Binge Eating and Obesity Treatment
Örebro Studies in Medicine 29

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Binge Eating and Obesity Treatment
– Prevalence, Measurement and Long-term Outcome
Abstract


Background: Overweight and obesity has increased markedly during the last decades. In addition to personal suffering, obesity is negatively associated to physical health, physical aspects of health related quality of life (HRQL), and mortality. Among weight loss treatment applicants, eating disorders and binge eating are common problems that are associated with psychopathology and low HRQL. Binge eating is also associated with weight gain, why an assessment of eating behaviour is recommended before weight loss treatments. Information is insufficient about the association between binge eating and weight loss treatment outcome, largely depending on methodological and diagnostic differences and difficulties in previous studies.

Method: Study I was a naturalistic study measuring the point prevalence of eating disorders and binge eating in 194 behavioural weight loss treatment applicants. Studies II–IV were all based on a cohort of surgical and behavioural weight loss treatment patients that were followed, from before treatment to three years after treatment. Study II investigated the psychometric properties of a new self-reporting questionnaire (Eating Disorders in Obesity) by comparing results from assessments of eating disorders and binge eating, to assessments made with the Eating Disorder Examination. In Study III the prevalence of eating disorders and binge eating was compared between patients applying for bariatric surgery or behavioural weight loss treatment. Study IV used long-term data to investigate whether binge eating before or after bariatric treatment was associated with BMI outcome, and whether binge eating after bariatric treatment was associated with psychopathology and HRQL.

Results: Study I showed that 9.8% of the behavioural weight loss treatment applicants had an eating disorder, while an additional 7.2% were classified as binge eaters. Eating disorders and binge eating was associated with lower HRQL and more psychopathology. In Study II the reliability and validity of the Eating Disorder in Obesity (EDO) questionnaire was shown to be good for assessments of eating disorders (κ=0.67) and binge eating (κ=0.63). Study III found that while binge eating as a symptom was equally common in participants before surgical and behavioural weight loss treatment, surgical treatment participants indicated more eating disorders. Surgical treatment participants also indicated higher levels of psychopathology than behavioural treatment participants. Study IV found that those that were classified as binge eaters before of after bariatric surgery did not differ in long-term BMI outcome, compared to those with no binge eating. However, binge eating after bariatric surgery was common and associated to less successful treatment outcome regarding HRQL and psychopathology.

Discussion: Results show that binge eating was common before surgical and non-surgical weight loss treatments. Binge eating three years after surgical treatment was also common, but neither pre- nor post-treatment binge eating was associated to long-term BMI outcome. Binge eating after surgical treatment though was associated to low HRQL and high psychopathology, why the overall treatment outcome for these binge eating patients can be considered to be poor. This indicates a need for assessing and treating binge eating in weight loss treatments. The mixed results from previous research on binge eating in weight loss treatment settings also show that there is a need of more research on this issue.

Keywords: Eating disorders, obesity, binge eating, long-term outcome, weight loss
List of Papers

This thesis is based on the following original papers:


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## Abbreviations

<table>
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<th>Description</th>
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<tr>
<td>AN</td>
<td>Anorexia Nervosa</td>
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<td>BED</td>
<td>Binge Eating Disorder</td>
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<td>BMI</td>
<td>Body Mass Index</td>
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<td>BN</td>
<td>Bulimia Nervosa</td>
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<tr>
<td>CPRS-S-A</td>
<td>Comprehensive Psychopathological Rating Scale – Self-rating scale for Affective Syndromes</td>
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<td>DSM</td>
<td>Diagnostic and Statistical Manual of mental disorders</td>
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<td>EDE</td>
<td>Eating Disorder Examination</td>
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<td>EDE-Q</td>
<td>Eating Disorder Examination – Questionnaire</td>
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<td>EDO</td>
<td>Eating Disorders in Obesity</td>
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<td>EDNOS</td>
<td>Eating Disorders Not Otherwise Specified</td>
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<td>SF-36</td>
<td>Short Form 36</td>
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<tr>
<td>-PF</td>
<td>Physical Functioning</td>
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<td>-RP</td>
<td>Role Physical</td>
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<td>-BP</td>
<td>Bodily Pain</td>
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<td>General Health</td>
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BACKGROUND

Eating disorders and binge eating symptoms are common in weight loss treatments. More knowledge about these eating behaviours and about their association to treatment outcome is of clinical importance to establish how these patients are to be addressed in weight loss treatments. Due to methodological difficulties and differences results from previous research are mixed and thus most inconclusive, which has led to great differences in the clinical weight loss treatment practice.

Obesity

The global increase in obesity in the westernized world, has been discussed intensively during the last decades, and in June of 1997 obesity was declared a worldwide epidemic at the World Health Organisation Consultation on Obesity. Through the documented negative effects of obesity on a wide range of health factors, obesity is now considered to be one of the major risks to global health. The increased medical cost brought by obesity\(^3,^4,^6\) is a matter of great concern and is an increasing challenge for all health care systems. In the wake of globalization, what used to be a problem in the industrialized world has now also become a major health problem in the less developed areas of the world\(^69\).

Obesity has repeatedly been shown to have a significant negative impact on somatic health, as well as on psychosocial well-being, mortality\(^112\), and quality of life\(^45\). Undoubtedly obesity brings health problems, but these negative effects are shown to be reduced if weight is lost. Long-term weight loss has been shown to be beneficial for a number of obesity-related comorbidities, such as Diabetes, Dyslipidemia, Hypertension and Sleep Apnea\(^71\), but also by decreased mortality\(^13,^112\). Results show that obese persons that manage to loose as little as 5–10% of their weight\(^50\), besides the above mentioned health benefits, show improvements in quality of life\(^126\), as well as in most psychological and psychosocial endpoints\(^2,^13,^36,^60,^79\).

In Sweden the prevalence of adult obesity (Body Mass Index (BMI)>30) has risen in the last decades, from approximately 5% in 1980 to more than 10% in 2005\(^93\). A corresponding increase in overweight (BMI>25) has led to an overweight prevalence of approximately 50% for men and 35% for women. The increase in the rates of overweight and obesity are alarming, but the rates are relatively low in an international comparison. According to the Center for Disease Control and Prevention in 2007\(^21\), all states but one in the United States, had an obesity prevalence of more than 20%, and in more than 30 states the prevalence rate was equal to or greater than 25%.

The global increase, increased health care costs, and individual negative consequences of obesity, have all contributed to bring attention not only to the global, but also to the local health care situations for obesity. Most regions in Sweden now have, or are in the progress of developing health policies that cover obesity, as well as strategies for how to manage obesity in e.g. local health care, child care and schools. Publicly financed surgical and behavioural weight loss
treatments are today offered in a large number of hospital-based clinics and health centres in Sweden, but the availability of these treatments fail to reach the needs by far.

**Weight loss treatment**

Clinical weight loss treatments are often categorized as being either behavioural\(^1\) or surgical (i.e. bariatric surgery). In general, results show that behavioural treatments provide only short-term weight-loss and are effective in the long term for only a limited percentage of the patients\(^{126, 129}\). Bariatric surgery on the other hand has been shown to produce long-term weight loss, with subsequent long-term health benefits and reductions in mortality\(^{112}\).

Bariatric surgery

Bariatric surgical procedures have been performed since the 1950’s. Since then, this has become a common surgical procedure, and the forms of bariatric surgery have been modified substantially. New procedures that have been introduced during the last decades have led to improvements in weight loss while complication rates and mortality have dropped\(^{71}\). Many of the bariatric procedures are now done laparoscopically which has further reduced the morbidity associated to the surgical procedure, and has improved recovery after surgery\(^{44}\).

The primary strategies of surgically induced weight loss are gastric restriction, intestinal malabsorption, or a combination of them\(^{44}\). The restrictive procedures, (such as vertical banded gastroplasty or adjustable gastric banding) cause early satiety by the creation of a small gastric pouch, and prolonged satiety by a small outlet from this gastric pouch. The malabsorptive procedures (such as biliopancreatic diversion or jejunoileal bypass) primarily depend on a surgical bypass of a substantial part of the small intestine. This causes a markedly reduced area for the absorption of nutrients. In procedures that combine the restrictive and malabsorptive strategies, improved long-term weight-loss results are produced through the initial restrictive effect being complemented by the malabsorptive effect of the procedure, when the restrictive effect starts to decrease after approximately 1–2 year post-surgery\(^{71}\). Gastric bypass (GBP) and gastric sleeve with duodenal switch are examples of combination procedures, where GBP is the most commonly performed procedure in bariatric surgery in Sweden today. In addition to the restrictive and malabsorptive effects of GBP, other aspects have been ascribed as contributing to the success of the procedure. One of these is the “dumping syndrome”, where eating large amounts of sweet and/or foods with high fat contents causes a most unpleasant sensation that consequently motivates changes in the choice of food. Changes have also been shown in plasma levels of certain gut hormones after gastric bypass surgery. These hormones are shown to be associated to decreased dietary intake, and to influence hedonic feeding\(^{71}\). These aspects of bariatric surgery lay beyond the scope of this thesis.

