion criteria: unable to return for follow-up, education below fifth grade, <18 years old, not first bariatric surgery	Unclear: 'data gathering through instruments was done by two psychiatrists'	Before surgery and 6 months postsurgery	Paired-sample t-tests to analyse change over time	11 declined to participate; of 70 enrolled, 3 withdrew at follow-up; complete data collected for 67 (96%)	Poor
Melero (2014) (40)	VSG	46 78.3% 37 (NR) 43 (5)	Spain	NR	VSG candidates underwent multidisciplinary assessment, approved for/advised to have surgery if BMI 35–40 (–50 in 'special cases') and ≥3 of: 'sweet eater', family history of obesity, insulin-dependent diabetes, cardiovascular and musculoskeletal limitations on exercising; study inclusion/exclusion criteria and recruitment procedure NR	After psychological evaluation, participants completed self-administered questionnaires before surgery, same protocol repeated at 12 months	'Days before' surgery and 12 months postsurgery	Comparisons using related-samples Wilcoxon signed tests	NR; study sample consisted of all patients who underwent VSG and completed both assessments	Fair
Peterelt (2014) (33)	RYGB	180 71.1% 42.7 (10.5) 45.2 (6.4)	Lithuania	Yes	180 of all 295 patients who underwent laparoscopic RYGB in Sep 2010–Jan 2013 prospectively consented to participate in study; inclusion criteria: 18–65 years old, BMI ≥40 or ≥35 with at least one related comorbidity	Baseline questionnaire completion process not detailed; participants completed follow-up measures at outpatient clinic visit	Before surgery and 1 year postsurgery	Raw scores transformed to scores out of 100, normality assessed with Kolmogorov–Smirnov test; Wilcoxon signed-ranks test to analyse changes	180 of 295 enrolled and completed presurgery measures; 99 completed follow-up (55%)	Fair

(*Continues*)

Table 1. (Continued)

Author (year)	Surgery	N % female M age (SD) M preSurgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
Scholtz (2007) (39)	AGB	29 96.6% 39 (9) 45 (7)	UK	Not noted	Analysis of case notes from a series of 37 patients who underwent LAGB by one surgeon at a UK centre between April 1997–June 2000 using Swedish adjustable gastric band; only exclusion noted: not having undergone full assessment by a psychiatrist or psychologist with specialist eating disorders experience prior to surgery	Data collected via retrospective audit of patient notes for evidence of past or current psychiatric disorders as per DSM-IV criteria; trained auditor applied measure to casenotes (including presurgical assessment) to assess binge eating episodes and diagnoses; assessors blinded to outcomes 'wherever possible'	Before surgery and 0–5 years postsurgery (5-year prevalence)	Proportion with evidence of objective bulimic episodes (objective binges with perceived LOC), objective overeating (binges without LOC), and full BED as percentages; no statistical tests on this data	Retrospective case note review: 8 of 37 excluded because they had not had full presurgery assessment	Fair
Sioka (2013) (41)	VSG	110 78.2% NR for *N* = 110 (<3-month group: 38.2 [10.8], 3–6 months: 38.0 [10.0], 6–12 months: 42.1 [10.9], 1–2 years: 39.6 [9.2], 2–3 years: 40.4 [9.7], >3 years: 38.6 [10.8]) NR for *N* = 110 (<3-month group: 43.7 [8.3], 3–6 months: 43.9 [5.7], 6–12 months: 45.9 [6.1], 1–2 years: 46.1 [5.6], 2–3 years: 46.5 [6.8], >3 years: 44.8 [5.6])	Greece	Yes	All 133 patients who underwent laparoscopic VSG at University Hospital of Larisa, Greece, August 2006–February 2011, were enrolled; all met criteria for surgery (Inclusion: BMI >40 or >35 with related comorbidities; exclusions: GERD, 'sweet eaters', severe mental health issues, drug addiction, alcoholism, high surgery risk)	Data retrieved from existing database for study; 'eating patterns were assessed in the interview by a dietitian preoperatively and postoperatively at the timing point of the follow-up. Additionally, the QEWP-R was employed'; assessed eating patterns were 'defined according to the IFSO European Accreditation Council for Bariatric Surgery (EAC-BS) including volume eater, binge eating disorder, sweet eater, night eater, snacker and emotional eater' (definitions not provided in article or by referenced website at time of this review); patients grouped by timing of follow-up	Before surgery and either <3 months (*n* = 10), 3–6 months (*n* = 11), 6–12 months (*n* = 11), 1–2 years (*n* = 39), 2–3 years (*n* = 23), or >3 years (*n* = 16) postsurgery	Shapiro–Wilk test for normality; group eating pattern comparisons analysed by ANOVA with post hoc Bonferroni correction	23 of 133 enrolled were lost to postsurgical follow-up (83%)	Poor
Thonney (2010) (34)	RYGB	43 100% 39.3 (SE = 1.4) 44.7 (SE = 0.4)	SwitzerlandYes	Yes	Patients prospectively recruited at Service of Therapeutic Education for Chronic Diseases, University Hospitals of Geneva, 1998–2003; inclusion/exclusion criteria and selection procedure NR	Standardized questionnaires were used for pre and postoperative assessments 'using a semistructured interview by a trained psychologist'	Before surgery and 1 and 2 years postsurgery	Differences in means over time calculated using one-tailed, one-sample *t*-tests	NR; 43 women were evaluated in this study'	Fair
Turkmen (2014) (35)	RYGB	9 100% 31.4 (7.4) 47.2 (8.9)	Sweden	Yes	Participants enrolled from female outpatients at the Department of Surgery, Sundsvall County Hospital; inclusion criteria: 18–40 years old with a BMI > 40 and diagnosed PCOS; exclusions: hormone therapy, benzodiazepines, or psychoactive drugs within 3 months of study enrolment, known psychiatric or premenstrual dysphoric disorder,	Participants completed examination, provided blood samples, and completed questionnaires at each assessment point	Before surgery and 6 and 12 months postsurgery	Friedman two-way ANOVA compared timepoints, post hoc Wilcoxon signed-rank test to detect differences by time point	9 of 13 with PCOS at centre had surgery; 8 of 9 completed follow-up (89%)	Fair

(*Continues*)

Table 1. (Continued)

Author (year)	Surgery	N % female M age (SD) M presurgery BMI (SD)	Setting	Ethics approval	Inclusion criteria and recruitment procedure	Assessment method	Assessment timepoints	Data analysis	Participant retention	Study quality rating
					history of drug or alcohol abuse, pregnancy					
White (2010) (20)	RYGB	361 86.1% 43.7 (10.0) 51.1 (8.3)	USA	Yes	Inclusion/exclusion criteria and recruitment procedure NR; participants informed results would have no impact on care/surgery; only participants with ≥1 completed follow-up assessment included in analyses	'Participants completed a battery of assessments' at each timepoint	Before surgery and 6, 12 and 24 months postsurgery	Binary logistic regressions to analyse whether presurgery LOC predicted postsurgery; chi-square to compare prevalence over time; nonlinear mixed model with random intercept and logarithmic transformation to analyse whether postsurgery LOC was a function of presurgery LOC and time	311 of 361 assessed presurgery completed follow-up at 6 months (86%), 294 (81%) at 12 months and 171 (47%) at 24 months	Fair
White (2006) (21)	RYGB	139 89.2% 42.4 (10.2) 51.7 (7.9)	USA	Yes	Inclusion/exclusion criteria NR; participants informed participation would not influence surgical care and assessments completed for research study only; all participants 'underwent gastric bypass surgery at a general medical centre'	NR; participants completed questionnaires at both time points	Before surgery and 12 months postsurgery	Proportion with no binge episodes, infrequent episodes (<1/week), regular episodes (1 to <2/week), and DSM-IV threshold episodes (≥2/week) as percentages; no statistical tests on this data	Number enrolled to participate NR; 137 of 139 baseline participants completed both assessments (99%)	Fair
Wood (2012; 2014) (18,19)	AGB	49 73.5% 41.4 (10.4) 43.1 (8.5)	UK	Yes	Participants recruited from two private hospitals in Kent, England, where they were scheduled for surgery; surgical indications: BMI ≥ 40 or ≥35 with serious comorbidity; no further inclusion/exclusions for study specified; recruitment procedure NR	Participants completed presurgical measures two weeks before surgery; follow-up questionnaires mailed to participants 3 months later	Two weeks before surgery and 3 months postsurgery	Proportion meeting DSM-IV diagnostic criteria as percentages; no statistical tests on this data	49 of 55 agreed to participate; 43 of 49 (88%) completed pre and postsurgery measures	Poor

AGB, adjustable gastric banding; ANOVA, analysis of variance; BED, binge eating disorder; BMI, body mass index; BPD, biliopancreatic diversion; DSM-IV, diagnostic and statistical manual of mental disorders, 4th ed.; GERD, gastro-esophageal reflux disease; LAGB, laparoscopic adjustable gastric banding; LOC, loss of control; M, mean; *N*, number of participants; NR, not reported; PCOS, polycystic ovary syndrome; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, roux-en-Y gastric bypass; SD, standard deviation; VSG, vertical sleeve gastrectomy.

Table 2 Number of included studies on each disorder or behaviour after each procedure

	RYGB	AGB	VSG
BED and related symptoms	13	6	1
BED	2	4	1
Binge eating symptoms	5	2	0
Binge eating episodes	3	2	0
Uncontrolled/loss of control eating	6	1	0
Bulimia and related symptoms	3	2	1
Bulimia nervosa	0	1	0
Bulimic symptoms	3	1	1
Emotional eating	7	1	1
Night eating syndrome	0	1	1
Grazing	0	1	1

AGB, adjustable gastric banding; BED, binge eating disorder; RYGB, Roux-en-Y gastric bypass; VSG, vertical sleeve gastrectomy

(29,39,41) conducted follow-up beyond 2 years postsurgery. Every study utilized a single presurgery assessment, and the majority (16 studies) examined participants at a single postsurgery timepoint. Almost all collected data via presurgery and postsurgery interviews and/or written measures, while two papers utilized retrospective case note audits. One of these (39) reviewed patient casenotes from presurgery and 5 years postsurgery for evidence of eating disorders, while the other (29) extracted retrospective case note data on eating disorder diagnoses from presurgery and 1 year postsurgery visits, and asked participants to return for an additional assessment at an average of 8 years postsurgery. One study recruited a specific subgroup of female RYGB patients with diagnosed polycystic ovary syndrome (35), while all others investigated general patient samples comprising bariatric candidates either before their presurgical assessment or from those who had already been assessed as eligible for surgery.

Table 2 displays the number of studies reviewed that investigated each eating behaviour in each surgery.

Methodological study appraisals

Based on study ratings for each appraisal checklist item, three studies were classified as 'good' (lowest vulnerability to bias) (25,29,30), 16 were 'fair' (medium vulnerability to bias) (20–24,26,28,31,33–40) and four were deemed 'poor' (highest vulnerability to bias) (18,19,27,32,41). Within the three 'good' studies, Castellini *et al.* (25) looked at binge eating symptoms and emotional eating in RYGB and AGB patients at presurgery and 1 year postsurgery; Laurenius *et al.* (30) examined uncontrolled eating and emotional eating in RYGB patients at presurgery, 6 weeks postsurgery, 1 year postsurgery and 2 years postsurgery; and Kruseman *et al.* (29) assessed bulimic symptoms in RYGB patients at presurgery and an average of 8 years postsurgery.

Key limitations of the studies included papers often not clearly describing the eligibility and selection criteria for their study population and demonstrating that these had been prespecified (18–24,26,32,34,37,40) and not describing the study participants and setting in sufficient detail (21–24,30,38,40). In almost all studies, the researchers did not provide evidence that their sample size was adequate to provide confidence in the findings (18–28,30–37,39–41), and others did not utilize prespecified, clearly defined, valid, reliable and consistently assessed measures of disordered eating and BMI (20,26,36,38,41), or provided insufficient detail to determine whether or not this was the case (23,24,27,31–33,35,39,40). Further limitations included 20% or greater loss to follow-up from baseline (20,26,27,29,31,33,36,38) or insufficient detail to determine the proportion lost to follow-up (22–24,34,40), follow-up of less than 18 months duration postsurgery (18,19,21–25,27,28,31–33,35–38,40) and a lack of reported statistics with *p*-values examining presurgery to postsurgery changes in disordered eating (18,19,21,26–28,39,41). Each study's ratings can be seen in Table S1.

Binge eating disorder, symptoms, episodes and uncontrolled eating

The reviewed studies of BED, binge symptoms, binge episodes and uncontrolled eating are shown in Table 3. In RYGB patients, while the literature strongly suggests positive changes in BED and related symptoms in the short-term to medium-term after surgery, there was also some evidence that these issues may re-increase after that initial decrease. The highest quality ('good') evidence reported positive medium-term changes after RYGB in both binge symptoms (25) (1 year postsurgery) and uncontrolled eating (30) (at 6 weeks, 1 year and 2 years postsurgery), with RYGB patients found to have significantly more uncontrolled eating than non-obese comparisons before but not after surgery. These positive findings were supported by 'fair'-rated studies showing large reductions (25.5% to 0%) in BED diagnoses at 2 years (26), significant binge symptom decreases at 6 months (23) and 1 year postsurgery (31), significant improvements in uncontrolled eating behaviours at 6 months (35) and 1 year (22,33,35), and large reductions in rates of binge episodes at 4 months (44% to 0% ≥1 objective binge episode [perceived loss of control while eating objectively, excessively large amounts of food] per week, 4% ≥1 subjective binge episode [perceived loss of control while eating small to normal amounts of food] per week) (28) and 1 year (23.8% to 0.7%) (21) after RYGB.

