Studies on Emotion Regulation in Anorexia Nervosa and Obesity:

Associations with Body Weight and Eating Disorder Psychopathology

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Abstract

Difficulties with emotion regulation (DER) have been described as a prominent deficit across the eating disorders (ED). In anorexia nervosa (AN), limited research has evaluated whether weight gain is associated with improvements in DER, and whether improvements in DER are associated with reductions in ED pathology. In obesity, there has been limited research into the role of DER on weight regain following weight loss. The aims of study one were to determine whether DER improved during specialized inpatient treatment for AN and to explore whether improvements in DER were associated with reductions in ED pathology. The aims of study two were to examine associations between DER, emotional eating (EE), and BMI over a 12-month period; and explore the relationship between DER, weight regain, and binge eating (BE). The participants in study one were 108 patients who met DSM-IV-TR criteria for AN and were admitted to an intensive treatment program. Self-report measures were administered at admission to and discharge from the program. The participants in study two were 75 participants recruited from the community who were obese and had recently lost at least 5% of their body weight. Self-report-measures were obtained at baseline, six-month follow-up, and 12-month follow-up. Results of study one indicated improvements in DER among individuals who completed treatment and became weight restored, and a significant positive association between improvements in DER and reductions in ED pathology. In study two, baseline DER were not associated with EE or BMI change; however, participants demonstrated difficulties in emotional awareness comparable to the AN sample, and those who regained weight were significantly more likely to report BE at baseline. Study implications, limitations, and future directions are discussed.

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Emotion Regulation

Emotion regulation is a psychological construct that, until recently, lacked a clear, agreed-upon definition (Gratz & Roemer, 2004). While some researchers perceived it as synonymous with emotional control (i.e., the ability to express, attenuate, and modulate emotions; e.g., Zeman & Garber, 1996), others described it as an ability to identify, label, and differentiate emotions (e.g., Gross & Munoz, 1995; Paivio & Greenberg, 1998). In his research on emotion regulation, Gross (1998) defined the construct as "an attempt to influence which emotions we have, when we have them, and how they are experienced or expressed" (p.224). He described it as an all-encompassing term for one's ability to regulate and cope with their emotions in a healthy, adaptive manner (Gross, 1998). More recently, Gratz and Roemer (2004) proposed that emotion regulation comprises all of the aforementioned facets, in addition to several others. Specifically, they argue that emotion regulation is the ability to: experience, differentiate, and accept one's emotions, implement strategies that will attenuate and modulate one's emotions, and express one's emotions in a healthy and socially appropriate manner. Factor analyses have confirmed that each of these facets exists as valid and unique aspects of emotion regulation (Gratz & Roemer, 2004).

According to Gross' (2015) process or modal model of emotion regulation, the process of emotion regulation begins when an individual encounters an emotionally-stimulating situation. Next, the individual attends to and appraises the situation evoking a particular emotion, and then selects a behavioural or psychological response based on

their prediction of how it will influence their emotional state. Emotion regulation strategies, then, can be implemented at any of four stages: the situation stage, the attentional stage, the appraisal stage, or the response stage. An example of a strategy implemented at the situation stage is situation selection (i.e., selecting a situation that will elicit desirable emotions); an example of a strategy implemented at the attentional stage is attentional deployment (i.e., directing one's attention to a stimulus believed to elicit desirable emotions); and an example of a strategy implemented at the appraisal stage is cognitive change (i.e., modifying one's cognitions to elicit desirable emotions). Gross and Munoz (1995) define the employment of emotion regulation strategies at any of the three stages as "antecedent-focused emotion regulation" in that these strategies are employed based on an individual's prediction of the emotion he or she will experience in a particular situation and, as such, they occur before the emotion is evoked and influence the emotion that is produced. Finally, an example of a strategy implemented at the response stage is response modulation (i.e., when unsatisfied with one's current emotions, modifying one's behaviour to elicit the desired emotion). Gross and Munoz (1995) define strategies used at this stage as "response-focused emotion regulation" in that they modulate an emotion that has already been activated.

The strategies implemented at each of the four emotion regulation stages can be adaptive or maladaptive. For example, exercise is usually considered an adaptive selection response while staying in bed all day is generally perceived to be a maladaptive selection response. Similarly, redirecting one's attention to upcoming weekend plans is considered an adaptive attentional strategy, while redirecting one's attention to being screened out of a job competition is a maladaptive strategy. With respect to appraisal

strategies, thinking about one's racing heart as a symptom of anxiety is an adaptive reappraisal strategy while perceiving it as a sign of a heart attack is a maladaptive reappraisal strategy. Finally, deep breathing is an example of an adaptive response modulation strategy while emotional suppression would generally be considered a maladaptive modulation response. It is important to note, however, that when considering the degree to which any given emotion regulation strategy is adaptive or maladaptive, it is necessary to consider the context in which the strategy occurs as well as the influence on the individual's overall functioning and quality of life. For example, while exercise is generally considered an adaptive emotion regulation strategy, it may be maladaptive if it interferes with social and occupational functioning or is excessively pursued despite a negative influence on one's physical or psychological health.