\(^{1}\) Behavioural weight loss treatments are also described as a non-surgical weight loss treatments.
Behavioural weight-loss treatments

Behavioural weight loss treatments represent a wide variety of non-surgical weight loss treatments, typically administered on a group basis. The main objective of these treatments is the (non-surgical) modification of people's behaviour and lifestyle, by helping the patient to identify behaviour and attitudes that are related to weight. This consequently helps the patient to make changes that will affect energy intake and expenditure (i.e. exercise and food). These lifestyle changes are promoted by a wide variety of cognitive, behavioural, psycho-educative, and/or other therapeutic techniques. The behavioural treatments that are offered differ widely in regard to aspects like treatment length and intensity.

Hospital-based behavioural treatments are sometimes combined with pharmacological treatment. In Sweden only Orlistat and Sibutramine are accepted for pharmacological weight-loss treatment. These anti-obesity drugs have both shown to cause a significant (but limited) increase in weight loss when they are combined with behavioural treatment. Sibutramine has also shown to reduce binge eating in patients with Binge Eating Disorder (BED), but the effects of pharmacotherapy will not be addressed in this thesis.

Also liquid Low (or Very-low) Calorie Diets (V)LCDs are occasionally combined with behavioural weight loss treatments. This commonly means that the patient starts the first weeks of treatment by substituting all or some meals for a liquid high protein supplement of 800–1200 kcal/day, which brings a fast initial weight loss. After the period of meal replacement sizable weight regain is typical, why these treatments cannot be shown to offer any long-term benefits over traditional diets.

Obesity and mental health

Obesity and measures of psychiatric symptomatology have in some studies been shown to be unrelated, while conflicting studies have found obesity to be related to e.g. mood disorders. In specific weight loss treatment samples though, it is indisputable that rates of both eating pathology and other psychopathology are raised. Obesity in the general population is in general associated with impaired physical functioning, but not with impaired mental and social functioning.

Eating disorders in weight loss treatments

Eating disorders and the associated symptoms of binge eating have repeatedly been shown to be common in behavioural and surgical weight loss treatments. Binge eating is the core criteria of BED and the primary symptom in most other eating disorders in obese patients. Binge eating is defined by the DSM-IV as eating amounts of food that are larger than most others would have eaten in similar circumstances, while feeling a loss of control over eating. Besides being a common symptom in weight loss treatment patients, the importance of binge eating has been emphasized through studies showing binge eating to be associated to overweight and weight gain, and binge cessation to be associated with weight stabilization.
According to the Statistical and Diagnostic Manual of Mental Disorders (DSM-IV) \(^5\), there are three main categories of eating disorders; Anorexia Nervosa (AN), Bulimia Nervosa (BN) and Eating Disorders Not Otherwise Specified (EDNOS) where BED is included. The criteria for AN, BN, EDNOS and BED are presented in Appendix A. The use of these diagnoses in weight loss treatment settings are presented briefly below.

The diagnosis of AN requires that the patient is below 85% of expected weight \(^5\) which is not applicable to patients in weight loss treatment setting. In theory this diagnose could be applicable to weight loss patients post-treatment, but to my knowledge strict cases of AN have not been reported. Problems of post-treatment anorectic symptoms or behaviours though, have been documented in rare cases \(^109\).

The criteria for BN indicate that this is a valid diagnose in a weight loss treatment setting even if purging BN is rarely seen in patients with severe obesity \(^43\). Since BED was introduced in the DSM-IV in 1994, BN has shown to represent only a smaller part of the eating disordered in weight loss treatments \(^62, 63\).

Overall, EDNOS is by far the largest diagnostic category representing approximately 60% or more of the eating disordered \(^39, 78\). Six examples of EDNOS are stated in the DSM \(^5\). The first two examples are similar to AN. Even though these patients show severe weight loss, they do not meet either the amenorrhea criteria, or are not below 85% of expected weight, why these EDNOS examples are applicable only for weight-loss patients after treatment. In the third example, patients are required to meet criteria for BN, except for not reaching the binge eating or compensatory frequency. This has been frequently reported in the weight loss literature \(^41\). The fourth example describes compensatory behaviour by an individual of normal body weight after eating only small amounts of food, and the fifth example describes compensatory behaviour after chewing and spitting out food or after eating small amount of food. These two behaviours have to my knowledge never been reported in weight loss treatment subjects. The last example is Binge Eating Disorder (BED) which according to Wade et al. \(^133\) accounts for a sizeable portion of EDNOS.

BED was included in the DSM in 1994, after the first clinical reports were presented on binge eating in the obese 50 years ago \(^117\). After that a number of large studies in the beginning of the nineties \(^113, 114\) led to Binge Eating Disorder (BED) being included in the DSM-IV \(^5\), as a disorder in need of further study. The essential features of BED are recurrent episodes of binge eating, and a number of associated features in the absence of regular use of inappropriate compensatory behaviours\(^5\).

Since BED was presented in the DSM, it has been used in many studies of eating behaviour in weight loss treatment settings \(^25, 30, 43, 91\). Studies based on self-reported data have shown large differences in the prevalence of BED in different populations, from 2–5% in community samples to 10–30% in weight loss treatment samples \(^25, 30\). Studies that also have included sub-clinical symptoms of
Binge eating, have shown rates of binge eating of more than 50% \(^56\). More current studies though have reported lower levels of BED, probably owing to more careful methodology and better definitions of this behaviour \(^85\). The gender imbalance shown in other eating disorders is less pronounced in BED, where women are approximately 1.5 times more likely to have BED than men \(^113, 114\).

**Associated features in weight loss treatments**

BED and binge eating in obesity have been shown to be associated to more psychopathology, compared to those without these symptoms \(^16, 19, 56, 87, 116, 140, 149\). The rates of frequently reported comorbidities, such as depression and anxiety, are lower in the specific group of obese binge eaters than in BN though \(^7, 17, 42, 152\). There are reports that individuals with high psychopathology may be at risk for attrition from behavioural weight loss treatments and that the may show earlier weight regain \(^81\), but others conclude that baseline psychiatric status, particularly depression, cannot predict postoperative weight loss \(^131\) and that there is little evidence that psychiatric treatment or psychiatric evaluation can improve patient selection for surgical treatments \(^70\). The high rates of psychopathology that has been shown in weight loss treatment settings is thought to be attributable to the severity of binge eating rather than to the degree of obesity \(^85, 99, 152\). In addition to psychopathology, interpersonal distress and Health Related Quality of Life (HRQL) is more impaired in obese individuals with eating disorders or binge eating, compared to those with no such problems \(^26, 27, 34, 68, 80, 99\). Binge eating and the associated features of psychopathology and HRQL are regarded as aspects of life that could cause, affect, maintain, or complicate obesity, why it is generally recommended that weight loss patients are assessed for these issues pre-treatment \(^32, 104\).

In the DSM-IV criteria for BED \(^5\) no distinction has been made between obese and non-obese binge eaters. Even though the diagnosis is not limited to overweight or obese individuals, BED has been shown to be associated to overweight and obesity \(^43, 140\), through most BED patients having varying degrees of obesity \(^25, 33, 114\). While some have shown that a higher degree of obesity leads to more binge eating or BED \(^149\), most conclude that weight has little, or no impact on the severity of eating disorders \(^11, 20, 31, 82, 85, 137, 152\).

In one of the few studies that have compared applicants to different types of weight loss treatments, Bancheri and colleagues \(^10\) found no difference in eating behaviour between those seeking bariatric treatment and psychotherapy plus dieting. Those seeking surgical treatment showed lower psychopathology scores in two of the subscales of the Minnesota Multiphasic Personality Inventory-2 though. In the Swedish Obese Subjects study, the only difference found between surgical and non-surgical weight loss participant, was that patients applying for surgery had lower HRQL than behavioural weight loss treatment applicants \(^64\).
Binge eating and weight loss treatment outcome

The association between weight loss outcome and eating disorders/binge eating is an issue of clinical concern for establishing if eating disorders or binge eating should be addressed in the context of weight loss treatments. The studies that have addressed this issue show mixed results, both regarding weight loss and eating behaviour. A number of studies have found less weight-loss after bariatric surgery for those with disordered eating, but conflicting studies show no such effect or even show more weight loss in those with binge eating. In behavioural weight loss treatments, patients with eating disorders or binge eating have not had more problems in losing weight but there is some evidence that these individuals are more likely to drop out of weight loss treatment. Thus binge eating cannot be shown to be a predictor for weight loss or weight regain after treatment which has been further confirmed by recent prospective findings. Some conclude though that binge eating pre-treatment could pose a risk of future weight regain.

Instead of focusing on binge eating as a predictor of weight loss treatment outcome, there has been an increased emphasis on the importance of post-treatment binge eating for the outcome of bariatric treatments (no corresponding studies from post-behavioural treatments have been found). A number of these studies have shown that binge eating that remains, or re-emerges post-treatment has a negative effect on weight-loss treatment outcome.

In addition to weight loss, changes in eating behaviour have also been reported as possible consequences of the calorie restriction that is caused in weight loss treatments. Restraint theory postulates that overeating results from the disruption of restraint in vulnerable individuals. According to this theory binge eating starts in response to dieting behaviour, and severe dietary restriction (like in bariatric surgery and (Very) Low Calorie Diets) could worsen binge eating. Binge eating though, has shown not only to follow on dieting, but also to precede dieting, which would question the restraint theory in weight loss treatment patients. Weight loss treatments in general do not worsen binge eating.