No studies found no overall change or an overall increase in BED and related symptoms after RYGB; however, several 'fair'-rated studies did report significant re-increases after an initial reduction. Bryant *et al.* (24) noted an overall significant decrease in uncontrolled eating to 1 year, finding no change at 3 days postsurgery and reductions from presurgery to 2 months and 1 year, with a significant re-increase between 2 months and 1 year. White *et al.* (20) also

Table 3 Presurgery to postsurgery changes in binge eating disorder and related symptoms, by procedure

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Binge eating disorder (BED)					
RYGB	de Zwaan (2010)(26)	QEWP (presurgery), EDE-BSV (postsurgery)	Proportion meeting BED diagnostic criteria	Presurgery: 23.7% (QEWP), 25.5% (EDE-BSV, retrospectively rated) 2 years postsurgery: 0% (OBE criteria), 3.4% (SBE criteria)	NR
	Dymek (2001)(27)	QEWP-R	Proportion meeting DSM-IV BED diagnostic criteria	Presurgery: 32% 1–3 weeks postsurgery: 6% 6 months postsurgery: 0%	NR
AGB	Colles (2008)(36)	QEWP-R; semi-structured clinical/phone interview	Proportion with BED according to DSM-IV criteria	Presurgery: 14.0% 12 months postsurgery: 3.1% (2/4 had not reported presurgical BED)	Decrease presurgery to 12 months, $p < 0.05$ At 12 months postsurgery, 61.1% of those with presurgery BED were grazers ($p = 0.029$), 44% reported loss of control or continued BED ($p = 0.048$), and 33.3% had no eating pathology ($p = 0.032$)
	De Panfilis (2007)(37)	SCID-I/P; confirmed by structured interview as per Spitzer *et?al.* (1992)	Proportion with BED according to DSM-IV criteria	Presurgery: 37.1% 12 months postsurgery: 11.4% (62.9% did not have BED at pre or postsurgery, 25.7% with presurgical BED were recovered at 12 months; 11.4% had BED both presurgery and at 12 months postsurgery)	Change over time, $p \leq 0.01$
	Scholtz (2007)(39)	EDE	Proportion with current BED according to DSM-IV criteria	Presurgery: 17.2% 0–5 years postsurgery: 17.2% (BED recurred in 33% with a presurgery history of BED; 66% of those with a history of BED had no postsurgery BED)	NR
	Wood (2012; 2014) (18,19)	EDDS	Proportion with current BED according to DSM-IV criteria	Presurgery: 49.0% (24/49) 3 months postsurgery: 7.0% (3/43; 19/22 with presurgical BED did not have BED at follow-up)	NR
VSG	Sioka (2013)(41)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified with BED	Presurgery: 23.6% (26/110) Postsurgical data presented in graph only; few patients (3.6%) presented	NR

(*Continues*)

Table 3. (Continued)

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
				the binge eating disorder pattern postoperatively' (p. 506)	
Binge eating symptoms					
RYGB	Boan (2004)(23)	BES	BES mean score (SD)	Presurgery: 15.1 (8.2) 6 months postsurgery: 2.7 (2.7)	Decrease presurgery to 6 months, $p < 0.001$
			Proportion with severe binge eating symptoms (BES ≥ 27)	Presurgery: 10.0% 6 months postsurgery: 0%	
			Proportion with moderate binge eating symptoms (BES 18–26)	Presurgery: 20.0% 6 months postsurgery: 0%	
			Proportion with no binge eating symptoms (BES ≤ 17)	Presurgery: 70.0% 6 months postsurgery: 100%	
	Castellini (2014) (25)	BES	BES mean score (SD)	Presurgery: 20.1 (9.5) 1 year postsurgery: 6.1 (4.2)	Treatment effect over time, $p < 0.001$
	Malone (2004) (31)	BES	Presurgery non-binge eaters ($n = 25$), BES mean score (SD)	Presurgery: 12 (6) 1 year postsurgery: 4 (3)	Decrease presurgery to 1 year, $p < 0.001$ Presurgical non-binge eaters still had lower symptoms than presurgical moderate and severe binge eaters at 1 year postsurgery, $p < 0.05$
			Presurgery moderate binge eaters ($n = 18$), BES mean score (SD)	Presurgery: 20 (3) 1 year postsurgery: 10 (7)	Decrease presurgery to 1 year, $p < 0.001$
			Presurgery severe binge eaters ($n = 13$), BES mean score (SD)	Presurgery: 31 (5) 1 year postsurgery: 13 (9)	Decrease presurgery to 1 year, $p < 0.001$ No difference between presurgical moderate and severe binge eaters at 1 year postsurgery, $p > 0.05$
AGB	Castellini (2014) (25)	BES	BES mean score (SD)	Presurgery: 15.5 (9.6) 1 year postsurgery: 6.0 (6.4)	Treatment effect over time, $p < 0.01$
	Lang (2002)(38)	BSQ	BSQ mean score (SD)	Presurgery: 14.2 (10.4) 3 months postsurgery: 4.9 (8.1) 6 months postsurgery: 6.9 (9.4) 9 months postsurgery: 6.2 (8.9) 12 months postsurgery: 6.2 (9.3)	Decrease presurgery to 3 months, $p < 0.001$ Increase 3 months to 6 months, $p < 0.05$ No change 6 months to 9 months, $p > 0.05$ No change 9 months to 12 months, $p > 0.05$
Binge eating episodes					
RYGB	Kalarchian (1999) (28)	EDE-I	Proportion 'binge eaters'	Presurgery: 44.0% (≥1 OBE per week) 4 months postsurgery: 0% ≥1 OBE per week, 0% any OBEs, 4% ≥1 SBE per week, 16% any SBEs	NR

(*Continues*)

Table 3. (Continued)

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
	White (2006)(21)	EDE-Q	Proportion with no episodes	Presurgery: 60.4% 12 months postsurgery: 90.5%	NR
			Proportion with 'infrequent' (<1/week) episodes	Presurgery: 15.8% 12 months postsurgery: 8.8%	
			Proportion with 'regular' (1 to <2/week) episodes	Presurgery: 13.7% 12 months postsurgery: 0.7%	
			Proportion with DSM-IV threshold (≥2/week) episodes	Presurgery: 10.1% 12 months postsurgery: 0%	
	White (2010)(20)	EDE-Q	Proportion with 'general LOC' (SBEs or OBEs)	Presurgery: 61.2% 6 months postsurgery: 30.7% (38.4% of participants who had 'general LOC' presurgery, 17.3% of participants who did not have 'general LOC' presurgery) 12 months postsurgery: 36.4% (45.3%, 23.0%) 24 months postsurgery: 39.4% (49.0%, 24.2%)	Presurgery predictive of 6 months, $p < 0.001$ Presurgery predictive of 12 months, $p < 0.001$ Presurgery predictive of 24 months, $p = 0.002$ Decrease presurgery to 6 months, $p < 0.001$ Increase 6 months to 12 months, $p = 0.03$ Increase 6 months to 24 months, $p = 0.02$ No change 12 months to 24 months, $p = 0.46$ Presurgery predicted postsurgery, $p = 0.0001$ Increase with time after surgery, $p = 0.04$
			Proportion with 'objective LOC' (OBEs)	Presurgery: 42.4% 6 months postsurgery: 30.7% (41.5% of those who had objective LOC presurgery, 22.4% of those who did not have objective LOC presurgery) 12 months postsurgery: 36.9% (49.6%, 28.1%) 24 months postsurgery: 39.5% (46.2%, 33.7%)	Presurgery predictive of 6 months, $p < 0.001$ Presurgery predictive of 12 months, $p < 0.001$ Presurgery not predictive of 24 months, $p = 0.102$
			Proportion with 'subjective LOC' (SBEs)	Presurgery: 40.2% 6 months postsurgery: 30.9% (40.6% of participants who had subjective LOC presurgery, 23.7% of participants who did not have subjective LOC presurgery) 12 months postsurgery: 36.6% (47.4%, 29.4%)	Presurgery predictive of 6 months, $p = 0.002$ Presurgery predictive of 12 months, $p = 0.002$ Presurgery predictive of 24 months, $p = 0.010$

(*Continues*)

Table 3. (Continued)

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
				24 months postsurgery: 39.3% (52.5%, 31.4%)	
AGB	Colles (2008)(36)	QEWP-R; semi-structured clinical/phone interview	Proportion with uncontrolled eating (OBE or SBE ≥1 per week in past 6 months; not BED)	Presurgery: 31.0% 12 months postsurgery: 22.5%	No change presurgery to 12 months, $p > 0.05$
	Lang (2002)(38)	BSQ	Proportion reporting binge eating episodes	Presurgery: 63.6% 12 months postsurgery: 28.8% (31.8% had no binge eating pre and postsurgery, 39.4% ceased binge eating after surgery, 24.2% continued to report binge eating, 4.5% reported new binge eating after surgery)	Significance of changes, $p < 0.001$
	Scholtz (2007)(39)	EDE	Proportion with binge eating episodes	Presurgery: 13.8% 0–5 years postsurgery: 13.8%	NR
Uncontrolled eating					
RYGB	Alfonsson (2014) (22)	G-FCQ-T	Lack of control over eating subscale, mean (SD)	Presurgery: 2.8 (1.1) 12 months postsurgery: 1.4 (0.5)	Decrease presurgery to 1 year, $p < 0.001$
	Bryant (2013)(24)	TFEQ-R18	Uncontrolled eating subscale, mean (SD)	Presurgery: 43.7 (29.2) 3 days postsurgery: 43.2 (19.2) 2 months postsurgery: 19.8 (12.1) 1 year postsurgery: 20.9 (10.9)	Change over time, $p < 0.001$ Decrease presurgery to 2 months, $p < 0.05$ Decrease presurgery to 1 year, $p < 0.05$ Increase 2 months to 1 year, $p < 0.05$ No change all other comparisons, $p > 0.05$
	Laurenius (2012) (30)	TFEQ-R21	Uncontrolled eating subscale	Data presented in graph only	Decrease presurgery to 6 weeks, $p < 0.001$ Decrease presurgery to 1 year, $p < 0.001$ Decrease presurgery to 2 years, $p < 0.003$
	Petereit (2014) (33)	TFEQ-R18	Uncontrolled eating subscale, mean	Presurgery: 59.1 1 year postsurgery: 20.6	Decrease presurgery to 1 year, $p < 0.001$
	Turkmen (2014) (35)	TFEQ-R21	Uncontrolled eating subscale, mean (SD)	Presurgery: 42.7 (20.1) 6 months postsurgery: 20.3 (14.5) 12 months postsurgery: 22.3 (14.8)	Change over time, $p = 0.03$ Decrease presurgery to 6 months, $p = 0.017$ Decrease presurgery to 12 months, $p = 0.017$ No change 6 months to 12 months, $p > 0.05$

AGB, adjustable gastric banding; BED, binge eating disorder; BES, binge eating scale; BSQ, body shape questionnaire; DSM-IV, diagnostic and statistical manual of mental disorders, 4th ed.; EDDS, eating disorder diagnostic scale; EDE, eating disorder examination; EDE-BSV, eating disorder examination – bariatric surgery version; EDE-I, eating disorder examination – interview; EDE-Q, eating disorder examination – questionnaire; G-FCQ-T, general food cravings questionnaire – trait; LOC, loss of control; NR, not reported; OBE, objective binge episode; QEWP, questionnaire on eating and weight patterns; QEWP-R, questionnaire on eating and weight patterns – revised; RYGB, roux-en-Y gastric bypass; SBE, subjective binge episode; SCID-I/P, structured clinical interview for DSM-IV axis I disorders, research version, patient version; SD, standard deviation; TFEQ-R18, three factor eating questionnaire – r18; TFEQ-R21, three factor eating questionnaire – r21.

Table 4 Presurgery to postsurgery changes in bulimia nervosa and related symptoms, by procedure

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Bulimia nervosa					
AGB	Scholtz (2007)(39)	EDE	Proportion with current bulimia nervosa according to DSM-IV criteria	Presurgery: 0% 0–5 years postsurgery: 0%	NR
Bulimic symptoms					
RYGB	Kruseman (2010)(29)	EDI-II	Bulimia subscale, mean (SD)	Presurgery: 3.4 (3.9) 8 years postsurgery: 2.1 (3.2)	Decrease presurgery to 8 years, $p = 0.001$
	Matini (2014)(32)	EDI-3	Bulimia subscale, mean (SD)	Presurgery: 11.5 (6.1) 6 months postsurgery: 7.9 (5.2)	Decrease presurgery to 6 months, $p < 0.0001$
	Thonney (2010)(34)	EDI-II	Bulimia subscale, mean (SD)	Presurgery: 2.9 (0.6) 1 year postsurgery: 1.4 (0.5) 2 years postsurgery: 1.2 (0.3)	Decrease presurgery to 1 year, $p < 0.01$ Decrease presurgery to 2 years, $p < 0.01$
AGB	De Panfilis (2007)(37)	EDI-2	Bulimia subscale, mean (SD)	Presurgery: 5.9 (4.1) 12 months postsurgery: 3.1 (1.9)	Decrease presurgery to 12 months, $p \leq 0.01$
VSG	Melero (2014)(40)	EDI-1	Bulimia subscale, mean	Presurgery: 1.96 12 months postsurgery: 0.22	Decrease presurgery to 12 months, $p < 0.01$

AGB, adjustable gastric banding; EDE, eating disorders examination; EDI-1, eating disorder inventory – 1; EDI-II/2, eating disorder inventory – 2; EDI-3, eating disorder inventory – 3; NR, not reported; RYGB, roux-en-Y gastric bypass; SD, standard deviation; VSG, vertical sleeve gastrectomy.

found a significant initial decrease in binge episodes at 6 months after RYGB (61.2% to 30.7%), followed by a re-increase in symptoms from 6 to 12 (36.4%) and 24 months (39.4%). Results of the 'poor'-rated (highest risk of bias) studies are presented in each Table but are not discussed in-text.