Most studies of larger surgical cohorts have also described the prevalence of eating disorders and binge eating to be less after bariatric surgery, but there are clinical reports and case studies that show that eating disorders sometimes start in response to weight loss treatments. In behavioural weight loss treatments, negative outcome regarding eating behaviour has been described only in treatments with Low, or Very Low Calorie Diets. Results from these treatments show that while some develop binge eating after these treatments, (V)LCD programs in general do not lead to emergence of binge eating. Weight loss treatments most often lead to reductions in binge eating, and caloric restriction does not appear to be associated with the development of binge eating in individuals who never reported problems with binge eating.

Besides weight loss and binge eating, weight loss treatment studies have not only focused on longevity, but also on other more qualitative measures of outcome.
such as Health Related Quality of Life \textsuperscript{60, 67, 70} and different measures of psychopathology \textsuperscript{2, 60, 65}. The great majority of these studies show that successful weight loss is associated with improvements in HRQL and psychopathology. The generality of this association can be questioned though, by the number of case studies that have shown disturbed eating patterns (such as anorectic behaviour) after bariatric treatment \textsuperscript{28, 108}. For these patients, the weight loss that has been achieved, has been a result of pathological eating patterns, why the overall treatment outcome for these patients is unlikely to be considered as successful \textsuperscript{105}.

**Eating disorders and binge eating in the clinical weight loss treatment practice**

Due to insufficient research data, there is a lack of agreement about how binge eating patients should be managed in weight loss treatments \textsuperscript{85}. Patients are therefore managed differently in different clinics in regard to eating disorders and binge eating, which includes differences in pre-treatment assessments, which patients are admitted for treatment, and if eating behaviour and other psychological issues are addressed in treatment or follow-up. Devlin and colleagues \textsuperscript{30} examined the current practice of bariatric surgeons and found that eating disorders and binge eating in most cases was routinely screened for, but there were large differences in how to proceed with these patients. While 20\% of the surgeons would proceed with surgery, 30\% would postpone or recommend against surgery, and as many as 50\% reported that they varied in their decision. The current practice was also studied by Zimmermann and colleagues \textsuperscript{154}, who showed that 18\% of the bariatric patients that were examined were not cleared for surgery after a psychiatric evaluation. The study concluded that the reliability of these decisions was good (i.e. a consensus within the clinic), but demonstrated no relationship between these decisions and treatment outcome.

**Diagnostic and methodological issues of concern**

Since BED was introduced in the DSM-IV \textsuperscript{5}, research on BED has dominated research in the field of eating behaviour in the obese \textsuperscript{43}. Research has shown BED patients to differ from other obese patients through their high rates of psychopathology \textsuperscript{16, 19, 150} and psychological distress \textsuperscript{99}. Patients with BED show similarities to patients with other eating disorders regarding weight and shape concerns, psychopathology, functional impairment and healthcare utilization \textsuperscript{16, 33, 137, 140}. In contrast to earlier reports, BED has been shown to be a stable, chronic disorder with long duration and similar placebo responsiveness as the other eating disorders \textsuperscript{137}. Despite these similarities BED patients are unique compared to patients with other eating disorders, regarding e.g. demographic profile, risk factors and obesity. Research on BED has suggested that BED is a valid and clinically significant disorder that in a revised version most likely will be included as an officially recognized diagnosis in the DSM-V \textsuperscript{137}.

The BED criteria that were formed in 1994 were not primarily based on empirical research but on expert consensus \textsuperscript{55, 137}. In addition to a general debate about the diagnostic validity of BED \textsuperscript{24, 140, 147}, critique has also been raised regarding the use of BED in weight loss treatments, as no differences have been shown regarding weight-loss between persons with sub-threshold symptoms of binge eating and those with BED \textsuperscript{6, 103}. There have been suggestions that the current categorical
classification in eating disorders most likely has been limiting to the development of more empirically based knowledge in the area. According to these suggestions, a dimensional approach would most likely convey richer and more complete information, which would have the ability to capture variations in symptomatology, and could through this further expand knowledge in the area.

A number of diagnostic and methodological concerns have been raised in the area of eating disorders and obesity. Those relevant to this specific research area are briefly addressed below.

BED frequency and duration criterion
Few differences have been shown between patients that were diagnosed with a strict definition of BED and those diagnosed with a modified binge eating frequency of once per week (compared to twice per week) 76, 115, 137, 145. This has questioned the utility of the frequency requirement of the DSM, which was not primarily based on empirical evidence but chosen to match the BN frequency criterion 85. There is also limited empirical support for the 6 months duration required for a diagnosis of BED (compared to the BN criteria of 3 months), why it has been suggested that also the BED duration criteria be set at 3 months 24. In line with this, research shows only few differences between those diagnosed with ED and binge eaters that indicate sub-clinical states 103, 116, 148, which may question the general procedure of classifying eating disorders as distinct entities 137, 148. A higher intensity and frequency of binge eating has been shown to be associated with more co-morbid symptoms and more distress 85, 135, why it has been suggested that binge eating should be assessed as a continuous symptoms.

Large amounts criterion and subjective binge eating
The DSM-IV definition of binge eating 5 states that the amount of food eaten in a binge eating episode should be definitely larger than most people would eat in a similar period of time under similar circumstances, while experiencing a lack of control over eating. Research has failed to show any differences between those having subjective or objective binge eating episodes 96, 148, why the feelings of loss of control instead have been emphasized. Feelings of loss of control have been known to be closely associated with psychological distress 23. Together with difficulties in operationalizing what should be considered as a large amount 137, this has led researchers to focus on the loss of control, over eating both objectively or subjectively large amounts of food 22, 88, 105, 106, 137. A binge eating definition that also includes subjectively large amounts of food is also of great importance in the assessments of binge eating after bariatric treatment 91, when large amounts of food can no longer be eaten. In accordance to this, the limited time of approximately two hours for a binge eating episode has also been criticized for not being empirically based 85, 137. This two hour limit, for example, fails to include grazing 22, 106 (eating small amounts continuously while feeling a loss of control) as a binge eating behaviour.
Shape and weight concern
Almost half of all patients with BED have a tendency to evaluate self-worth in terms of weight and shape, which has been shown to be an indicator of disease in BED patients 89, 99. Shape and weight concern has therefore been suggested to be included as a core feature of BED 54, 83, 99, 100, 115, 137, 139. According to Wilfley and colleagues 137 an inclusion of weight and shape concerns instead of the associated features and “marked distress”, is motivated to simplify the BED diagnosis and bring it in line with AN and BN 5.

BED vs. EDNOS
As shown above, diagnostic shortcomings have been found in the preliminary BED diagnosis. Fichter and colleagues 43 described that BED has been used with two different definitions, one through the BED research criteria, and the other through the general EDNOS-criteria. The difference between these alternatives is mainly that EDNOS does not require “marked distress” to be present, which the BED-criteria does. This means that using the EDNOS-definition (without adding the criterion of “marked distress”) increases the probability that milder cases of binge eating are included in the sample 43, 85. Fichter and colleagues 43 reported that those that also indicated “marked distress” did not do as well over time as those without distress, and that these BED patients emerge as having severe disorders that are comparable in severity to BN.

Instruments for assessing eating behaviour in weight loss treatments
In addition to the above described difficulties in defining binge eating and eating disorders in weight loss treatment samples, a large number of different instruments have been used that may account for some of the variations that have been found in previous research. During the last decades eating disorders and binge eating in weight loss treatments have been assessed with a large number of different questionnaires such as; Bulimic Investigatory Test, Edinburgh (BITE 59); Binge Eating Scale (BES 51), Three Factor Eating Questionnaire (TFEQ 118) Eating Disorder Inventory (EDI 47) Questionnaire of Eating and Weight Patterns-R (QEWP-R 114) and the Eating disorder Examination-Questionnaire (EDE-Q 12). It has been shown that the use of different instruments can generate different estimates within the same patient group, and that rates of disorders are reported to be lower when using a structured diagnostic interview and formal criteria, compared to when unstructured clinical interviews or self-report measures are used 37. In general, interviews are considered to be the most valid method of assessment of eating disorders 66, but in weight loss treatments settings assessments are commonly done by self-reported questionnaires 40, despite their questionable validity 35, 40, 53, 66.

In summary, research has established that binge eating and eating disorders are common in weight loss treatments. In spite of the efforts to describe the clinically important associations between eating disorders/binge eating and treatment outcome, methodological variations and diagnostic difficulties have led to inconclusive results, which has failed to provide sufficient scientific support for how eating disorders and binge eating is associated to weight loss treatment outcome 91, 105, 124.
AIMS
The overall aim of this thesis has been to study eating disorders and binge eating in weight loss treatments, and the association of binge eating to weight loss treatment outcome. The specific aims in the four articles of the thesis are presented below.