Six studies looked at BED and related symptoms in AGB patients, reporting less consistent findings than the reductions reported after RYGB. While the single 'good' study that found a significant reduction in binge eating at a year after RYGB also found the same in AGB (25), findings from 'fair' studies varied. Several studies reported significant decreases in BED rates at 1 year postsurgery (36,37), while another found no change in the proportion with BED between presurgery and 0–5 years after surgery (39). Lang *et al.* (38) noted a significant initial short-term decrease in binge symptoms (to 3 months postsurgery), followed by a significant re-increase from 3 to 6 months, and no change through to 12 months postsurgery, but did not report the overall significance of this change. Studies of binge episodes reported significant decreases (38) and no change (36) at 12 months after AGB, while a further study found no change in rates at 0–5 years postsurgery (39). No 'good' or 'fair' studies examined uncontrolled eating in AGB patients. No studies with a 'good' or 'fair' rating examined BED or any related symptoms in VSG patients.

Bulimia nervosa and related symptoms

The limited amount of acceptable-quality evidence reviewed here suggests positive short, medium and longer-term changes in bulimic symptoms after RYGB (Table 4). One 'good' study found a significant decrease in bulimic symptoms at 8 years postsurgery (29), and 'fair' studies also reported significant decreases to 6 months (32) and 1 and 2 years (34) after surgery. No 'good' or 'fair' studies examined changes in bulimia nervosa after RYGB.

Fewer studies examined bulimia and bulimic symptoms in AGB and VSG. In AGB, Scholtz *et al.* reported that no patients in their sample at presurgery and 0–5 years postsurgery had bulimia nervosa (39), and significant reductions were found in bulimic symptoms at 12 months after AGB (37) and VSG (40) (all rated 'fair').

Emotional eating

The reviewed studies consistently suggest positive short to medium-term changes in emotional eating after RYGB. Two 'good'-rated studies found significant decreases in emotional eating between presurgery and 1 year (25), and from presurgery to 6 weeks, 1 year and 2 years, with RYGB patients reporting significantly more emotional eating than non-obese reference subjects before but not after surgery (30). These positive results were supported by 'fair' studies that showed significant decreases in emotional eating at 1 year (22,33) and 6 months and 1 year (no change from 6

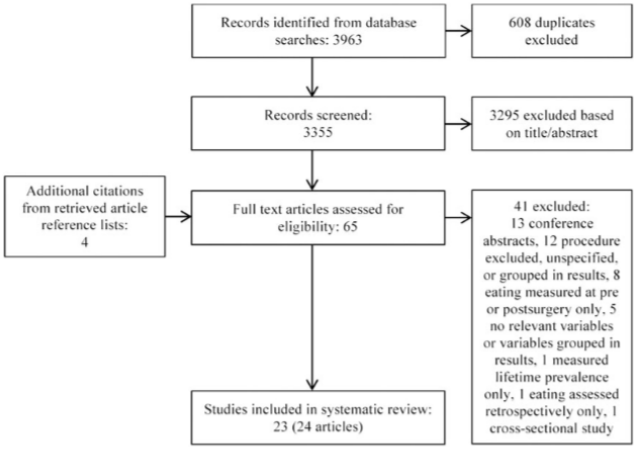

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta Analyses flow chart for study inclusion.

to 12 months) (35), a significant change over time to 1 year (assessment at 3 days, 2 months and 1 year) (24), and significant changes over time in anxiety-related, anger-related and depression-related emotional eating between presurgery and 6 months, with a decrease presurgery to 1–3 weeks and no change 1–3 weeks to 6 months (27).

There was little evidence related to emotional eating in AGB, with the 'good' study that reported a significant decrease in emotional eating in RYGB patients showing a similarly large but nonsignificant change in emotional eating at 1 year after AGB (25). No reviewed studies examined emotional eating changes after VSG.

Night eating syndrome

One 'fair' study examined changes in NES after AGB. With no endorsed criteria available, Colles *et al.* (36) composed questions according to the definition of Stunkard *et al.* (42): that within the last 3 months the individual usually had no appetite for breakfast, consumed half or more of their total energy intake after 7 pm and had trouble getting to sleep or staying asleep three or more nights per week. Based on these criteria, they found a significant decrease in NES from presurgery (17.1%) to 12 months postsurgery (7.8%). No studies investigated changes in NES after RYGB or VSG.

Grazing

No reviewed studies examined grazing in RYGB or VSG patients, and the same single 'fair' study of NES also examined grazing in AGB patients (Table 5). Again lacking recognized criteria, Colles *et al.* (36) defined grazing according to Saunders *et al.* (43) as 'consumption of smaller amounts of food continuously over an extended period of time, eating more than the subject considers best for them' (p. 616). They asked whether participants had often engaged in grazing in the past 6 months and found a significant increase in grazing between presurgery (26.4%) and 12 months postsurgery (38.0%).

Reoccurrences and new occurrences of problematic and disordered eating

Reports from the reviewed literature of reoccurrences and new occurrences of binge behaviours and NES after RYGB, and especially after AGB, are noteworthy. The only study of RYGB patients (20) to mention these issues found a substantial rate of new occurrences of binge episodes, with 17.3% of patients who had not reported presurgical binge episodes (subjective binge episodes or objective binge episodes) reporting binge episodes at 6 months, 23.0% at 12 months and 24.2% at 24 months. Rates of postsurgical reoccurrences were almost twice those of new occurrences. Of those who had experienced presurgical binge episodes, 38.4% reported their reoccurrence at 6 months postsurgery, 36.4% at 12 months and almost half (49.0%) reported a reoccurrence at 24 months.

A larger number of studies reported on reoccurrences and new occurrences after AGB than RYGB. In reports of new occurrences, Colles *et al.* (36) found that 50% of those with BED at 12 months after surgery (of the 3.4% of the sample) and 60% of those with NES (of that 7.8% of the sample) had not been diagnosed at presurgery, Scholtz *et al.* (39) found identical rates of BED at presurgery and 0–5 years postsurgery but noted that these

Table 5 Presurgery to postsurgery changes in problematic eating behaviours: emotional eating, night eating syndrome and grazing, by procedure

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Emotional eating					
RYGB	Alfonsson (2014)(22)	G-FCQ-T	Emotional food cravings subscale, mean (SD)	Presurgery: 2.27 (1.03) 12 months postsurgery: 1.39 (0.72)	Decrease presurgery to 12 months, $p < 0.001$
	Bryant (2013)(24)	TFEQ-R18	Emotional eating subscale, mean (SD)	Presurgery: 58.9 (33.2) 3 days postsurgery: 61.1 (31.3) 2 months postsurgery: 37.0 (24.8) 1 year postsurgery: 37.4 (24.5)	Change over time, $p = 0.025$
	Castellini (2014)(25)	EES	EES mean score (SD)	Presurgery: 43.1 (12.4) 1 year postsurgery: 0.8 (0.7)	Treatment effect over time, $p < 0.01$
	Dymek (2001)(27)	EES	Anger subscale, mean (SD)	Presurgery: 13.9 (10.3) 1–3 weeks postsurgery: 5.3 (8.4) 6 months postsurgery: 5.4 (7.8)	Change over time, $p < 0.009$ Decrease presurgery to 1–3 weeks, $p < 0.05$ No change 1–3 weeks to 6 months, $p > 0.05$
			Anxiety subscale, mean (SD)	Presurgery: 11.3 (8.0) 1–3 weeks postsurgery: 4.7 (7.3) 6 months postsurgery: 5.4 (7.8)	Change over time, $p < 0.009$ Decrease presurgery to 1–3 weeks, $p < 0.05$ No change 1–3 weeks to 6 months, $p > 0.05$
			Depression subscale, mean (SD)	Presurgery: 8.9 (5.3) 1–3 weeks postsurgery: 3.8 (5.3) 6 months postsurgery: 2.5 (4.2)	Change over time, $p < 0.001$ Decrease presurgery to 1–3 weeks, $p < 0.05$ No change 1–3 weeks to 6 months, $p > 0.05$
	Laurenius (2012)(30)	TFEQ-R21	Emotional eating subscale	Data presented in graph only	Decrease presurgery to 6 weeks, $p < 0.001$ Decrease presurgery to 1 year, $p < 0.001$ Decrease presurgery to 2 years, $p = 0.046$
	Peterelt (2014)(33)	TFEQ-R18	Emotional eating subscale, mean	Presurgery: 28.2 1 year postsurgery: 17.2	Decrease presurgery to 1 year, $p < 0.001$
	Turkmen (2014)(35)	TFEQ-R21	Emotional eating subscale, mean (SD)	Presurgery: 47.9 (27.6) 6 months postsurgery: 32.1 (27.5) 12 months postsurgery: 33.8 (24.0)	Change over time, $p = 0.021$ Decrease presurgery to 6 months, $p = 0.027$ Decrease presurgery to 12 months, $p = 0.017$ No change 6 months to 12 months, $p > 0.05$
AGB	Castellini (2014)(25)	EES	EES mean score (SD)	Presurgery: 46.3 (9.9) 1 year postsurgery: 1.3 (1.0)	No treatment effect over time, $p > 0.05$
VSG	Sloka (2013)(41)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified 'emotional eaters' (criteria unclear)	Presurgery: 14.5% (16/110) Postsurgical data presented in graph only	NR

(*Continues*)

Table 5. (Continued)

Surgical procedure	Author (year)	Assessment tool(s)	Outcome measure	Results	Statistical change
Night eating syndrome					
AGB	Colles (2008)(36)	Researcher-composed items based on Stunkard *et al.* (1996) proposed diagnostic criteria	Proportion with NES (over past 3 months)	Presurgery: 17.1% 12 months postsurgery: 7.8% (60% of those did not have presurgical NES; only 18.1% of those with presurgical NES had postsurgical NES)	Decrease presurgery to 12 months, $p < 0.05$
VSG	Sioka (2013)(41)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified 'night eaters' (criteria unclear)	Presurgery: 5.5% (6/110) Postsurgical data presented in graph only	NR
Grazing					
AGB	Colles (2008)(36)	Researcher-composed item based on Saunders (1999, 2004) definition	Proportion 'grazers' (over past 6 months)	Presurgery: 26.4% 12 months postsurgery: 38.0% (94.1% of presurgical grazers continued grazing after surgery; 31% higher prevalence postsurgery)	Increase presurgery to 12 months, $p > 0.05$
VSG	Sioka (2013)(41)	Unspecified interview assessment by dietitian; QEWP-R	Proportion classified 'snacker eaters' (criteria unclear)	Presurgery: 29.1% (32/110) Postsurgical data presented in graph only	NR

AGB, adjustable gastric banding; EES, emotional eating scale; G-FCQ-T, general food craving questionnaire trait; NES, night eating syndrome; NR, not reported; RYGB, roux-en-Y gastric bypass; SD, standard deviation; TFEQ-R18, three factor eating questionnaire – r18; TFEQ-R21, three factor eating questionnaire – r21; VSG, vertical sleeve gastrectomy.

'were not the same actual patients, as some developed the disorder de novo or progressed from isolated bingeing to the full disorder' (S. Scholtz, email communication, 14 July 2015), and Lang *et al.* (38) noted a 4.5% rate of new occurrences in binge episodes at 12 months. Reports of reoccurrence or continuations again suggest these may be more common than new occurrences, with reports of an 11.4% BED reoccurrence at 12 months postsurgery (37), 33% BED reoccurrence rate between 0–5 years postsurgery in those with any history of BED (39) and a 24.2% reoccurrence rate of binge episodes at 12 months (38). Colles *et al.* (36) found that 18.1% of those with NES and 94.1% of those with significant grazing behaviours reported reoccurrences at 12 months after AGB. No reviewed studies reported on new occurrences or reoccurrences of problematic or disordered eating behaviours after VSG.

Discussion

To the best of our knowledge, this is the first systematic review to compare the literature on changes in eating disorders, symptoms and problematic eating behaviours from before to after each of the three most common current bariatric surgeries: Roux-en-Y gastric bypass, adjustable gastric banding and vertical sleeve gastrectomy. While there are substantial limitations on the scope and strength of the literature, a number of preliminary but potentially valuable insights can be drawn from the available evidence.

Changes in problematic and disordered eating behaviours

While the literature strongly suggests overall significant reductions in BED and related symptoms in the short-term and medium-term after RYGB, there is some evidence that these issues may follow a pattern of an initial large reduction, followed by a later re-increase in symptoms. The longer-term trend and significance of this re-increase has not been investigated. The literature on changes in BED and related symptoms after AGB is inconsistent, with reports of increases, decreases and no change. Several review articles have found strong evidence linking binge eating, BED and loss of control eating after bariatric surgeries to poorer weight loss or greater weight regain (11,12,44), although links between presurgical binge eating and poorer postsurgical outcomes are less consistent (12,45). Wood and Ogden (18) found that whether or not the patient's binge eating decreased or persisted after AGB, rather than simply the presence of BED at presurgery or postsurgery, was predictive of weight loss.

The limited reviewed evidence suggests positive short, medium and longer-term changes in bulimic symptoms after RYGB, but there was little to review related to AGB and

VSG, or in regards to bulimia nervosa. Presurgical and postsurgical rates of bulimia nervosa are largely unknown (46). As a recommended contraindication to surgery (45), it may be that few patients with bulimia, or few who admit to it, undergo bariatric surgery. However, bulimia nervosa may develop after surgery even if not present before (47). Similarly, little is understood about the effects of bulimia and its symptoms in bariatric surgeries, although Thonney *et al.* (34) found that bulimic symptoms were not related to weight loss at 2 years post-RYGB.

This review found consistent evidence for significant reductions in emotional eating in the short to medium-term after RYGB. There was little evidence on emotional eating after AGB and none on VSG. Although widely viewed as a risk factor for poorer postsurgical outcomes and a common reason for exclusion from bariatric surgery (48), the literature on the actual effects of emotional eating after bariatric surgeries is inconsistent (46). While some studies have found no link between presurgical emotional eating and weight outcomes (49,50), Castellini *et al.* (25) reported that greater presurgical emotional eating predicted lower BMI reductions 1 year after AGB and RYGB, and Canetti *et al.* (51) found a relationship between greater postsurgical emotional eating and poorer weight loss. Interestingly, several studies have linked emotional eating with improved postbariatric weight loss outcomes. Wedin *et al.* (52) reported that a self-reported presurgical history of emotional eating was associated with five times increased odds of successful weight loss at 2 years after RYGB, AGB or VSG, and Mathus-Vliegen (53) noted that women with successful weight loss at a mean of 8.2 years after VBG or RYGB reported more postsurgical emotional eating than reference norm scores. The effects of emotional eating on postbariatric outcomes are yet to be well understood. Further, there are questions as to whether or not responses on emotional eating questionnaires, which commonly ask about feeling the 'urge' or 'need' to emotionally eat rather than actual emotional eating, accurately reflect an individual's emotional eating behaviours (54).

None of the reviewed studies investigated changes in NES after RYGB or VSG, and just one study reported a significant decrease in NES at 1 year after surgery (36). The few studies to date have found no clear links between presurgical (36,55,56) or postsurgical NES (36) and poorer postsurgical outcomes. Presurgical NES has been strongly linked to presurgical BED (36,57) and has also been found not to predict postsurgical NES, uncontrolled eating or grazing (36). Research into NES in bariatric populations is in its early stages, and little can be concluded at this stage. It is hoped that the recent inclusion of NES in the DSM-5 (58), involving recurrent episodes of night eating, either after waking from sleep during the night or excessive food consumption after dinner, which the individual is aware of and can recall, and which cause significant distress or impairment, and the likely forthcoming publication of measures of NES as per the new DSM criteria will inspire researchers to further investigate this issue in patients after bariatric surgeries.

Just one study investigated grazing in AGB patients, finding a significant decrease in both NES diagnoses and the proportion who grazed at 1 year after surgery (36). No studies investigated this in RYGB or VSG. The few studies that have investigated the effects of grazing to date have consistently linked presurgical (36) and postsurgical (36,59,60) grazing with reduced weight loss and increased weight gain. It has also been reported that individuals with preoperative binge eating may be likely to 'swap' to grazing behaviours after bariatric surgery (36,43).

There has been significant discussion regarding the need for research and clinical differentiation between grazing as a normative, healthy eating pattern and grazing as a problematic, disordered eating behaviour (61,62). Although linked to poorer outcomes after bariatric surgery, grazing may actually be more common in nonclinical populations than eating-disordered populations, (63) and has been described as a behaviour that may only be problematic under certain circumstances or in particular populations (59). Lane and Szabó (62) have proposed that perceived loss of control may be the factor that distinguishes between healthy and 'disordered' grazing. Grazing research to date has also been hindered by the lack of specific, validated assessment measures. However, two new measures of grazing may prove useful in bringing consistency and validation to definitions and measures of grazing. The first reflects repetitive eating behaviours and a sense of loss of control (64), while the other (65) examines two types of grazing: compulsive, characterized by a perceived loss of control over eating, and non-compulsive, involving distracted eating. Conason (61) notes that bariatric research has commonly failed to differentiate disordered grazing, which is not a response to hunger and satiety signals, from both mindful eating in an unplanned way in response to hunger and satiety, and from eating in accordance with postbariatric surgery eating recommendations to consume numerous small 'meals' per day. Whether these measures, or others, are able to differentiate these variations requires investigation.

Reoccurrences and new occurrences

The findings of this review support previous assertions that patients with presurgical disordered or problematic eating behaviours, especially binge behaviours, are at greater risk for the continuation or redevelopment of these issues after surgery (66). In their review, Niego *et al.* (12) reported that 'despite some indications that binge eating behaviour is eliminated by gastric restrictive surgeries, many patients continue to have maladaptive and psychologically

distressing eating behaviours following surgery' (p. 356). They found that postsurgical binge eating was most often seen in those who had binge eating behaviours before surgery, many of whom continued to report feelings of loss of control when eating much smaller amounts of food after surgery. While less common than the redevelopment of presurgical issues, it is a worrying prospect that bariatric surgery may in fact result in an individual developing a new and serious eating problem or disorder (67). The majority of evidence regarding reoccurrences and new occurrences in this review was found in regards to AGB, although a single study suggested these may also occur after RYGB. It is yet to be seen whether similar patterns are seen after VSG and whether further research finds differing or similar patterns of reoccurrence and new occurrences in the different disordered and problematic eating behaviours across the three most common bariatric surgeries and over time after surgery.

A small but substantial proportion of RYGB, AGB and VSG patients either do not ever experience significant weight loss after their surgery or regain significant weight often from 1 or 2 years after their operation. In the Swedish Obese Subjects study, weight loss peaked at 1–2 years after RYGB and AGB, with regain in subsequent years that finally levelled off after 8–10 years. At 10 years, 8.8% of RYGB patients and 25.0% of AGB patients had lost less than 5% of their original weight, (68,69), and at 15 years postsurgery, RYGB patients had regained an average 5% from their highest weight loss and AGB patients had regained 7%. Golomb *et al.* (70) reported similar regain and weight loss failure in VSG, with average excess weight loss of 76.8% at 1 year, 69.7% after 3 years and 56.1% at 5 years postsurgery, and excess weight loss of <50% at 13.3% at 1 year, 21.1% at 3 years and 38.5% at 5 years. Multiple determinants, including biological, surgical, social, behavioural and psychological factors such as problematic and disordered eating behaviours, have been linked to poor weight loss and weight regain (71,72). Hsu *et al.* (73) hypothesized that patients may experience an initial postsurgical improvement in problematic and disordered eating during which they lose weight, but which erodes at approximately 2 years postsurgery, resulting in subsequent weight regain. However, the reasons why maladaptive eating behaviours may reoccur after an initial remission and often return at 1 to 2 years postsurgery requires investigation.

As Meany *et al.* (11) outlined in relation to BED, binge eating and loss of control, but which appear applicable to the wider spectrum of disordered and problematic eating behaviours, there are a number of items related to reoccurrences and new occurrences that require investigation: (a) why some patients, but not others, experience new occurrences or reoccurrences of problematic and disordered eating, (b) whether there is a critical follow-up for the emergence or re-emergence of these problems after surgery, (c) whether there are predictive factors for these occurrence or reoccurrences and (d) whether clinicians can presurgically distinguish patients who will cease their disordered or problematic eating behaviour after surgery, from those who will show reoccurrences, and those who show no issues before but develop them after undergoing bariatric surgery.

Issues of measurement and follow-up

The American Society for Bariatric Surgery recommends that ideal follow-up after bariatric surgery should be for 5 years or longer and discourages reporting weight loss with less than 2 years of follow-up (74). Although the attainability of that goal may be debated (75), this seems a similarly appropriate recommendation in regards to the study of disordered and problematic eating behaviours. Given evidence that disordered and problematic eating disorders may abate long-term, occur de novo, continue unchanged, return in the short-term or long-term, or 'swap' from one symptom or disorder to another, the 1-year follow-up period most often seen in this review appears inadequate for understanding the bigger patterns of changes in problematic or disordered eating after RYGB, AGB and VSG. As with weight changes, data collection that concludes at just 1 or 2 years after surgery will often report only a short chapter of a longer, more complex story (11,72). Further, with the potential start or reoccurrence of eating issues at 1 to 2 years after surgery, any links between problematic and disordered eating issues and outcomes are likely to depend on the point at which they are examined.

The findings of this review appear to support assertions that while a substantial proportion of patients may not fit the full criteria for an eating disorder before and/or after bariatric surgery, many will still experience problematic eating behaviours that are often still distressing and difficult (72). Measuring full disorders rather than symptoms may mean missed links between subdiagnostic eating-related issues and outcomes, or may lead to inaccurate conclusions that an eating disorder has been 'cured' after surgery when the patient is still experiencing substantial, problematic (but subdiagnostic) symptoms. It will be important to explore the utility of exploring symptoms or diagnoses to improve our understanding of eating behaviours and their related impacts after bariatric surgeries.

This review demonstrates that while patients may not able to eat an objectively large amount of food, binge behaviours may continue after bariatric surgery, although they may be expressed differently, altered or limited (12). Investigation of binge eating in bariatric patients is complicated by limitations on the amounts of food patients are usually able to eat postsurgery (12,46,75). Because of the anatomical and physiological alterations of bariatric procedures (11), it is generally very difficult or impossible for patients to eat an 'objectively large' amount of food (definitely larger than most people would eat in a similar time under similar circumstances; required for diagnosis of

BED under the DSM-5 (58)) after bariatric surgery. Given this difficulty of measurement and the lack of diagnostic distinction between eating issues in the general population and populations with anatomical and physiological limitations on their diet and eating behaviour (46), there has been a push away from using standard criteria to diagnose BED in bariatric populations. Instead, a number of researchers have suggested 'loss of control' over eating as the defining characteristic of binge eating, rather than the quantity of food ingested (12,73,75,76), and recommend investigating loss of control rather than objective binges (46). Indeed, Niego *et al.* (12) note in their review that studies that utilized the DSM-IV criteria for binge episodes have largely reported an absence of binge eating after surgery, as opposed to those studies that omitted or modified the 'objectively large' criteria. Further study of experiences of loss of control over eating as a standalone concept rather than as a symptom of BED may also facilitate investigation of loss of control related to other patterns of problematic and disordered eating. For example, Saunders (43) described that many who binged presurgery reported a shift towards grazing behaviours with feelings of loss of control after RYGB. The push towards investigation of concepts such as loss of control over eating appears useful for understanding links between loss of control and other problematic eating behaviours in bariatric populations.

Review limitations

This review highlights the dearth of high-quality evidence on changes in many types of disordered and problematic eating behaviours after RYGB, AGB and VSG. No 'good' or 'fair' (acceptable quality) rated studies investigated changes in bulimia nervosa, NES or grazing after RYGB, and just one examined BED. In AGB patients, only one study each examined bulimia nervosa, bulimic symptoms, emotional eating, NES and grazing. The most conspicuous absence of evidence was in regards to VSG, with just one acceptable-quality study (on bulimic symptoms), and none on changes in BED, binge eating symptoms or episodes, uncontrolled eating, bulimia nervosa, emotional eating, NES or grazing found. With VSG only approved as a standalone primary procedure in 2009 (77), investigations into changes in maladaptive eating patterns after VSG are hopefully forthcoming. The lack of studies regarding most of the eating behaviours makes it difficult to both see and understand any differences in the impacts of RYGB, AGB and VSG on disordered eating, and is a significant limitation of this review. As such, the findings of this review should be treated as preliminary and require further investigation.

Beyond this scarcity of evidence, a large proportion of the existing literature is limited by methodological issues and vulnerability to bias. Just three of the 23 studies included were rated as 'good', and comparisons and generalizations were impeded by weaknesses including large loss to follow-up, inconsistently defined key variables, non-reporting of the statistical change significance and researchers not using validated, reliable, consistent measures. Few papers examined any potential influence of presurgical or postsurgical support received from clinicians such as a psychologist or dietitian on eating-related outcomes. There was often little description of the presurgical data collection, and if it had been conducted as part of presurgical psychological evaluation, whether that was likely to have influenced patient responses. As bariatric surgery candidates may minimize symptoms in order to receive a positive recommendation for surgery (78) and poor agreement has been reported between diagnoses obtained during routine presurgical psychological evaluation and those obtained separately for research purposes (79), the method of presurgical data collection may influence findings. Just one study compared (non-randomized) surgery groups (25). While randomized controlled trials are likely inappropriate, it is hoped that future research will prioritize prospective comparison studies of changes in disordered and problematic eating behaviours from before to after different bariatric surgeries.

As only three studies reviewed reported any assessment beyond 2 years postsurgery, little can be understood at this stage about longer-term patterns of disordered and problematic eating behaviours after bariatric surgery, let alone comparing differences in this between RYGB, AGB and VSG. With several investigations having reported initial decreases followed by re-increases in symptoms, it is currently unclear whether any short or medium-term changes are sustained in the longer-term and whether these differ by surgical procedure.

The reviewed studies overwhelmingly studied female bariatric patients in their middle adulthood. Although this may reflect the average characteristics of bariatric patients in many Western countries (80,81), it is unlikely to represent wider populations of obese and surgery-seeking individuals. Further, the vast majority of the studies were conducted in western, industrialized countries (primarily European and North American), and their results may be bound to those regions. As Herpertz *et al.* (9) also note, patients in most bariatric studies have survived a number of selection biases including actively seeking surgery and being approved for surgery by a psychiatrist or psychologist. Therefore, the findings of many studies may not be generalizable to morbidly obese or prebariatric populations.

To facilitate a manageable paper, a number of further eating-related variables identified as important in previous research (8,46), including sweet eating, cravings and food addiction, were not included in this review. It is hoped other researchers will address this in future reviews. Similarly, important links between changes in problematic and disordered eating and outcomes after different bariatric surgeries were not systematically reviewed.

Conflict of interest statement

MO and ACH have nothing to disclose. GW reports non-financial support from Weight Watchers; personal fees and non-financial support from Novo Nordisk; grants, personal fees and non-financial support from Bayer Schering; grants and personal fees from Eli Lilly and Lawley; and personal fees from Astra Zeneca, Roche, Amgen, Bhesins, Sanofi and Elsevier, outside the submitted work.

Funding

MO was supported by a University of Adelaide Faculty of Health Sciences Divisional PhD Scholarship. No external funding was obtained for this study.