Study I
The aim of Study I was to estimate the prevalence of eating disorders and symptoms of binge eating among obese men and women seeking non-surgical weight-loss treatment in Sweden. A secondary aim was to delineate the possible differences between 1) Eating Disordered, 2) Binge Eaters and 3) Non Binge Eaters, regarding co-morbid psychopathology, health related quality of life and anthropometric data.

Study II
The aim of Study II was to assess the psychometric properties of the Eating Disorders in Obesity (EDO) questionnaire, by comparing it with assessments of binge eating and eating disorders made with the interviewer-based Eating Disorder Examination (EDE).

Study III
The main aim of Study III was to investigate whether there was a difference between patients allocated to surgical compared to non-surgical weight loss treatment, regarding eating disorder diagnoses and binge eating as a symptom. A secondary aim was to investigate whether there were any group differences regarding general psychopathology and Health Related Quality of Life.

Study IV
The objective of the present study was to investigate the long-term associations between binge eating and outcome in bariatric surgery. Our specific research questions were:
a) Is pre- or post-treatment binge eating associated with long-term weight loss?
b) Is post-treatment binge eating associated with long-term health related quality of life and general psychopathology?
METHODS AND MATERIALS

The studies in this thesis were based on material from two separate groups of weight loss treatment patients. Study I was based on a group of behavioural weight loss treatment applicants that were studied cross-sectionally. Studies II-IV were all based on a cohort of 252 behavioural and surgical weight loss treatment patients that were included within the same project, and followed longitudinally from pre-treatment to three years after weight loss treatment. A methodological overview of the four studies is presented below in Table 1.

Table 1. Overview of the papers presented in this thesis

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Design</th>
<th>Instruments (and points of measurement)</th>
</tr>
</thead>
</table>
| I     | n=194, from one behavioural weight loss treatment unit | Cross-sectional | Self-report questionnaires:  
- Eating disorders & binge eating = SEDs (pre)  
- Psychopathology = CPRS-S-A (pre)  
- HRQL = SF-36 (pre) |
| II    | n=97, from one surgical and one behavioural weight loss treatment unit* | Cross-sectional | Semi-structured interview:  
- Eating disorders & binge eating = EDE (pre)  
Self-report questionnaires:  
- Eating disorders & binge eating = EDO (pre) |
| III   | n=100, from one surgical and one behavioural weight loss treatment unit* | Cross-sectional | Self-report questionnaires:  
- Eating disorders & binge eating = EDO (pre)  
- Psychopathology = CPRS-S-A (pre) |
| IV    | n=130, from four surgical weight loss treatment units* | 3-year follow-up | Self-report questionnaires:  
- Binge eating = EDO (pre)  
- Binge eating = EDE-Q (post)  
- Psychopathology = CPRS-S-A (pre & post)  
- HRQL = SF-36 (pre & post) |

*See Figure 1, Flow-chart

Participants

The participants of Study I were 194 behavioural weight loss treatment applicants, 131 females and 63 males. The mean age of these participants was 46.8 years (SD=12.9). Participants had a mean Body Mass Index (BMI) of 39.8 kg/m² (SD=5.8) and mean waist-hip ratio (WHR=waist circumference/hip circumference) of 0.96 (SD=0.09).

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2 Behavioural treatments were described as non-surgical treatments in studies I, II and III.
Figure 1 shows an overview of the three different sub-samples that constituted the participants of Studies II, III, and IV. These participants had all been accepted for weight loss treatment at either of the four surgical and the only behavioural weight loss clinics. Participants of the cohort were assessed longitudinally, from before treatment to three years after treatment. The participation from each clinic was different in the three studies. The reason for these differences were that not all participants in the long-term cohort were interviewed in Study II, and not all surgical treatment participants in the long-term cohort received treatment in time for being included in the long-term follow-up of Study IV.

Figure 1. Flow-chart showing the inclusions of participants from the five weight loss treatment units (n=252), to studies II, III and IV, and dropouts of each study.

The participants of Study II were 97 surgical and non-surgical/behavioural weight loss treatment patients (70 women and 27 men) from all five weight loss clinics in the cohort above. Out of these 97 participants, 48 were included for confirming the binge eating definition presented in the EDO (see the appendix 1 of Study II) while 49 denied fulfilling the criteria of the definition. Twenty of the participants (five men) were included at the non-surgical/behavioural clinic and 77 (15 men) at the surgical weight loss clinics. The mean age of the participants was 41.1 years (SD=10.6), ranging from 19 to 62 years. Mean BMI was 44.2 kg/m² (SD=7.7) ranging from 31.0 to 76.8 kg/m².
The participants of Study III consisted of 100 patients from the only non-surgical/behavioural weight loss clinic (n=46) and one of the surgical (n=54) clinics (clinic A in Figure 1). Of the 100 participants 28 were men. Thirteen of the men applied for surgical treatment and 15 for non-surgical/behavioural weight loss treatment. Participants had a mean age of 42.6 years (SD=10.8) and a mean BMI of 43.3 kg/m² (SD=6.2).

Participants of Study IV were 130 bariatric surgery patients from the four surgical clinics (clinics A, B, C, and D in Figure 1 above) in the cohort. These participants were followed from before treatment to three years after treatment. When included, these participants were on average 40.6 years old (SD=9.2) with a mean BMI of 45.8 kg/m² (SD=6.7). Twenty-eight (21.5%) of the participants were male. The surgical procedures performed were 100 Gastric Bypass (76.9%), 18 Gastric Banding (13.8%), seven Vertical Banded Gastroplasty (5.4%) and five Biliopancreatic Diversion with Duodenal Switch (3.8%).

Instruments
Survey of Eating Disorders (SEDS), short version
The SEDs was used in Study I for measuring self-reported eating disorder symptoms. The questionnaire is based on the DSM-criteria, and was adjusted, with the purpose of detecting eating disorder symptoms in patients seeking weight-loss treatment. Questions referring only to issues of underweight were excluded, leading to a total of 11 questions. The SEDs has been shown to have high sensitivity and high positive predictive value.

Short Form – 36 (SF-36)
The SF-36 is a well-validated self-reporting questionnaire that was used in Studies I, III and IV to measure Health Related Quality of Life (HRQL). The SF-36 consists of eight dimensions, ranging from mainly physical to mainly psychological; Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-emotional (RE) and Mental Health (MH). The sum of the SF-36 item scores within each dimension is transformed into a scale ranging from 0 (poor health) to 100 (good health). The good psychometric properties of the SF-36 have been repeatedly been confirmed.

Comprehensive Psychopathological Rating Scale – Self-rating scale for Affective Syndromes (CPRS-S-A)
The CPRS-S-A was used in Studies I, III and IV for measuring self-reported psychopathology in three scales and a total score. A total of 19 items are given a score of 0-3, leading to a score for each of the three scales (depression, anxiety and obsessive-compulsive symptoms) as well as a total score. The CPRS-S-A was constructed by re- phrasing the items from the interview-based Comprehensive Psychopathological Rating Scale (CPRS), covering depression, anxiety and obsessive-compulsive symptoms. The depression and anxiety scales show a high degree of concordance with the interview-based CPRS rating.
Eating Disorders in Obesity (EDO, see appendix 1 in Study II)
The EDO is a short self-reporting questionnaire that was constructed from the SEDs to be used for assessing the full range of eating disorders and binge eating in the studies of this thesis. The questionnaire was constructed to be used in the specific group of obese patients why questions that refer to states of underweight were excluded. Some modifications of the diagnostic segments of the SEDs were also done to avoid ambiguities that were found in some questions. The psychometric properties of the EDO were studied in Study II. The EDO was also used in Studies III and IV to assess pre-treatment binge eating (and eating disorders in Study III), according to DSM-IV criteria. Binge eating is explicitly defined in the questionnaire in accordance to the DSM-IV definition.

Eating Disorder Examination (EDE)
The EDE was used in Study II to assess binge eating and eating disorders in bariatric weight loss treatment patients before bariatric surgery. The EDE is an interview-based assessment that is considered to be the “gold standard” for the assessment of eating disorders. The interview requires an interviewer with good knowledge of eating disorders. In this study only the diagnostic questions of the EDE were used, and questions that only refer to the diagnosis of AN were excluded. Questions about the associated features of BED that are described in the DSM-IV were added to the interview, in accordance to the DSM-IV criteria.

Eating Disorder Examination-Questionnaire (EDE-Q)
The EDE-Q is a 36-item self-report measure that was used in Study IV to assess binge eating after weight loss surgery. The EDE-Q was derived from the Eating Disorder Examination Interview and assesses the specific psychopathology of eating disorders over the previous 28 days. Several forms of overeating are assessed by the EDE-Q in accordance with the DSM-IV definition; objective binge episodes, subjective binge episodes and objective overeating. Research supports the validity of the EDE-Q in the assessment of binge eating.

Procedure
In Study I all participants were asked to fill out the self-report questionnaires SEDs, CPRS-S-A and SF-36, as a part of the routine clinical assessment of behavioural weight loss treatment applicants. The SEDs was used for measuring both eating disorders and binge eating pre-treatment.

In Studies II, III, and IV, all patients that accepted to participate in this long-term study were assessed regarding pre-treatment binge eating, by completing the EDO. In Studies II and III also pre-treatment eating disorders were assessed by the EDO. All participants were also asked to complete the CPRS-S-A and SF-36 at home and return these questionnaires before treatment. Participants were assessed at inclusion and three years after treatment, regarding eating behaviour, HRQL and psychopathology. Specific procedures of the three studies are described below.