Acknowledgement

Thank you to Maureen Bell for her assistance with the database searches.

Supporting Information

Additional Supporting Information may be found in the online version of this article, http://dx.doi.org/10.1111/obr.12425

Supplementary Table S1. Methodological quality of the included studies.

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Appendix J: Paper 3 (Surgery for Obesity and Related Diseases, 2017) in press article

ARTICLE IN PRESS

ELSEVIER

Surgery for Obesity and Related Diseases ▮ (2017) 00–00

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Patients' reasons for and against undergoing Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy

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Received February 2, 2017; accepted July 6, 2017

Abstract

Background: The most common bariatric procedures, Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (LAGB), and sleeve gastrectomy (SG), generally induce significant weight loss and health improvements. However, little is known about how patients decide which procedure to undergo.
Objective: Investigate patients' reasons for and against undergoing RYGB, LAGB, and SG.
Setting: Online questionnaire.
Methods: Data were analyzed from 236 Australian adults with current RYGB (15.7%), LAGB (22.0%), or SG (62.3%) who completed a questionnaire including an open-ended question about why they underwent their procedure. Data were coded for content and analyzed.
Results: Patients most often underwent RYGB because of its *evidence base and success rate* and the *patient's characteristics*, whereas the most common reason for SG was a *medical practitioner's recommendation, preference, or choice*, followed by the patients' *evaluation of information* gathered from their own research and observations of others' success. The most common reasons for undergoing LAGB related to *characteristics of the procedure*, including its reversibility and a perception of LAGB as less invasive. The most common reason against undergoing both RYGB and SG was a desire to avoid *postsurgical complications and risks* such as leaks or malabsorption, whereas the most common reason against LAGB was *information and evidence* from other people's unsuccessful experiences and failure rates.
Conclusions: Patients' reasons for and against procedures differed by procedure. In addition to the surgeon's influence, patients demonstrated clear procedure preferences based on their own research, knowledge, and experiences. Preferences should be understood to assist patients to select the most appropriate procedure for their circumstances. (Surg Obes Relat Dis 2017;▮:00–00.)

Keywords: Bariatric surgery; Roux-en-Y gastric bypass; Adjustable gastric band; Sleeve gastrectomy; Procedure; Choice; Reason; Decision

M.O. was supported by University of Adelaide Faculty of Health and Medical Sciences Divisional and Australian Government Research Training Program Scholarships.

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Roux-en-Y gastric bypass (RYGB) comprises almost half (45%) of all bariatric procedures performed, followed by sleeve gastrectomy (SG; 37%), and laparoscopic adjustable gastric banding (LAGB; 10%) [1]. The magnitude of weight loss achieved varies across procedures, with RYGB and SG demonstrating significantly greater average weight

http://dx.doi.org/10.1016/j.soard.2017.07.013
1550-7289/

reductions than LAGB [2]. Although positive results from bariatric surgery may be maintained for more than 10 years [2], a substantial minority of patients do not ever lose a significant amount of weight after these procedures [3,4].

Furthermore, while "most [bariatric] operations have the ability to be successful in providing a given patient meaningful weight loss" [5], each patient's characteristics and circumstances may mean that he or she is more likely to achieve a better outcome with one particular procedure rather than another. The bariatric population is extremely heterogeneous, and it is impractical to assume that any single bariatric procedure would succeed in all patients [6]. For example, a nationwide French study found that the best patient profile for a successful outcome (excess weight loss >50%) 2 years after LAGB was individuals aged <40 years with an initial body mass index (BMI) <50 who their changed eating habits and were physically active after surgery [7]. However, little is known about why patients undergo one bariatric procedure rather than another.

In their review of the literature, Khan, et al. [8] suggested that choice of either LAGB or RYGB was most often based on either patient choice or a surgeon's recommendation. However, information seminars and meetings with a surgeon have been shown to rarely influence choice of procedure by patients who have decided on a procedure before these visits [9]. Insurance coverage may also influence procedure choice, with a U.S. survey of patients 3–24 months postsurgery [10] finding that 19% of patients who had undergone RYGB had insurance policies that would not cover adjustable gastric banding. The most common reason for choosing RYGB in this cohort was the expectation of greater weight loss, while LAGB was chosen for its lower risk.

Procedure perceptions and preferences also appear to vary by location. While SG is currently the most frequently performed procedure in the North America and Asia–Pacific regions, RYGB is most common in Europe and Latin and South America [1]. Ren et al. [11] interviewed presurgical patients using open-ended questions and found that Australian patients preferred AGB due to its safety, while U.S. patients' preference for the procedure was most often related to a perception of it being the least invasive bariatric surgery. RYGB was preferred by U.S. patients because of its lack of a foreign body and "inability to cheat," while for Australian patients, a desire for dumping was the most common primary reason for choosing this procedure. In their book chapter, Abeles et al. [6] suggest that choice of operation may be influenced by factors including health insurance restrictions; government coverage of procedures; patient and surgeon opinion; and patient characteristics, such as the degree of adiposity, co-morbid conditions, previous surgeries, underlying gastrointestinal disorders, and eating habits such as binge and sweet eating.

No study to date has examined patients' broader repertoires of reasons for undergoing one procedure rather than others. Reasons against undergoing other procedures, which may also play important roles in the decision-making process, have also not been investigated. Of particular interest are reasons for and against undergoing SG, which was only approved as a standalone primary procedure in 2009 [12]. This paper aims to begin to fill these gaps in the literature.

Methods

Data for the present study were collected as part of an investigation into the eating-related behaviors of people who undergo bariatric surgery. The reasons patients indicate for choosing to undergo one procedure rather than another have not been extensively researched to date. To provide a wider and richer understanding than is currently available in the literature [13], this study took a qualitative, exploratory approach.

Procedure

The participants were individuals living in Australia with a current RYGB, LAGB, or SG that had been performed in Australia when they were >18 years old. The study was promoted on online Australian bariatric forums and Facebook groups, in the media, in bariatric and medical practices, and by clinicians directly to patients. Promotions directed individuals to the study website, where they could learn about the research, provide consent, undergo screening, and participate. Data were collected in April to August 2016. Participation was anonymous, and no tangible incentive was offered. Approval (16/12) for the study was obtained from the University of Adelaide Human Research Ethics Subcommittee.

Materials

Participants completed a single online questionnaire collecting quantitative and qualitative data about their presurgery and postsurgery eating-related behaviors and experiences. Online questionnaires offer a number of advantages over paper-based surveys, including lower rates of social desirability bias, more truthful self-reports, higher levels of self-disclosure, and fewer nonresponses regarding questions on sensitive or personal topics [14–16].

For this study, responses to the open-response question, "For what reasons did you have a band, bypass, or sleeve (the procedure or procedures currently in your body), and not a different procedure? (For example, if you have a bypass: Why did you have a bypass, rather than a sleeve or band?)," were investigated.

Demographic data including self-reported presurgical and current weights and height were collected. Participants were also asked questions about current and previous bariatric

surgeries, including which type of procedure(s) they currently had, whether they had undergone any previous bariatric surgeries, when and where their current procedure had been performed, and how their surgery was funded. Patients provided presurgical and current ratings of their general mental and physical health (e.g., "In general, would you say your physical health before surgery was:" 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent), with changes calculated by taking presurgical from postsurgical ratings (positive results indicating improvement). Ratings of satisfaction with surgical result, weight loss, current eating behaviors, current physical appearance, physical activity, and social support (e.g., "How satisfied are you with… your weight loss since surgery?" 1 = extremely dissatisfied, 5 = extremely satisfied; Cronbach's $\alpha = .84$ for all items) [17] were averaged to create an overall score of postsurgical satisfaction. Percentage of excess BMI lost was calculated using the formula ([preoperative BMI – current BMI]/[preoperative BMI – 25]) × 100.

Analysis

The qualitative data were first subjected to content analysis, an established data analysis technique that uses a "systematic classification process of identifying themes and patterns" [18] to transform qualitative text into meaningful categorical data that may then be numerically described and statistically analyzed [19]. Each patient response was examined to understand its meaning, with categories given labels to reflect their meaning. Categories were generated inductively from the data, as is appropriate for studies that intend to develop new knowledge rather than describe existing phenomena or replicate previous findings. Codes were assigned to any amount of text, whether a single word or entire paragraph, that represented a relevant category [20]. The constant comparison method was used, with each new piece of text assigned to a category compared systematically with the data already within the category. Coding was checked for consistency within categories and against other categories throughout and after the first round of coding. After the initial round of coding, thematically similar categories were collapsed where appropriate. Coders were blind to patient details during coding. M.O. carried out the initial coding, A.C.H. checked its consistency, and both agreed on the final categories and coding.

Analyses were then performed in SPSS 23.0. *P* values $< .05$ were considered statistically significant. Fisher's exact test was used to assess associations between categorical variables, with adjusted standardized residuals examined to identify cells making a significant contribution ($z = \pm 1.96$) within significant results [21]. One-way analyses of variance (ANOVA, Welch's ANOVA when homogeneity of variance was violated) with the Šídák method for multiple comparisons were used with continuous variables.

Response rate

Of the 408 consenting participants, 386 were eligible. Of those, 150 responses were excluded due to missing data (n = 144) or because the participant had multiple current bariatric procedures in place (n = 6). Likely explanations for the high proportion of missing data included the complexity and length of the questionnaire and lack of completion incentive. Data from the remaining 236 participants (61.1%) were analyzed.

Results

Participants

As shown in Table 1, 62.3% of participants had a current SG, 22.0% had LAGB, and 15.7% had RYGB. Participants had a mean age of 45.5 years, and 93.9% were female. Patients with LAGB had undergone surgery significantly earlier than the other procedure groups. While their presurgery BMIs did not significantly differ, patients with LAGB had lost less excess BMI and weight and had lower postsurgical physical health change and poorer postsurgical satisfaction than had patients with RYGB or SG. Patients with RYGB were more likely to have had previous bariatric surgery. Significantly more patients with RYGB (91.7%) and SG (84.7%), and fewer with LAGB (47.6%), reported that they would choose the same procedure again.

Reasons for and against undergoing RYGB

Patients with a current RYGB cited *information and evidence* (50.0%), almost always related to the procedure's *evidence base, success rates, and long-term effectiveness* (46.4%), as their most frequent reason for having chosen this surgery. The second most commonly noted reason for undergoing RYGB related broadly to *patient characteristics* (35.7%). Specific reasons included the aim to lose a larger amount of weight than might be expected with other procedures, damage to the stomach and/or scar tissue from a previous LAGB, and pre-existing medical conditions including reflux and diabetes. The third and fourth most common reasons were a *medical professional's recommendation, preference, or choice* (21.4%), and a desire for *procedure-related effects*, most often *physical repercussions* like dumping and malabsorption (17.9%). Those who underwent RYGB were significantly more likely to have chosen this procedure due to the *characteristics of the patient*, for its *physical repercussions*, and because of its *evidence base* (Table 2).

Concerns regarding undesirable *procedure-related effects* (37.8%; most often possible *postsurgical complications and risks*, such as malabsorption or irritable bowel exacerbations) were LAGB and SG patients' most commonly cited reason against undergoing RYGB. Their next frequently noted reason against RYGB was related to the procedure's

Table 1
Participant characteristics

	All participants (N = 236)	RYGB patients (n = 37; 15.7%)	LAGB patients (n = 52; 22.0%)	SG patients (n = 147; 62.3%)	*P* value
Months since surgery, mean (SD)	26.6 (36.4)	21.6 (35.8)	62.9 (52.6)*	15.2 (15.8)	<.0005†
Previous bariatric surgery, n (%)	36 (15.3)	16 (43.2)‡	0 (0)§	20 (13.6)	<.0005†
Surgery funding, n (%)					
Public health system (no cost to patient)	13 (5.5)	2 (5.4)	4 (7.7)	7 (4.8)	.634
Private health insurance with/without gap payment	177 (74.2)	31 (83.8)	37 (71.1)	109 (74.2)	
Fully self-funded	25 (10.6)	1 (2.7)	6 (11.5)	18 (12.2)	
Other (accessed superannuation, another individual or organization paid, specialist did not charge)	21 (8.9)	3 (8.1)	5 (9.6)	13 (8.8)	
Sex, n (%)					
Female	214 (93.9)	35 (94.6)	48 (92.3)	131 (94.2)	.868
Male	13 (5.7)	2 (5.4)	4 (7.7)	7 (5.0)	
Other	1 (0.4)	0 (0)	0 (0)	1 (0.7)	
Age, yr, mean (SD)	45.5 (10.1)	47.0 (9.6)	45.3 (10.4)	45.2 (10.2)	.644
Weight (M, SD)					
BMI before surgery	45.5 (8.0)	46.3 (9.1)	45.1 (8.3)	45.4 (7.6)	.770
% excess BMI loss	63.6 (29.1)	75.6 (25.7)	50.0 (29.7)*	65.4 (28.0)	<.0005†
Weight loss (kg)	34.9 (20.5)	42.9 (22.5)	27.3 (23.1)*	35.6 (17.9)	.001†
Mental health, mean (SD)					
Before surgery	2.2 (1.2)	2.2 (1.1)	1.9 (0.9)	2.3 (1.2)	.070
Change (current – before)	0.9 (1.2)	1.0 (1.4)	1.2 (0.2)	1.1 (0.1)	.526
Physical health, mean (SD)					
Before surgery	1.9 (0.9)	1.8 (0.8)	1.9 (0.8)	1.9 (1.0)	.712
Change (current – before)	1.5 (1.1)	1.9 (1.0)	1.1 (1.3)	1.6 (1.0)	.002†
Postsurgical satisfaction, mean (SD)	3.8 (0.8)	4.0 (0.7)	3.3 (1.1)*	4.0 (0.7)	<.0005†
Would have bariatric surgery again if could redo, n (%)					
No (probably/definitely not)	5 (2.1)	0 (0)	2 (3.8)	3 (2.0)	.780
Yes (probably/definitely)	221 (93.6)	36 (97.3)	47 (90.4)	138 (93.9)	
Unsure	10 (4.2)	1 (2.7)	3 (5.8)	6 (4.1)	
If would have bariatric surgery again, which surgery would choose, n (%)					<.0005*
RYGB	54 (24.8)	33 (91.7)‡	3 (7.1)§	18 (13.1)§	
LAGB	21 (9.6)	0 (0)§	20 (47.6)‡	1 (0.7)§	
SG	134 (61.5)	2 (5.6)§	16 (38.1)§	116 (84.7)‡	
Unsure	9 (4.1)	1 (2.8)	3 (7.1)	2 (1.5)	

RYGB = Roux-en-Y gastric bypass; LAGB = laparoscopic adjustable gastric banding; SG = sleeve gastrectomy; SD = standard deviation; BMI = body mass index.

*LAGB versus SG and RYGB.

†$P < .05$.

‡Overrepresented in sample compared with expected.

§Underrepresented in sample compared to expected.

characteristics (35.1%)—most often a perception of RYGB as being *too invasive, extreme, or permanent* (Table 3).

Reasons for and against undergoing SG

A *medical professional's recommendation, preference, or choice* was SG patients' most commonly cited reason for undergoing this procedure (48.5%). *Information and evidence* was their second most common reason for undergoing SG, but in contrast with patients' reasons for undergoing RYGB, the sources of these data were most often the *patients' own research* (14.4%) and *others' success with the procedure* (11.3%). A wish for *procedure-related effects*, most often the *ability to eat normally and healthily and to learn new habits* (8.2%), was the third most frequently cited reason for undergoing SG (20.6%). Patients with SG were significantly more likely to have chosen this procedure due to the *influence of a medical professional* and less likely to have chosen it for reasons including its *evidence base, patient characteristics*, and because they desired what they perceived to be a *less invasive or drastic procedure* (Table 2).

As seen in the reasons against RYGB, the most common reason against undergoing SG was also concern regarding undesired *procedure-related effects* (26.7%), most often *postsurgical complications and risks*, such as suture line leaks or reflux. Patients' next most common reason against SG related to the *procedure's characteristics* (20.0%), with perceptions of SG as *too invasive, extreme, or permanent*. Further reasons cited against undergoing SG related to the

Table 2
Patient reasons for undergoing their particular bariatric procedure

Category	Overall	RYGB patient responses (n = 28)	LAGB patient responses (n = 41)	SG patient responses (n = 97)	Fisher's Exact	*P* value	Sample patient responses
Medical professional recommendation/ preference/choice	57 (34.3%)	6 (21.4%)	4 (9.8%)*	47 (48.5%)†	14.69	.001‡	*"Recommended as best for me by the surgeon"* *"The sleeve was suggested/preferred by my surgeon for me and my circumstances"*
Information and evidence	49 (29.5%)	14 (50.0%)†	4 (9.8%)*	31 (32.0%)	14.28	.001‡	
Evidence base/success rates/long-term effectiveness	*22 (13.3%)*	*13 (46.4%)†*	*1 (2.4%)**	*8 (8.2%)**	*25.48*	*<.0005‡*	*"Chose the bypass because it has the greatest level of weight loss and long-term success in keeping the weight off"* *"There was more scientific data about the effectiveness of this operation, it had been done for a longer time than the sleeve"* *"The bypass has been used for over 50 years for weight loss surgery, whereas the sleeve has only been used for 10 years, so there are no long-term studies about the effects and impacts"*
Own research	*17 (10.2%)*	*1 (3.5%)*	*2 (4.9%)*	*14 (14.4%)*	*2.55*	*.271*	*"… and I did my own research and decided the sleeve would be a better option for me"* *"I had the sleeve as it appeared from my research to have better long-term success than the band"*
Others' success with the procedure	*12 (7.2%)*	*0 (0%)*	*1 (2.4%)*	*11 (11.3%)*	*3.97*	*.112*	*"Knew people who'd had the band and it hadn't been a terrific result and knew people who'd had the sleeve and it had been terrific"* *"I had seen 2 family members fail to lose weight with the band and when an acquaintance explained that she had succeeded after having the sleeve, I realized that it was my last chance to ever conquer my weight struggle"*
Characteristics of the procedure	48 (28.9%)	4 (14.3%)	28 (68.3%)†	16 (16.5%)*	37.80	<.0005‡	
Wanted a reversible/ removable procedure	*28 (16.9%)*	*3 (10.7%)*	*25 (61.0%)†*	*0 (0%)**	*75.10*	*<.0005‡*	*"I had the bypass as it is reversible if any issues arise"* *"Chose the band because it is reversible if reacted adversely with me"* *"I liked that the band wasn't permanent"*
Less invasive/drastic than other procedures	*15 (9.0%)*	*2 (7.1%)*	*9 (22.0%)†*	*4 (4.1%)**	*11.55*	*.002‡*	*"Less invasive than the other procedures"* *"A band is the least invasive procedure"* *"Sleeve was less invasive […] than the bypass"*
Wanted a permanent procedure	*8 (4.8%)*	*0 (0%)*	*0 (0%)*	*8 (8.2%)*	*3.80*	*.097*	*"I wanted a permanent solution…"* *"Had the band first because of the ability to reverse it. When this did not suit, I desperately needed to lose weight for health reasons so went with the permanent gastric sleeve"* *"Sleeve surgery was to me a more permanent solution to my problems"*
Wanted an adjustable/ controllable procedure	*8 (4.8%)*	*0 (0%)*	*8 (19.5%)†*	*0 (0%)**	*21.17*	*<.0005‡*	*"As it is adjustable…"* *"So it was able to have ongoing adjustments as required"* *"I can control it"*
Allows for further surgery later if needed	*3 (1.8%)*	*0 (0%)*	*0 (0%)*	*3 (3.1%)*	*0.85*	*.742*	*"I understood that if the sleeve gastrectomy did not result in adequate weight loss, I could proceed to a bypass"* *"Sleeve so there is another option if needed (i.e., bypass)"* *"Personally I also felt bypass would be the last step for me if something went wrong with the sleeve"*

Table 2
Continued.

Category	Overall	RYGB patient responses (n = 28)	LAGB patient responses (n = 41)	SG patient responses (n = 97)	Fisher's Exact	*P* value	Sample patient responses
No ongoing procedures or follow-up needed	*2 (1.2%)*	*0 (0%)*	*0 (0%)*	*2 (2.1%)*	*0.69*	*0.999*	*"No ongoing procedures required"* *"I didn't want the band due to […] the number of follow ups and interventions"*
Procedure-related effects	29 (17.5%)	5 (17.9%)	4 (9.8%)	20 (20.6%)	2.32	.334	
Fewer complications/ shorter recovery time/ less risky than other procedures	*11 (6.6%)*	*2 (7.1%)*	*4 (9.8%)*	*5 (5.2%)*	*2.00*	*.367*	*"I had the sleeve because I thought it has less long-term complications than the band"* *"I had the band because it was a quicker recovery time than the other surgeries"* *"The recovery time was more beneficial for me, as I have a ten month old"*
Ability to eat normally and healthily, learn new habits	*8 (4.8%)*	*0 (0%)*	*0 (0%)*	*8 (8.2%)*	*3.80*	*.097*	*"I was considering a band, but once I found out that I would be limited by the fresh foods that I could eat (apple, lettuce, etc) […] this changed my mind"* *"I love that I can still eat all of the foods that I love – just smaller portions"* *"I also thought long-term I would be able to deal with that surgery and eat and live most 'normally' afterwards"*
Avoid side-effects (e.g., malabsorption) associated with other procedures	*7 (4.2%)*	*0 (0%)*	*0 (0%)*	*7 (7.2%)*	*3.07*	*.179*	*"Had sleeve because my research indicated that side effects were minimal compared to other bariatric procedures"* *"I had a sleeve as […] less side effects like malnutrition and dumping syndrome"* *"Had the sleeve due to less side effects"*
Wanted physical repercussions associated with procedure	*5 (3.0%)*	*5 (17.9%)* †	*0 (0%)*	*0 (0%)**	*16.00*	*<.0005*‡	*"I chose the bypass because I knew my weakness was highly fatty and sugary food. I wanted there to be a repercussion if I chose to eat badly because I knew it was the only way I'd learn to eat healthier"* *"I wanted the malabsorption and dumping benefit that bypass may bring"* *"I have a sweet tooth and wanted to be turning off craving sweets"*
Allows good quality of life/normal life	*3 (1.8%)*	*0 (0%)*	*0 (0%)*	*3 (3.1%)*	*0.85*	*.742*	*"Sleeve seemed to be the least lifestyle invasive"* *"Chose the sleeve for quality of life"*
Chosen due to patient characteristics	17 (10.2%)	10 (35.7%)†	3 (7.3%)	4 (4.1%)*	19.40	<.0005‡	*"Sleeve was recommended by my doctor due to my age and lower BMI"* *"I had sleeve instead of bypass as I don't suffer from reflux"* *"I had a bypass because I believed my body absorbed more fats from my food than other people do"*
Only procedure provided/ mentioned/offered	6 (3.6%)	0 (0%)	4 (9.8%)†	2 (2.1%)	5.33	.046‡	*"Only option at the time"* *"I refused to have the band so they said I could only have the sleeve"* *"It was offered to me free as part of a […] trial"*

LAGB = laparoscopic adjustable gastric banding; RYGB = Roux-en-Y gastric bypass; SG = sleeve gastrectomy.
*Underrepresented in sample compared with expected.
†Overrepresented in sample compared with expected.
‡$P < .05$.

Table 3
Patients' reasons for not undergoing other procedures

Category	Reasons against RYGB (n = 37 responses)	Reasons against LAGB (n = 50 responses)	Reasons against SG (n = 15 responses)	Sample patient responses
Information and evidence	1 (2.7%)	24 (48.0%)	2 (13.3%)	
Other people's unsuccessful experiences	*1 (2.7%)*	*14 (28.0%)*	*0 (0%)*	*"Everyone I knew that had the band it didn't work"* *"I know many people who have 'eaten around' a band…"* *"Bypass didn't appear to be permanently effective – knew several people who regained their weight in 2-3 years"*
Concerns re: effectiveness/failure	*0 (0%)*	*10 (20.0%)*	*0 (0%)*	*"Bands fail"* *"I […] found many band recipients suffered complications and/or less than desired weight loss"* *"I had read a lot of evidence around failure, slippage, and adverse outcomes with band"*
New procedure/lack of evidence	*0 (0%)*	*0 (0%)*	*2 (13.3%)*	*"…the sleeve was a relatively new procedure"* *"Given that the sleeve is a newer procedure and there was less information available about long term results (i.e., whether patients had kept the weight off long-term)…"*
Unwanted procedure-related effects	14 (37.8%)	20 (40.0%)	4 (26.7%)	
Potential postsurgical complications/risks	*14 (37.8%)*	*14 (28.0%)*	*4 (26.7%)*	*"…heard many problems with band slipping, eroding"* *"Concern about nutrient malabsorption and ongoing nutritional deficiencies"* *"I considered bypass, but as I have IBS I was concerned that I may end up with intolerable bowel issues"*
Eating-related concerns	*0 (0%)*	*9 (18.0%)*	*0 (0%)*	*"I was considering a band, but once I found out that I would be limited by the fresh foods that I could eat (apple, lettuce, etc.) and run the risk of food getting stuck, this changed my mind"* *"I also wanted to change my eating habits and did not like the idea of being able to adjust the band at different events. It felt like cheating"*
Characteristics of the procedure	13 (35.1%)	13 (26.0%)	3 (20.0%)	
Procedure too invasive/extreme/ permanent	*13 (35.1%)*	*0 (0%)*	*3 (20.0%)*	*"I had my band done in 2006 and back then bypass was considered too radical and risky"* *"Removing a part of my stomach sounded frightening"* *"Sleeve was too permanent"*
Did not want foreign object in body/ ongoing upkeep	*0 (0%)*	*12 (24.0%)*	*0 (0%)*	*"Didn't want a port under my skin, I'm needle phobic. Didn't like the idea of having something additional in my body"* *"I was not keen on a band because I didn't want something foreign in my body"* *"Did not want the upkeep of a band"*
Did not want a reversible procedure	*0 (0%)*	*1 (2.0%)*	*0 (0%)*	*"I opted to have the sleeve over the band as I was not interested in a reversible procedure"*
Procedure not suitable	7 (18.9%)	4 (8.0%)	3 (20.0%)	*"I was morbidly obese with multiple co-morbidities and my research indicated that the band was unsuitable in those circumstances"* *"Already had a fundo so surgeon wouldn't do the sleeve"* *"The bypass was performed as the stomach was too damaged from the band slippage for the sleeve option"*
Procedure not offered/ available/considered	5 (13.5%)	0 (0%)	3 (20.0%)	*"The surgeon didn't discuss a bypass with me"* *"My surgeon recommended the sleeve only after doing a gastroscopy to eliminate the need for bypass"* *"Bypass […] wasn't on offer as a public patient anyway"* *"Sleeve was not available at the time"*
Medical professional recommended against procedure	0 (0%)	4 (8.0%)	0 (0%)	*"My surgeon no longer feels bands are a good effective option for weight loss surgery"* *"…surgeon no longer performs or recommends banding"* *"…surgeon won't do lap band"*

LAGB = laparoscopic adjustable gastric banding; RYGB = Roux-en-Y gastric bypass; SG = sleeve gastrectomy.

procedure not being suitable for the patient for reasons including young age or an existing medical condition (20.0%) or SG *not having been offered, available, or considered* at the time of the patient's decision (20.0%; Table 3).