In Study II the participants of the long-term cohort were asked about also participating in an interview study, where results from the self-reported EDO-
questionnaire and the EDE interview were compared regarding eating disorders and binge eating. The EDO was also completed once again for test-retest purposes. The interview and EDO-retest were completed approximately two weeks after inclusion. The interviews took 20 to 60 minutes, and were conducted by either of two interviewers, at the weight loss clinic, or at a suitable location of the patient’s choice.

In Study III pre-treatment eating disorders and binge eating (EDO) were compared between surgical and behavioural weight loss treatment participants. Also differences in HRQL (SF-36) and psychopathology (CPRS-S-A) were compared between the treatment groups.

In Study IV, pre-treatment binge eating was assessed with the EDO. Post-treatment binge eating (EDE-Q), psychopathology (CPRS-S-A) and HRQL (SF-36), were assessed by sending these questionnaires to all participants three years after surgical weight loss treatment. At this time participants were also sent structured follow-up questions asking the patients for their self-reported weight. Those not returning the questionnaires of the three-year follow-up where reminded two to five months after the three-year follow-up, and were at that time also sent the EDE-Q and the structured follow-up questions again.

Definitions
Eating disorders and binge eating
In Study I binge eating was present in participants that reported repeated episodes of eating objectively large amounts of food while feeling out of control over eating (during the last three months), without fulfilling all criteria for an eating disorder diagnosis (see appendix A).
An eating disorder was present in those that fulfilled strict DSM criteria for BN, the Oxford criteria for BED (requiring a minimum of one binge eating episode per week for the last three months), or EDNOS. In EDNOS, a minimum requirement of binge eating was set at once monthly during the last three months, while indicating marked distress.

In Studies II, III and IV, pre-treatment binge eating, according to the EDO, was present in participants that confirmed the DSM binge eating definition that was presented in the EDO, but who also confirmed eating objectively large amounts of food, and feeling out of control over eating in two additional questions.

An eating disorder (according to the EDO) was present in Studies II and III, if strict DSM criteria for BN or BED were met pre-treatment. In Study II, those fulfilling the Oxford definition of BED (binging at least once per week during the last three months) were also classified as BED, while these participants were classified as EDNOS in Study II. Both these definitions therefore classified these participants as eating disordered, but through either the diagnosis of BED or EDNOS. In Study II the minimum requirement for an EDNOS diagnosis was set at binging at least once a week during the last three months. Study III required EDNOS participant to binge only once every month during the last three months, but also required these participant to indicate marked distress.
In **Study IV** subjective and objective binge eating *after* bariatric treatment was also assessed. This was done by means of the EDE-Q. Subjective binge eating participants were required to indicate feelings of loss of control over eating either objectively or subjectively large amounts of food during the last 28 days.

**Body Mass Index**

In all four studies calculations of pre-treatment Body Mass Index (BMI=weight/length$^2$ (kg/m$^2$)) were obtained through length and weight that were extracted from patient records.

In **Study IV** BMI three years after treatment was calculated through length from patient records, and weight mainly through self-reporting data from the 3-year follow-up questions. The choice of deviating from the original plans of using only clinical data was based on the insufficient number of clinical data that were found one year after treatment. Self-reported data were complemented by data from patient records for increased statistical power. Mixing these data was shown not to affect results significantly.

**Analyses**

Statistix, version 8, was used to analyse data in all four studies. An alpha level of $p<0.05$ was considered as significant throughout these studies.

In **Study I** differences between the three eating behaviour groups, regarding co-morbid Psychopathology, Body Mass Index, Waist-Hip Ratio and Age were analysed using the one-way ANOVA. Subsequent to the ANOVAs, post-hoc tests were conducted with Tukey’s multiple comparison procedure. For categorical comparisons regarding sex, marital status and occupation Chi-square tests was used. HRQL (SF-36) was analysed by the non-parametrical tests, Kruskal-Wallis and Mann-Whitney, as the three groups showed unequal variances, different sample sizes, and a number of outliers.

In **Study II**, validity and reliability of the EDO were tested using Cohen’s Kappa. For group comparisons of categorical data (sex, occurrence and non-occurrence of eating disorders and binge eating), Chi-square tests were used. Group comparisons of continuous data (level of obesity and age) were analyzed by means of the Student’s t-test. Because of small sample sizes Chi-square tests of the differences between men and women in the classifications of eating disorders and binge eating (EDE vs. EDO, and EDO vs. EDO-retest) were performed to address the sex issue, instead of doing separate analyses for men and women.

In **Study III**, possible group differences of sex and eating pathology were analysed by Chi-square. Differences in age and level of obesity were tested by means of the student’s t-test. The Mann-Whitney test was used for analyzing CPRS-S-A and SF-36 scales, as they were found to have unequal distributions with a number of outliers, also including the corresponding effect sizes measured by Cohen’s d. In analyzing the results of group differences in SF-36, Bonferroni-Holms method was used for a statistical correction for multiple testing.
As data did not meet requirements for running parametric data, the Kruskal-Wallis test was used to compare the CPRS-S-A-scores in three equally large BMI strata. To investigate whether differences between treatment groups regarding CPRS-S-A were associated with differences in the occurrence of eating disorders, the three treatment groups were compared again after excluding the participants with eating disorders, and these result was compared with the one including the participant with eating disorders.

The association between eating disorders and level of obesity was investigated by comparing mean scores of BMI in the three eating disorder group, by means of the one way ANOVA. For the post-hoc comparison Tukey’s test was used.

In Study IV the overall changes in BMI, pre-to post-treatment, were analysed by paired t-test.

Differences in post-treatment BMI, between those with or without objective binge eating (before or after treatment), and with or without subjective binge eating after bariatric surgery, were analysed by means of ANCOVA, with the corresponding effect sizes measured by Cohen’s d. In these analyses pre-treatment BMI was used as a covariate.

Differences in long-term HRQL and psychopathology were compared between those with and without subjective binge eating by means of ANCOVA, with the corresponding effect sizes measured by Cohen’s d. Pre-treatment scores were used as covariates.

Besides the main sample of 130 participants, two different sub-samples were used in the different analyses, due to the accumulated dropout from each measure. In each of these sub-samples, comparisons between those analysed and those not analysed were done by means of student’s t-test for continuous data (BMI and age) and by Chi-square for categorical data (eating disorders, binge eating, and sex).

**Ethical considerations**

The sample in Study I consisted of a clinical population that was studied using the standard clinical instruments and routines that were used at the clinic at that time. The participants had previously signed a consent form, stating that their treatment data could be used for research purposes. Participants had been informed verbally as well as in writing about research confidentiality, and that their participation in research was strictly voluntary.

Participants in Studies II, III and IV were all recruited within the same research project. The project was approved by the appropriate ethical committees. All participants were informed verbally as well as in writing about confidentiality, that participation was strictly voluntary, and that failure to participate would not affect the treatment decisions.
RESULTS

The results of each of the four studies are briefly presented below.

**Study I: Eating disorders and disordered eating among patients seeking non-surgical weight-loss treatment in Sweden**

No differences were found between the three eating behaviour groups (Eating Disorders (ED), Binge Eating (BE), Non Binge Eating (NBE)), regarding sex, marital status, occupation, age, Body Mass Index or Waist-Hip Ratio. Of the total sample, 9.8% were classified as ED. Of these ED participants, 52.6% were classified as BED, but this rate increased to 73.9% (while the rate of EDNOS decreased) if the Oxford criterion for BED was used instead. In addition to the ED participants, 7.2% reported binge eating (BE) (without fulfilling eating disorder criteria) which indicated that, in total, 17.0% had symptoms of binge eating.

Differences between the three groups regarding psychopathology (CPRS-S-A) and HRQL (SF-36) are shown in Table 2 below.

**Table 2**

Significant differences (p<0.05) between the eating behavior groups, regarding the CPRS-S-A and SF-36 subscales.

<table>
<thead>
<tr>
<th>CPRS-S-A</th>
<th>NBE&lt;ED*</th>
<th>NBE&lt;BE*</th>
<th>BE&lt;ED*</th>
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<th>NBE&gt;ED*</th>
<th>NBE&gt;BE*</th>
<th>BE&gt;ED*</th>
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*In the CPRS-S-A more psychopathology is indicated by higher scores, while higher scores in the SF-36 indicate better HRQL.

**Study II: Psychometric properties of the Eating Disorders in Obesity questionnaire: validating against the Eating Disorder Examination interview**

Validity and reliability of the EDO was tested for assessments of both eating disorders and binge eating as a distinct symptom. Validity was measured as the concordance between the self-reported EDO questionnaire and the EDE-interview.
This comparison indicated a good validity in the assessment of both eating disorders (κ=0.67) and binge eating (κ=0.63).

Of the 48 participants that confirmed the binge eating definition in the first question, 39 fulfilled criteria for binge eating according to the EDO. All eating disordered participants according to the EDE (n=12), were a subgroup of these 39 participants. Results further show that none of the 49 participants that denied fulfilling the binge eating definition, were subsequently classified as a binge eater (or as eating disordered) by the EDE.