Reasons for and against undergoing LAGB

In contrast with patients' reasons for RYGB and SG, the most common reasons for undergoing LAGB (68.3%) were all related to specific *characteristics of the procedure*. Patients most frequently cited and were statistically more likely to cite LAGB's ability to be *reversed and removed* (61.0%) and *adjusted and controlled* (19.5%) and reported a positive perception of the procedure as being *less invasive and dramatic than other procedures* (22.0%). Patients with LAGB significantly less often cited *information and evidence* (9.8%) or a *medical professional's recommendation, preference, or choice* (9.8%) as reasons why they had undergone their procedure, but they were significantly more likely to note that LAGB had been the *only procedure provided, mentioned, or offered* at the time of their decision (9.8%; Table 2).

RYGB and SG patients' most common reasons against undergoing LAGB were related to *information and evidence* (48.0%); specifically, *other people's unsuccessful experiences* (28.0%) and *concerns regarding the procedure's effectiveness and failure rates* (20.0%). The second most frequent reason against LAGB (40.0%) was concern regarding undesired *procedure-related effects*, most commonly *postsurgical complications and risks*, such as bands slipping or eroding (28.0%), followed by *eating-related concerns*, including food intolerances (18.0%). The next most frequent reason related to LAGB's *characteristics*, with patients reporting *not wanting a foreign object in their body and not wanting ongoing upkeep* (24.0%). LAGB was the only procedure that any patients noted their *surgeon had specifically recommended against* (8.0%; Table 3).

Discussion

In this first study to examine patients' reasons for and against the 3 current most common bariatric surgeries, reasons for and against each procedure varied. The influence of medical professional recommendation in patients' decisions for and against various bariatric procedures seen in this study was significant. In their review, Khan et al. [8] concluded that "surgeon's bias may have very little role in patients' decisions as they already have decided on the type of procedure for themselves […] surgeon visit will only affect the undecided patient." However, the influence of medical practitioners (primarily bariatric surgeons) on the choice of sleeve gastrectomy (SG) appeared to be substantial in this cohort, with just under half of those who had undergone SG stating that their medical practitioner's recommendation, preference, or choice had influenced them to undergo that procedure. Over 1 in 5 in the RYGB group also cited a medical practitioner's influence for their choice of procedure, contrasting with the findings of Ren et al. [11], in which U.S. and Australian patients did not report this as a reason for undergoing RYGB. LAGB was also the only procedure that any patients reported a medical practitioner had recommended against. This is consistent with a recent large trend away from this procedure in Australia [1]. In keeping with the overwhelming popularity of adjustable gastric banding in Australia at the average time our adjustable gastric band participants underwent surgery (82.5% of all Asia-Pacific bariatric procedures in 2008) [22], patients were more likely to have undergone LAGB because it was the only procedure offered or available at the time of their surgery.

Reversibility and removability was the most commonly cited reason for undergoing LAGB. Despite RYGB also being reversible [2], this was cited by only 10.7% of those who had undergone RYGB a reason for choosing this procedure. Reversing RYGB is a more complex and much less common operation than reversal of LAGB [23]. It may be that RYGB's potential reversibility is not known or is not an appealing feature to many who undergo it. Given that RYGB is associated with the greatest long-term weight loss and co-morbidities resolution of the 3 investigated surgeries [2], it may be unsurprising that patients who underwent RYGB more often cited the procedure's evidence base, success rate, and long-term effectiveness as reasons for choosing this procedure. Patients' understanding of and beliefs about the potential risks and effects of revisional surgery or band removal are unclear and would benefit from further investigation.

While the procedure's evidence base, success rate, and long-term evidence was the most common information influencing patients toward RYGB, for SG this most often came from patients' own research and seeing others' success after having SG. Given SG's relatively recent introduction and swift rise in popularity [12], it is understandable that patients were significantly less likely to have chosen it because of its evidence base, success rates, and long-term effectiveness and more likely to choose it because of others' success and doing their own research. Information and evidence was significantly less likely to have positively influenced patients toward LAGB and was instead the most common reason cited against undergoing LAGB. Little is currently known about sources and accuracy of patient information and whether the evidence used by presurgical patients to make procedure decisions is relevant to their own personal circumstances.

Patients' reasons against procedures they had not undergone also showed interesting patterns. A greater proportion of patients reported not undergoing RYGB (37.8%) due to the procedure's perceived extreme, invasive, or permanent nature than reported not undergoing SG (26.7%) for the

same reasons. Given that RYGB requires significant but reversible anatomic changes, whereas SG involves permanent, irreversible removal of the majority of the stomach, perceptions of RYGB as more radical than SG are interesting and require further investigation. Potential postsurgical complications and risks including malabsorption, reflux, irritable bowel, band erosions, and eating-related difficulties were also frequent reasons against RYGB, SG, and LAGB.

Other people's unsuccessful experiences were another commonly cited reason against undergoing LAGB. Though it has been theorized that patients may use media, the Internet, or personal acquaintances to gather information on procedures [8,9], this is the first study to document the significant specific influence of other patients' experiences on considerations of which bariatric procedure to undergo. Whether these influential others are personally known to the individual, such as family members or friends, or are at a greater distance, such as media stories or other anecdotal accounts, is yet to be explored.

There is no simple flow chart to indicate which surgery will best fit each patient and no consensus on one "best" bariatric procedure for everyone. Given this, understanding why patients undergo one particular procedure instead of others is important. Patients may be basing their procedure selection on potentially inaccurate or inapplicable information, such as the positive or negative experiences of a friend or colleague or a celebrity whose medical, behavioral, psychological, and social circumstances may differ in ways that will likely affect their outcome after undergoing the particular procedure. Patients may undergo a surgery based on their belief about the extreme or invasive nature of a procedure. Knowing these potential motivators will hopefully prompt clinicians to enquire why patients wish to undergo a particular bariatric procedure and to target the provision of appropriate and accurate information to inform and guide patients toward the most appropriate procedure for their individual circumstances.

Medical professionals have significant influence over patients' choices for and against bariatric procedures. The training and experience of bariatric surgeons may be limited to one particular procedure or another. For example, RYGB is more time consuming to perform and requires a high level of technical skill, with a reported learning curve of up to 500 cases [24,25]. Therefore, surgeons may limit their practice to one particular operation [6] or may hold unconscious bias toward or against a particular procedure. There may be referral bias by primary care practitioners, who are not aware of the different bariatric procedures and their risks and benefits for particular patients, resulting in referral to a surgeon who performs the favored operation. Patients seeking bariatric surgery may request a particular procedure based on anecdotal evidence or unrealistic expectations or may have circumstances that make them more suitable for one procedure over another [6]. In other cases, patients may not have a strong preference for or against any procedure. In either case, practitioners have an obligation to provide informed, accurate, and personalized information in the most objective manner possible. In the event that the surgeon involved does not competently perform each of the procedures, patients should receive independent advice and referral to the most appropriate surgeon [6,8].

Doctors' reasons for recommending for and against particular bariatric procedures remain largely unclear. While it seems intuitive that surgeons would recommend for and against particular bariatric procedures based on their assessment of a patient's medical concerns, current conditions, or weight loss goals, the influence of these issues versus patient demands and the surgeon's ability to perform, or comfort in performing, a particular procedure remain unclear. Where choice is available, procedure selection should be guided by unbiased evidence-based guidelines, and patients should be counseled with impartiality and cognizance regarding their level of health literacy and potential pre-existing biases. Where the payor dictates the procedure that is performed, it should be the procedure with the strongest evidence base.

Limitations of this study include the smaller LAGB and RYGB groups, procedure-based differences in time since surgery, and retrospective patient responses, all of which may have influenced findings. Our procedure groups (SG 62.3%, LAGB 22.0%, RYGB 15.7%) roughly approximated but statistically differed from the distributions of the 3 surgeries in Australia over the 3 years before our study (SG 71.7%, LAGB 19.4%, RYGB 8.8%; $\chi^2 = 16.09$, $P = .0003$) [26]. The representativeness of the sample against the Australian bariatric population is not known.

While a strength of this study is that we did not limit responses to only patients' primary reasons for and against procedures, further research may benefit from investigating the relative influence of each reason on patient decisions. Additional research will also be important to understand whether reasons for and against procedures relate to variables including patients' disordered eating behaviors and psychological symptoms and to understand how a patient's presurgical reasons for choosing their particular procedure, and whether those expectations match their actual postsurgical experiences, relate to their outcomes after surgery. Investigation is also needed to assess patients' sources of information and evidence for and against procedures and to understand medical practitioners' reasons for making recommendations for and against bariatric procedures.

Conclusion

Patients report a wide and varied range of reasons for and against undergoing different bariatric procedures. Those who chose LAGB most commonly desired a reversible and removable procedure; those selecting RYGB valued its strong evidence base, success rate, and long-term

effectiveness; and SG was most often chosen based on the recommendation, choice, or preference of a medical professional. The most common reasons against both RYGB and SG were a desire to avoid postsurgical complications and risks. Patients most often cited information and evidence, commonly other people's unsuccessful experiences and concerns about effectiveness, as their reasons for not having chosen LAGB. In addition to the influence of the surgeon on choice, patients show clear preferences based on their own research, knowledge, and experiences; this requires further investigation and understanding to assist patients in choosing the most appropriate procedure for their circumstances.

Disclosures

M.O. and A.C.H. declare no conflicts of interest related to this submission. G.W. receives an annual honorarium for his role as Independent Chair of the Weight Management Council of Australia and has received research funding from Weight Watchers.

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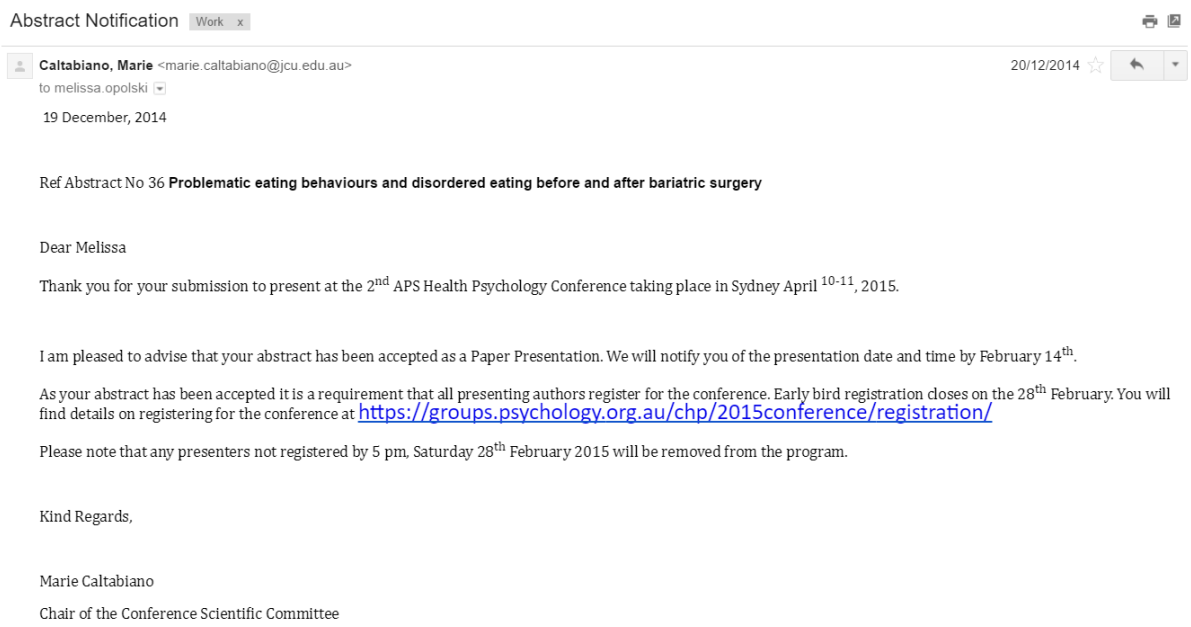
Appendix K: APS Health Psychology Conference abstract and acceptance

Problematic eating behaviours and disordered eating before and after bariatric surgery

OPOLSKI, M. (Schools of Psychology and Medicine, University of Adelaide), CHUR-HANSEN, A. (School of Psychology, University of Adelaide), & WITTERT, G. (School of Medicine, University of Adelaide)

melissa.opolski@

More than five million Australians are obese (body mass index ≥30), a disease commonly associated with significant, negative consequences for physical and mental health and well-being. Weight loss programs based around diet, medication, therapy, or exercise typically demonstrate low to moderate success in achieving long-term weight reduction in obesity, and bariatric (weight loss) surgery is recommended as the most beneficial and cost-effective treatment for motivated, well-informed individuals with severe obesity. Bariatric surgeries are common in Australia, with the most recent data indicating that over 17000 individuals underwent bariatric surgery in the financial year 2007-2008. Accordingly, it is important to understand these procedures and the eating-related difficulties that patients may present with before or after undergoing bariatric surgery. This presentation will (a) introduce the most common bariatric procedures (Roux-en-Y gastric bypass, adjustable gastric banding, and vertical sleeve gastrectomy), their mechanisms of change, and their typical outcomes, benefits, and difficulties, and (b) discuss the prevalence and potential consequences of problematic eating patterns and disordered eating that may occur before or after each type of bariatric surgery. This information will be useful for health psychology clinicians and researchers.



Abstract Notification Work x

Caltabiano, Marie <marie.caltabiano@jcu.edu.au> 20/12/2014

to melissa.opolski

19 December, 2014

Ref Abstract No 36 **Problematic eating behaviours and disordered eating before and after bariatric surgery**

Dear Melissa

Thank you for your submission to present at the 2nd APS Health Psychology Conference taking place in Sydney April 10-11, 2015.

I am pleased to advise that your abstract has been accepted as a Paper Presentation. We will notify you of the presentation date and time by February 14th.