The test-retest reliability of the EDO regarding assessments of eating disorders (κ=0.65) and binge eating (κ=0.65) showed good agreements between the two assessments.

**Study III: A comparison of eating disorders among patients receiving surgical vs. non-surgical weight loss treatments**

Results indicated that there was a difference in eating related pathology between the surgical and non-surgical weight loss treatment participants (χ² (1)=6.4, p=0.04). While binge eating was equally common in surgical (31.5%), and non-surgical (30.4%) weight loss treatments, eating disorders were more common in participants that were accepted for surgical weight loss treatment (18.5%), compared to those accepted for non-surgical (4.3%) weight loss treatment (χ² (1)=4.7, p=0.03).

Differences were shown between treatment groups, where surgical participants had higher scores than the non-surgical participants, regarding all three CPRS-S-A categories (depression, anxiety and obsessive-compulsive symptoms) as well as the total scale. These differences were not associated with differences in the occurrence of eating disorders or in differences in BMI. After correcting for multiple testing, patients accepted for surgical weight loss treatment did not differ in HRQL from the non-surgical patients.

**Study IV: Binge eating in surgical weight-loss treatments – Long-term association with weight loss, health related quality of life (HRQL), and psychopathology**

Objective binge eating before bariatric surgery was indicated by 18.5% of the 130 participants. Participants who reported objective binge eating before bariatric treatment did not differ from participants without these symptoms in regard to long-term BMI after correcting for pre-treatment BMI.

Results further showed that 28.4% of the 102 participants that were analysed regarding binge eating after bariatric surgery indicated subjective binge eating episodes. There was no difference in BMI outcome between those with or without subjective or objective binge eating after bariatric surgery. Subjective binge eating after surgical treatment was associated to significantly more psychopathology and lower HRQL post-treatment, than in those with no binge eating.
Summary of the main findings

• Eating disorders and binge eating was common in patients that were accepted for non-surgical/behavioural weight loss treatment.
• Eating disorders and binge eating before non-surgical/behavioural weight loss treatment, was associated with lower pre-treatment HRQL and higher pre-treatment psychopathology, than in those with no eating disorders or binge eating.
• The EDO indicated good validity and reliability in the assessments of binge eating and eating disorders before weight loss treatment.
• All those failing to agree with the presented binge eating definition, confirmed in the interview that they had no symptoms of binge eating.
• Surgical weight loss treatment participants had more eating disorders before treatment, than non-surgical/behavioural weight loss treatment participants.
• The prevalence of binge eating as a symptom was equally common in surgical and non-surgical/behavioural weight loss treatment participants.
• Surgical weight loss treatment participants displayed more co-morbid psychopathology than non-surgical/behavioural weight loss treatment participants.
• Objective binge eating was common before bariatric treatment, but this did not predict the long-term BMI-outcome.
• Subjective binge eating was common after bariatric treatment, but this did not predict the long-term BMI-outcome.
• Participants with subjective binge eating after bariatric treatment were shown to have less successful long-term treatment outcome through indicating more co-morbid psychopathology and lower HRQL than participants without subjective binge eating.
DISCUSSION

Since BED was introduced as a preliminary diagnose in the DSM, research in the field of eating behaviour in weight loss treatments has increased considerably. This research has indicated that BED could represent a meaningful category of the eating disordered 16, 33, 137, 140. There is only limited empirical support for some of the criteria in BED (e.g. the frequency and the duration criteria 88, 137, 148) why there has perhaps been too much focus on the use of BED in weight loss treatment settings 103. This focus has most likely limited research on other diagnostic aspects than BED, therefore failing to adequately challenge, explore and further expand knowledge, beyond this specific scope 137. After 15 years of eating disorder research in weight loss treatments, there is still insufficient scientific support for how binge eating and eating disordered patients are to be addressed and managed in weight loss treatments.

Major findings

The prevalence of eating disorders and binge eating pre-treatment has been a specific aim only in Study I, but the other three studies also confirm the undisputed evidence that eating disorders and binge eating is highly prevalent in patients before weight loss treatments 4, 25, 97, 100, 107. The rates of binge eating and eating disorders that were displayed in Study I were lower than in many previous studies 141 which could perhaps be explained by the EDO defining binge eating in the questionnaire, and through this does not include other aspects of overeating than objective binge eating. Of greater importance than the exact prevalence rates though, are the issues of a more clinical concern, such as which the implications/associations of these problems are, and if eating disorders or binge eating is associated with treatment outcome. Of major interest in the search for answers to these questions are also questions of how to relevantly define and validly assess binge eating and eating disorders in weight loss treatment patients.

In Study I differences in prevalence rates were shown when using different definitions of BED and eating disorders. The rate of BED was shown to increase by almost 50% when the Oxford definition was used 24, instead of the strict DSM-definition. When the focus of eating disorders was limited to strict BED, almost 50% of all eating disordered participants were excluded. This shows the importance of how eating disorders are defined. There is so far no empirical support 6, 103 for using BED instead of the whole spectrum of eating disorder in weight loss treatment settings. In the coming DSM-V the present categorical approach to eating disorders (and BED) has been suggested to be replaced by a more dimensional approach 137, 148. This approach would most likely help provide more knowledge in the research area which may also help to develop future guidelines of how binge eating in weight loss treatments is to be addressed.

There have been many previous attempts to predict long-term weight loss through eating behaviour 18, 32, 77, 103, 111, 134. The results of these studies however, have been most inconclusive 14, 15, 63, 74, 79, 103, 131, which has many to the conclusion that long-term weight loss may not be predicted through pre-treatment eating behaviour 91. This was also confirmed through the results from Study IV, where no association
between pre-treatment binge eating and long-term weight loss was shown. This questions the procedure of excluding binge eating or eating disordered patients from e.g. bariatric treatments, if this exclusion is based on a risk of less long-term weight loss. Also patients with pre-treatment eating disorders or binge eating have successful weight losses, and therefore have large health benefits from this procedure. Being the most effective weight loss treatment, bariatric surgery will lead to severe improvements of physical health for most binge eating patients. Exclusions from treatments with such positive health effects should only be motivated by indisputable evidence. There is no such evidence regarding the effect on long-term weight loss today.

Considering data from Study IV, there may be reasons other than weight loss outcome for why e.g. binge eating should be considered in weight loss treatments. Addressing these issues throughout treatment may help to expand knowledge in the area through collecting more information. This is most relevant in the specific weight loss treatment research area, where many methodological shortcomings have been reported. A pre-treatment assessment of binge eating and other psychopathology may also be used in a discussion with the patient about possible treatment options, and how to proceed with treatment considering these specific comorbidities. Knowing that eating disorders and other psychopathological problems are common, these symptoms should perhaps be addressed not as a problem in treatment, but as one (of many) associated symptoms to consider in the decisions about treatment. With an open clinical approach of finding the best available treatment and optimal time for treatment (also considering comorbidities) there is less risk of the patient concealing psychopathological problems. This also gives the opportunity for the patient to discuss which of the problems that the patient is most motivated to address, and which approach. This open dialogue will most likely lead to more motivated patients who expect to receive help in accordance with their needs.

The previously reported negative changes in eating pathology in weight loss treatments provide good reasons for assessing these issues from pre-treatment and continuously in treatment. In Study IV binge eating after bariatric surgery was shown to be common, and also to be associated to low HRQL and high psychopathology. Thus evidence shows that the commonly reported success of bariatric surgery on a wide range of outcome measures, can be questioned in patients that indicate binge eating post-treatment. In contrast to Hsu et al. these binge eating participants were not shown to have less successful weight loss outcome. Even if there are few long-term studies, binge eating post-treatment has in one study been shown to be associated to weight gain beyond three years. We can therefore speculate whether the low quality of life and high psychopathology that was found in Study IV indicates a risk for future weight regain beyond three years. Perhaps the time span of three years that was used in Study IV was too short for getting a good picture of possible post-bariatric changes regarding binge eating psychopathology and weight loss. For this reason not only weight loss, but also other measures of outcome are needed to help establish what should be considered to be positive outcome.
In Study IV, the EDO-questionnaire that was used pre-treatment was exchanged for the EDE-Q in the post-treatment assessments. Through this change of questionnaire, pre- and post-treatment binge eating was unfortunately not possible to compare by sufficiently valid measures. Considering that both instruments are DSM-based and both assess binge eating in a similar manner, an investigation pre- to post-treatment changes still managed to provide some indication of possible changes. Most prominent was that only approximately 20% of the post-treatment binge eaters indicated binge eating pre-treatment and that only one third of the pre-treatment binge eaters reported binge eating problems post-treatment. Despite the large uncertainty of these data, results can at the least indicate that some of the patients who binge eat after bariatric treatment, have not done so previously. Previous studies have shown post-treatment binge eating to be associated to pre-treatment eating behaviour, but results from Study IV show that this conclusion can be questioned. In these studies only regain of binge eating, and remaining binge eating was assessed. Study IV indicates that there are patients that binge eat after, but not before weight loss treatments, why also these patients should be included in an analysis of long-term weight losses. For more conclusive results this must be further studied with adequate methods.

Clinical considerations
In some surgical weight loss clinics, eating disorders are explicitly stated as something that excludes patients from treatment. Therefore it is considered that weight loss applicants may minimize their eating problems prior to surgery, because they want to be approved for this procedure. This is probably true in a setting where no treatment alternatives are offered, and when binge eating and other psychopathology are assessed to investigate if treatment applicants fulfill the inclusion criteria. My experience from a large number of interviews for Study II is that these patients honestly reveal binge eating and other psychopathology when this information will not affect whether treatment is offered or not. If the goal of the assessment instead was to inquire how this patient can be helped, the issues of binge eating and other psychopathology could most likely be explored openly. Such an open approach could help the clinic and patient to decide whether this treatment targets the patients’ most essential problems (such as obesity, binge eating or perhaps depression), and if these problems should be addressed in e.g. psychiatric treatment. This open approach towards psychopathology may be difficult to carry out though, through the lack of psychiatric expertise in most Swedish weight loss clinics. During the last decades bariatric surgery has gained large positive attention in Sweden for its good weight loss and its associated improvements in somatic health and HRQL. This has led to long waiting lists for receiving publicly financed bariatric treatments, why an increased focus on psychiatric and psychosocial aspects of bariatric surgery may perhaps not be prioritized.

An important concern when eating behaviours in weight loss programs are studied, is having a long-term approach that can assess changes in both psychopathology and weight. In spite of the convincing support for a long-term approach in clinical treatment and research, many outcome studies have a follow-up duration of twelve months or less. The long-term approach is also important if one wants to learn more about which participants drop out of...
treatment, and out of research. A long-term study is difficult to carry out though, which was shown in the long-term analyses of participants in the cohort, where only a relatively low number of surgical participants attended follow-up according to the treatment plan. Unpublished results of the follow-up of behavioural weight loss treatment participants in the large cohort shows that less than 50% of the 52 non-surgical behavioural participants had completed the two-year weight loss program. This emphasizes the importance of having a long-term focus that can report temporal changes in several measures, but that also considers those that drop out of treatment.

**Diagnostic and methodological considerations**

In the effort to learn more about how eating behaviour is associated to outcome in weight loss treatments a wide definition of eating disturbance has been used in the studies of this thesis; all eating disorders as well as binge eating symptoms. The strict DSM-classifications of BED has been questioned, why the Oxford definition (that was used in Studies I and III) of BED has been promoted in research. As shown above, there are perhaps reasons for not assessing these features as dimensional at all, but as continuous. Also in the specific area of assessing binge eating after bariatric treatment, the strict DSM-based definition of binge eating has been questioned. Research has revealed problems in defining binge eating as objectively large, and suggestions have been presented of how binge eating after bariatric treatment should be assessed.

In spite of the critique raised regarding eating disorder diagnostics, strict DSM-based definitions were used in validating the EDO (in Study II). The main differences this brought, compared to Study I and III, was mainly that less cases of BED were found when the strict definition of BED was used. Many of the potential BED cases (those fulfilling the Oxford, but not full BED definition) though were classified as eating disordered, through the diagnosis of EDNOS. There was a difference in regard to how EDNOS was classified though. While the classification of EDNOS in Study II relied on a binge eating frequency of once per week, Study III required a frequency of only once per months but also that “marked distress” should be present. During the last decade studies have suggested that “shape and weight concern”, should be included in the BED criteria (instead of “marked distress”) 54, 83, 99, 100, 115, 137, 139. This could perhaps be used as a requirement for all eating disordered patients (also for EDNOS), to include some degree of severity as a diagnostic requirement, like in AN and BN 4.

A general shortcoming in the research area is that a large number of different instruments and assessment methods have been used over the years 37, 79, 91, 105. In these assessments, a variety of methods have been used, from clinical standardised interviews to self-made, un-validated self-reporting instrument, that have measured a wide span of different symptoms, using different definitions. As previously shown this diversity can produce different estimates in otherwise comparable samples 37, and makes comparisons difficult. To address the problem of this diversity the EDO was developed and validated in Study II. The EDO was found to have reliability and good concurrent validity in assessments of both binge eating and eating disorders pre-treatment. The overestimation of prevalence rates that previously has been shown in self-reported measures 47, 146, was not
reported when using the EDO. An explanation to this may be that the binge eating definition is explicitly defined in the questionnaire, and that objectively large amounts and loss of control is further confirmed in separate questions. This has helped to discriminate between different forms of overeating and thus helped to avoid false-positive results. Results from more recent research have provided results that questions the use of EDO (and other instruments that make use of the objective binge eating definition) in post-bariatric samples. To address this, changes could perhaps be made to the EDO by defining binge eating as eating large (not objectively large) amounts of food while feeling out of control, with separate indications of subjective and objective large amounts. In this way more can be learned about these symptoms, not only post-, but perhaps also pre-treatment. Recent research have also showed reports of grazing and uncontrolled eating before bariatric treatment (i.e. subjective binge eating). The importance of pre-treatment subjective eating can be questioned through Study II though. There it was shown that only one participant (out of 97) indicated subjective binge eating pre-treatment in the EDE, and that this participant indicated objective as well as subjective binge eating in the EDO.

Research considerations and future research

From this thesis there are at least three main issues of importance to address in future research of eating behaviour in weight loss treatment settings. First is the question if and how eating pathology changes over time in weight loss treatments. For valid assessments of these changes, diagnostic interviews are most likely required to assess all kinds of overeating, and to be able to address these issues more precisely. The influence of possible changes in psychopathology is also of major importance in future studies, as binge eating and psychopathology commonly occur together and seem to shift in regard to when, and perhaps what treatment is received. For a proper investigation of these issues a longitudinal study (of at least three years) is required, that continuously can monitor temporal changes in weight, eating behaviour and psychopathology.

In addition to this, information is insufficient about other measures of outcome (than weight) in weight loss treatments. In Study IV both psychopathology and HRQL were used as outcome measures, but due to dropout, the conclusions were drawn from results of relatively small samples. Beyond the scope of this thesis, data from the large cohort (of 252 participants) will be used for examining outcome in relation to psychopathology and HRQL.

A third point of importance for future research is the difficult question of how obese binge eaters should be treated for their obesity, for their eating disorder or for a combination of these. There is little evidence that successful treatment of binge eating brings about significant weight loss. We here also show that successful treatment for weight loss most likely does not lead to long-term improvements in binge eating (Study IV). There is also limited evidence to suggest that specific eating disorder approaches are superior, or significantly add to outcome of standard weight control approaches.
Strengths
A strength of the studies in this thesis is the clinical and naturalistic approach, where eating behaviour was studied in the current practice of weight loss clinics in Sweden. This was a reflection of the every-day clinical practice where all different types of weight loss treatment patients were included. By including patients that already were accepted for treatment the patients were also more likely to admit to behaviours that, if revealed before the treatment decision, may have excluded them from treatment. A strength was also that the participants of Study IV were studied prospectively and long-term, which allowed the assessment of long-term changes in weight, HRQL and psychopathology.

The wider scope of eating behaviours that was assessed, compared to studies that only have assessed BED, is a strength of the studies in this thesis. In the assessments of Studies I, II and III, both eating disorders and binge eating as a symptom have been assessed, while only binge eating was assessed in Study IV. This wider scope has perhaps made comparisons to other studies more difficult, but this approach was chosen in response to empirical data. The inclusion of subjective binge eating in the definition of binge eating after bariatric treatment is also supported by previous research data.

Data is inconclusive regarding the association of binge eating to outcome in weight loss treatments. In Study IV, besides weight and eating behaviour, also measures of HRQL and psychopathology have been included, which has given a more complete picture of weight loss outcome in weight loss treatment patients.

Limitations
One of the shortcomings in three of the four studies (Study I, III, and IV) of this thesis is the reliance on self-report measures for assessing eating pathology (EDO and EDE-Q). This is a shortcoming of all self-reported questionnaires that also was a motivation to develop the EDO and to investigate the psychometric properties of the questionnaire. Self-reporting measures have previously been shown to overestimate the numbers of binge eaters, compared to interviews 52, 138. The validation of the EDO though showed no such overestimation. Also self-reporting measures were used in the assessment of long-term BMI in Study IV. It is known that self-reported weight differs from clinically assessed weight 92, but this possible difference was shown to be of no major importance for the results of the analyses of weight data.

As described above, two different self-rating instruments of eating disorder symptoms were used for assessing pre- (EDO) or post-treatment binge eating (EDE-Q). The EDO was exchanged for the EDE-Q in the post-bariatric follow-up, in response to the documented importance of also including subjective binge eating in assessments of binge eating after bariatric treatment. This change of instrument has made pre- and post-treatment comparisons difficult, but has most likely increased the validity of the post-bariatric assessments. Some preliminary and most careful conclusions have been drawn from a comparison pre-to post-treatment, but these data must be interpreted with caution.
The third limitation to be addressed is the small sample sizes of some of the analyses. In spite of a large cohort of 252 participants being included in the sample (in studies II, III, and IV), many of these participants never started the assigned weight loss treatment, or dropped out of (behavioural) treatment. There has also been drop-out of research data, which was most evident in the long-term follow-up when several measures are assessed together. The drop-out analyses have shown no differences between those analysed and those excluded, but small samples lead to a loss of statistical power and cause uncertainty regarding how representative the remaining sample.
CONCLUSIONS

Eating disorders and binge eating is common in patients that are enrolled in both surgical and behavioural/non-surgical weight loss treatments. These patients display higher psychopathology and lower HRQL than patients without eating disorders or binge eating. The rates of these eating disturbances depend on how they are defined, but results show that also sub-clinical binge eaters show high psychopathology and low HRQL, why also these patients should be considered in weight loss research and practice.