As your abstract has been accepted it is a requirement that all presenting authors register for the conference. Early bird registration closes on the 28th February. You will find details on registering for the conference at https://groups.psychology.org.au/chp/2015conference/registration/

Please note that any presenters not registered by 5 pm, Saturday 28th February 2015 will be removed from the program.

Kind Regards,

Marie Caltabiano

Chair of the Conference Scientific Committee

Appendix L: APS Health Psychology Conference (2015) presentation

CRICOS PROVIDER 00123M

Melissa Opolski [1,2], Prof Anna Chur-Hansen [1], & Prof Gary Wittert [2]
[1] School of Psychology, The University of Adelaide, [2] School of Medicine, The University of Adelaide

Disordered eating before and after bariatric surgery

adelaide.edu.au

seek LIGHT

Introduction

- Health psychologist in private practice and PhD student within the School of Psychology, University of Adelaide
- Bariatric experience:
  - Postsurgical support groups for bariatric patients
  - Pre- and postbariatric patients for assistance
  - Also nonsurgical weight loss clients
- PhD: eating, hunger, appetite, and eating-related experiences, and expectations before and after bariatric surgery

Outline

- Overview of bariatric surgeries and potential eating-related issues before and after surgery

1. Bariatric surgery
   - What they do, how they work
   - Similarities and differences, outcomes by procedure

2. Disordered eating in bariatric candidates
   - What to look out for
   - How do patients expect their eating to change after surgery?

3. Is disordered eating "fixed" by bariatric surgery?

Bariatric surgery

- Best treatment currently available for severe obesity
  - Greater, longer-term weight loss and comorbidities resolution/ improvement than nonsurgical interventions (Buchwald et al., 2009)

- Recommended for well-informed individuals:
  - BMI ≥40 or BMI ≥35 with serious obesity-related comorbidities, for whom nonsurgical measures have failed to result in significant, sustained weight loss (NIH, 1992)
  - First-line treatment for BMI ≥50 (NICE, 2006)

- >1 million Australian adults have BMI 35-39.9
- >500,000 have BMI ≥40

Bariatric surgery

- In Australia:
  - ~13,000 bariatric surgeries performed 2007-08
  - Increased 54% per year 1998-99 to 2007-08 (AIHW, 2010)

- At basic level, either:
  - Reduce volume of stomach, to restrict food intake/induce satiety
  - Or combine that restriction with malabsorption, to reduce body's absorption of calories and nutrients (Colquitt et al., 2009)
  - But actually much more complex

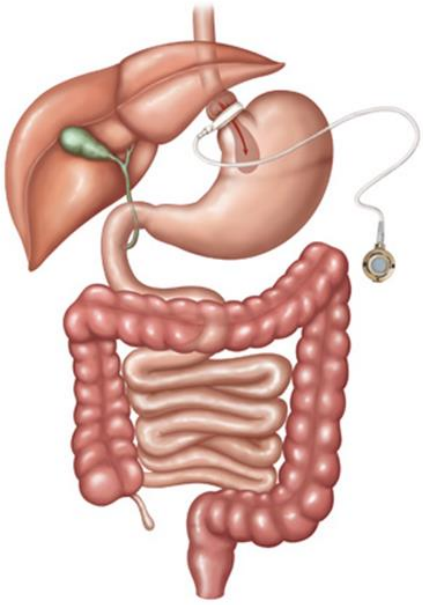
- Misconception: lose weight without effort
- Tool to assist lifestyle changes to begin/maintain weight loss

- Three common procedures in Australia

Laparoscopic adjustable gastric banding (lap band)

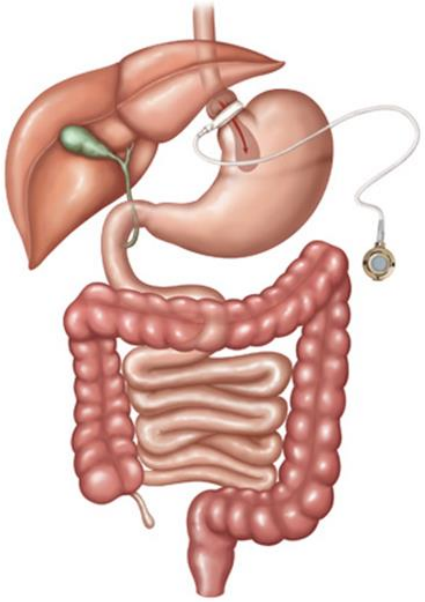
- Restrictive procedure
- Constricting band placed around fundus
- Induce earlier, longer-lasting satiety with little food
- Inflatable balloon contained within band lining – saline added/removed via injection to adjust restriction

(Surgical images via realize.com)



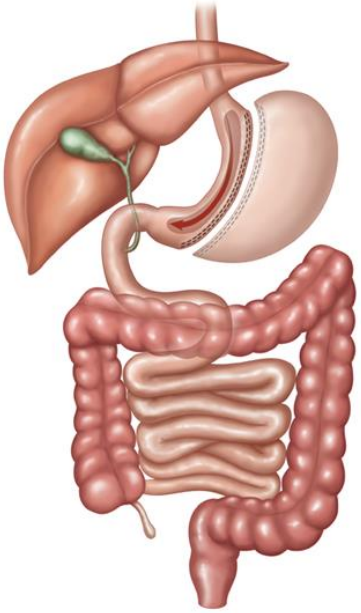
Lap band advantages and disadvantages

- Good: simplest, fastest, easiest, lowest mortality, least invasive operation; few major complications, easily reversible, can convert to another surgery if needed; low risk of malnutrition
- Not so good: Lowest long-term weight loss; lowest comorbidity resolution/ improvement; greatest longer-term (but usually low risk) complications; high failure rates; needs adjustments to work optimally



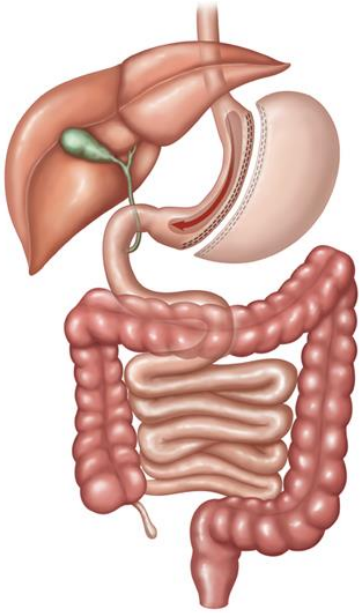
Vertical sleeve gastrectomy (sleeve)

- Restrictive surgery
- Complete removal of greater curvature of stomach
- Induce earlier, longer-lasting satiety with little food
- Leaves "sleeve-like" stomach of around 25% of original size
- Pyloric valve left intact, stomach function/digestion unaltered



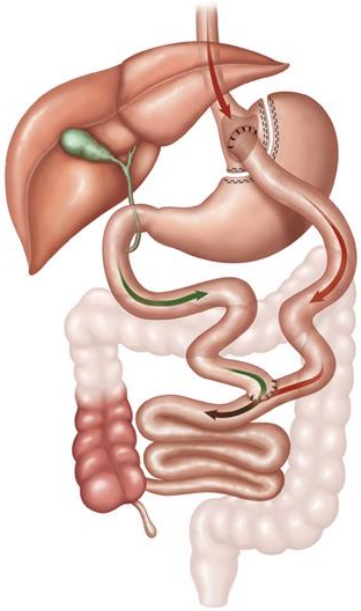
Sleeve advantages and disadvantages

- Good: Relatively simple; can add bypass later if needed; digestion unchanged; comparable/slightly better average weight loss than bypass; comorbidities resolution/ improvement good
- Not so good: Not reversible; risk of stomach stretching; large wound, potential leakage; long-term data not available; longer hospital stay than banding, comparable to bypass



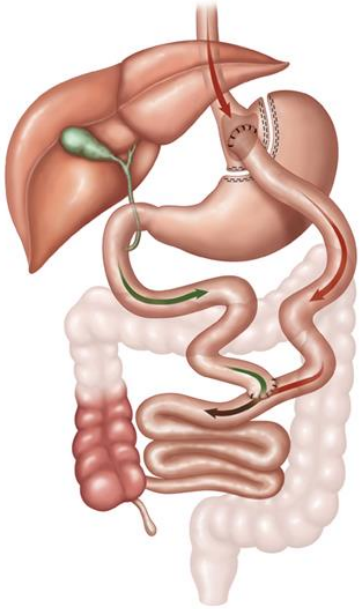
Roux-en-Y gastric bypass (bypass)

- Restriction and malabsorption
- Stomach partitioned with staples across upper portion, small intestine divided, reconfigured into "Y" arrangement
- Food enters/leaves upper pouch, bypassing much of small intestine
- Lower stomach does not receive food but continues to function
- Food mixes with normal secretions from new join onwards
- Weight loss via restricted food intake, food/drink malabsorption, dumping syndrome



Bypass advantages and disadvantages

- Good: Higher long-term weight loss than banding, similar to sleeve; best comorbidities resolution/improvement; dumping syndrome can assist; few long-term complications; reversible (?)
- Not so good: Complicated surgery, higher risk of mortality and major surgical complications; longer hospital stay than banding; dumping syndrome hurts; risk of malnutrition



Disordered eating in candidates

- Disordered eating common in bariatric candidates (article under review)
- 4-45% fit criteria for binge eating disorder (BED)
  - May be more likely to have BED than similarly obese individuals
  - Associated with other problems incl. depression, anxiety, worse quality of life, increased food cravings
- 20-60% graze
- 2-42% have night eating syndrome
- 38-59% emotionally eat
  - Linked to other problems incl. increased anxiety, depression, and neuroticism, less control over eating

Presurgical expectations of postsurgery eating

- Qualitative studies (Engstrom et al., 2011; Ogden et al., 2006; da Silva & Maia, 2012; Wolfe & Terry, 2006):
  - Candidates believe they have lost, cannot internally regain control over their diet and ability to lose weight
  - Seek new external mechanism to regain control
  - Patient hands control to surgeon, who will end battle, change how their body works
  - Belief surgery will virtually guarantee changed eating behaviours, lead to significant, long-term weight loss

After surgery

- Patients expected to develop, maintain new eating behaviours
  - Eat very small meals very slowly
  - Chew thoroughly
  - Increase protein intake
  - Avoid high fat and high sugar foods
  - Avoid drinking during meals
  - Avoid snacking/bingeing/grazing
  - Increase water intake
  - Avoid alcohol and carbonated and high-calorie drinks
  - Take vitamins (Colles et al., 2008; Elkins et al., 2005; Hsu et al., 1997; Saunders, 2004)
- Possible: social/family difficulties, emotional issues, stress, loneliness, grief, uncertainty about decision

Disordered eating after bariatric surgery

- Full/final literature review in progress
- Disordered eating behaviours often reduce/disappear after surgery, but can also persist, change, or develop (Dodsworth et al., 2010; Zunker et al., 2012)
- May begin or reoccur at any time (Kruseman et al., 2010), though patterns may change after surgery
  - e.g. Bingeing difficult after surgery because of smaller stomach capacity, increased negative consequences (dumping syndrome, blockages)
  - Uncontrolled eating may present as constant grazing or subjective loss of control over eating
  - Can also eat in response to emotions, or as coping mechanism (Fischer et al., 2007)

… After bypass

- White et al. (2010):
  - 31% reported loss of control over their eating at 6 months postsurgery, 39% at 2 years (vs. 61% presurgery)
  - Postoperative loss of control = worse outcomes at 1 and 2 years postsurgery
- De Zwaan et al. (2010):
  - 2 years postsurgery, 3% had BED, 25% subjective binge eating episodes, 12% self-induced vomiting to avoid gaining weight or promote weight loss, 12% had night eating
  - Preoperative BED associated with postoperative subjective binge eating
  - Postoperative subjective binge = worse outcomes at 2 years postsurgery
- Kofman et al. (2010):
  - 3-10 years postsurgery, 18% had (subjective) BED, 17% subjective overeating, 47% grazed, 50% loss of control over eating
  - Loss of control, binge eating, and grazing = lower weight loss, regain at 3-10 years postsurgery

… After banding

- Colles et al. (2008):
  - 1 year postsurgery, 3% had BED (14% presurgery), 23% uncontrolled eating (31%), 8% night eating syndrome (17%), grazing increased to 38% (26%)
  - Those with presurgical BED most often became postsurgical grazers
  - Postsurgical uncontrolled eating and grazing = poorer weight loss

- Larsen et al. (2004):
  - 32% BED at 8-24 months postsurgery, 37% at 25-68 months (56% presurgery)
  - Postoperative BED = greater fat intake, external eating, emotional eating, lower eating self-efficacy, poorer weight loss

… After sleeve

- Sioka et al. (2013):
  - 17% showed new tendency to eat sweets after first 6 months postsurgery
  - "Normal" (compliant with recommendations) and "snacking" eating patterns achieved highest excess weight loss
  - Those with BED and emotional eating patterns had lowest

- Kafri et al. (2011):
  - Average 19 months post-sleeving, 30% binge eating episodes or ate when they didn't feel hungry, almost 50% grazed and/or emotionally ate, around 45% said it was difficult to eat slowly

Summary

- Three most common bariatric surgeries in Australia, each with advantages and disadvantages
- Disordered eating patterns (BED, grazing, emotional eating, and night eating syndrome):
  - Appear common in presurgery bariatric surgery candidates
  - May or may not resolve, persist, reoccur, or change after surgery
  - Postsurgically, often associated with worse weight and psychological outcomes (esp. binge eating, perceived loss of control over eating, grazing)
- Can't assume surgery will "fix" disordered eating
  - Assess, educate, assist at whatever current stage of treatment
  - Remember potential grief, stress, loneliness, etc. before and after surgery

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