The Eating Disorder in Obesity questionnaire was shown to indicate good concurrent validity and good reliability in the assessments of binge eating and eating disorders before weight loss treatment. In contrast to many self-reporting questionnaires the rate of binge eating and eating disorders was not overestimated by the EDO. The EDO can be used as a first preliminary assessment of binge eating in weight loss treatment, as it was shown that all patients that were identified as binge eaters by the EDE confirmed the binge eating classification in the EDO.

Approximately 30% of both surgical and non-surgical weight loss treatment participants indicated symptoms of binge eating before treatment. Surgical weight loss treatment participants were shown to have significantly more eating disorders and co-morbid psychopathology than non-surgical/behavioural weight loss treatment participants before treatment.

Objective binge eating was shown to be common before bariatric surgery, but did not predict the degree of long-term (three-year) BMI-outcome. Also subjective binge eating after bariatric surgery was common and failed to predict long-term BMI-outcome. In spite of an average weight loss that was comparable to those with no binge eating, participants with binge eating after bariatric surgery had less successful treatment outcome in terms of co-morbid psychopathology and HRQL.

Results show that binge eating is common in both surgical and non-surgical/behavioural weight loss treatments, and that binge eating after bariatric treatment has a negative impact on long-term quality of life and psychological well-being. This shows that binge eating should be assessed within the context of weight loss treatments.
SAMMANFATTNING PÅ SVENSKA (SUMMARY IN SWEDISH)

Under de senaste decennierna har förekomsten av fetma och övervikt ökat i Sverige liksom i övriga världen. Utöver ett personligt lidande, har fetma visat sig vara associerat med sämre fysisk livskvalitet, sämre fysisk hälsa, samt högre mortalitet. Den ökning av följdsjukdomarna som är associerad till fetma har även inneburit ökade sjukvårdskostnader för samhället. Patienter som söker viktreducerande behandlingar har visat sig ha en ökad förekomst av åtstörningar och hetsätning, vilka är kopplade till sämre psykisk hälsa och sämre livskvalitet. Hetsätning är det primära symptomkriteriet på åtstörningar hos patienter med fetma vilket innebär att personen åter stora mängder mat och upplever att han/hon saknar kontroll över detta ätande. Då hetsätning är förknippat med viktuppgång, med vidmakthållande av en hög vikt, samt med svårigheter att gå ned i vikt, har detta beteende ansetts vara viktigt att identifiera inför viktreducerande behandlingar. Många kirurgiska kliniker avråder dessutom patienter med åtstörningar från kirurgiska viktreduktionsbehandlingar, då hetsätning anses vara en indikation på svårighet att tillgodogöra sig behandlingen, alternativt att behandlingen anses riskera att förvärra åtstörningssymtomen. Ännu saknas dock tillförlitliga data om associationen mellan äteteende och behandlingsutfall i viktreduktionsbehandlingar, delvis på grund av metodologiska och diagnostiska olikheter och problem i sådana studier.

I syfte att öka denna kunskap undersökt undersöktes åteteende, vikt, livskvalitet och psykisk hälsa i två olika grupper av patienter. I första studien undersöktes detta hos 194 patienter som sökte icke-kirurgisk/beteendeförändrande viktreduktionsbehandling, och i de följande tre studierna hos en annan grupp av 252 patienter som hade accepterats för kirurgiska eller icke-kirurgiska/beteendeförändrande viktreduktionsbehandlingar. De 252 deltagarna i den andra gruppen följes från före behandlingen till tre år efter behandlingsstart, med avseende på ovanstående parametrar. Av de 252 deltagare som följes intervjuades 97 av dem för en jämförelse mellan ett nykonstruerat frågeformulär, Eating Disorders in Obesity (EDO), och åtstörningsintervjun Eating Disorder Examination (EDE).

Resultaten från de fyra studierna i avhandlingen presenteras kort nedan:

I Studie I undersökt förekomsten av åtstörningar och hetsätning bland patienter som hade accepterats till icke-kirurgisk/beteendeförändrande viktreduktionsbehandling. Resultaten visar att 17% av patienterna hade ett återkommande hetsätningssymtom, och att drygt hälften av dessa patienter även uppfylde kriterierna för en åtstörning. Åtstörningar och hetsätning var associerat med sämre psykisk hälsa samt sämre livskvalitet.

I **Studie III** jämfördes patienter från kirurgiska och icke-kirurgiska/beteende-förändrande viktreduktionsbehandlingar, med avseende på åtstörningar, hetsätning, psykisk hälsa och livskvalitet. Resultaten visade att förekomsten av åtstörningar var betydligt högre bland de som sökte kirurgisk behandling, men att förekomsten av hetsätning var lika stor i de båda grupperna. De kirurgiska viktreduktionsdeltagarna uppförde även en högre grad av psykopatologi, än de icke-kirurgiska deltagarna, men grupperna skilde sig inte åt avseende livskvalitet.

I **Studie IV** undersökeres hur förekomsten av hetsätning var associerat med vikt (BMI) efter kirurgisk viktreduktionsbehandling. Förekomsten av hetsätning före eller efter kirurgisk behandling, visade sig inte vara associerad med BMI efter tre år. Det fanns dock en relevant förekomst av hetsätning tre år efter behandlingen, som visade sig vara associerad med en betydligt sämre psykisk hälsa och sämre livskvalitet.

**Nyckelord:**
Åtstörning, fetma, hetsätning, longitudinell, viktreduktion
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APPENDICES

Appendix A

DSM-IV Diagnostic criteria for Eating Disorders

307.1  Anorexia Nervosa (AN)
A. Refusal to maintain body weight at or above a minimally normal weight for the age and height (e.g. weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to a body weight less than 85% of that expected).
B. Intense fear of gaining weight or getting fat, even though underweight.
C. Disturbance in the way in which one’s body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current body weight.
D. In post menarcheal females, amenorrhea, i.e. the absence of at least three consecutive menstrual cycles. (A woman is considered to have amenorrhea if her periods occur only following hormone, e.g. oestrogen administration.)

Specify type:

**Restrictive Type:** during the current episode of Anorexia Nervosa, the person has not regularly engaged in binge eating or purging behaviour (i.e. self-induced vomiting or the misuse of laxatives, diuretics, or enemas)

**Binge eating/Purging Type:** during the current episode of Anorexia Nervosa, the person has regularly engaged in binge eating or purging behaviour (i.e. self-induced vomiting or the misuse of laxatives, diuretics, or enemas)
307.51 Bulimia Nervosa (BN)

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both the following:

(1) eating, in a discrete period of time (e.g. within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances

(2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop what or how much one is eating)

B. Recurrent inappropriate compensatory behaviour in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.

C. The binge eating and inappropriate compensatory behaviours occur, on average, at least twice a week for 3 months.

D. Self-evaluation is unduly influenced by body shape and weight

E. The disturbance does not occur exclusively during episodes of Anorexia Nervosa

Specify type:

Purging type: during the current episode of Bulimia Nervosa, the Person has regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics or enemas.

Non-purging type: during the current episode of Bulimia Nervosa the Person has used other inappropriate compensatory behaviours, such as fasting or excessive exercise but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics or enemas.

307.50 Eating Disorders Not Otherwise Specified (EDNOS)

1. For females, all of the criteria for Anorexia Nervosa are met except that the individual has regular menses.

2. All of the criteria for Anorexia Nervosa are met except that, despite significant weight loss, the individual’s current weight is in the normal range.

3. All of the criteria for Bulimia Nervosa are met except that, despite significant weight loss, the individual’s current weight is in the normal range.

4. The regular use of inappropriate compensatory behaviour by an individual of normal body weight after eating small amounts of food (e.g. self-induced vomiting after the consumption of two cookies).

5. Repeatedly chewing and spitting out, but not swallowing, large amounts of food.

DSM-IV Binge eating Disorder criteria

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:

1. eating in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
2. a sense of lack of control over eating during the episode (e.g. a feeling that one cannot stop eating or control what or how much one is eating)

B. The binge eating episodes are associated with three (or more) of the following:

1. eating much more rapidly than normal
2. eating until feeling uncomfortably full
3. eating large amounts of food when not feeling physically hungry
4. eating alone because of being embarrassed by how much one is eating
5. feeling disgusted with oneself, depressed, or very guilty after overeating

C. Marked distress regarding binge eating is present

D. The binge eating occurs, on average, at least 2 days a week for six months

Note: The method of determining frequency threshold is counting the number of days on which binges occur or in counting the number of episodes of binge eating.

E. The binge eating is not associated with regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa
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