Deficits in emotion regulation at all levels of the emotion regulation process have been associated with the presence of several psychological disorders. Disorders that have been associated with emotion dysregulation include, but are not limited to, borderline personality disorder (Chapman, Dixon-Gordon, & Walters, 2011; Sharp et al., 2011), substance abuse disorder (Ejei, Lavasani, & Erami, 2015), anxiety (Hofmann, Sawyer, Fang, & Asnaani, 2012), and, in more recent years, eating disorders (Pearson, Wonderlich, & Smith, 2015). While some disorders, such as borderline personality disorder and bulimia nervosa (BN), are most consistently associated with emotional *underregulation* (i.e., an inability to control one's emotional impulses), other disorders, such as somatoform disorders and anorexia nervosa (AN), have been most consistently associated with emotional *overregulation* (i.e., the suppression or inhibition of one's emotions) (Lynch et al., 2013; Danner, Sternheim, & Evers, 2014). However, while several studies

have addressed the role of overregulation in AN (e.g., Lynch et al., 2013; Danner, Sternheim, & Evers, 2014), and underregulation in BN (e.g., Lavender et al., 2014), elevated emotion overregulation in BN (e.g., Anderson et al., 2018) and emotion underregulation in AN (e.g., Haynos et al., 2014) have also been reported, thus demonstrating that individuals with AN and BN may both experience the entire spectrum of emotion regulation difficulties (i.e., overregulation and underregulation; Lavender et al., 2015).

The Present Dissertation

This dissertation is comprised of two studies, both of which examined the relationships between difficulties with emotion regulation, disordered eating, and body weight regulation. Study one presents the results of a study of a treatment-seeking sample of individuals with AN. Specifically, this study examined the nature and extent of difficulties with emotion regulation in AN at the time of admission to specialized inpatient treatment program with a particular focus on: 1) changes in difficulties with emotion regulation during intensive treatment for AN; and 2) the relationship between improvements in difficulties with emotion regulation and improvements in eating disorder psychopathology in AN. Study two presents the results of a study of a community sample of individuals who were obese and, within four weeks prior to the study, had lost at least 5% of their body weight. Specifically, this study examined the nature and extent of the participants' difficulties with emotion regulation with a particular focus on: 1) the association between difficulties with emotion regulation, emotional eating and weight regain over a 12-month period; and 2) the relationship between difficulties with emotion regulation, binge eating behavior and weight regain.

Study 1: Emotion Regulation Difficulties in Anorexia Nervosa: Associations with Improvements in Eating Psychopathology

Anorexia Nervosa

Anorexia Nervosa (AN) is a psychological disorder characterized by an intense drive for thinness combined with an associated restriction of food intake leading to a significantly low body weight (American Psychiatric Association [APA], 2013). Individuals with AN are extremely fearful of gaining weight and often perceive themselves to be much larger than they are in reality (APA, 2013). Due to inaccurate perceptions of their own weight and shape, individuals with this disorder often deny the presence or seriousness of their problem, and thus rarely seek out treatment on their own accord (Keski-Rahkonen et al., 2007).

Research has identified two subtypes of AN: the binge/purge (AN-BP) subtype and the restricting (AN-R) subtype. While both subtypes of AN are characterized by an intense drive for thinness and a fear of weight gain, they differ with respect to the strategies each uses to maintain a significantly low body weight. While individuals with the AN-R subtype maintain weight loss exclusively through the use of exercise and food restriction, individuals with the AN-BP subtype maintain weight loss through a combination of food restriction, exercise and compensatory mechanisms such as purging or laxative misuse, and they may engage in episodes of binge eating.

Most of the research on AN has demonstrated that it has a lifetime prevalence rate of approximately .5% (e.g., Hudson, Hiripi, Pope, & Kessler, 2007) indicating that it is not a commonly occurring disorder, particularly compared to many other mental disorders such as anxiety and depressive disorders (Kessler, Petukhova, Sampson, Zaslavsky, &

Wittchen, 2012). However, recent research has reported higher lifetime prevalence rates of approximately 2.00% (Keski-Rahkonen et al., 2007) suggesting that rates of the disorder may be increasing. Corroborating this notion are research findings by several groups of researchers showing increased rates of AN among youth and young adults since the 1930s (Lucas, Beard, O'Fallon, & Kurland, 1991; van Son, van Hoeken, Bartelds, van Furth, & Hoek, 2006). Nevertheless, these results may be interpreted in varying ways; that is, rather than lifetime prevalence rates of AN increasing over time, researchers and clinicians may simply be getting better at detecting cases of the disorder in the population.

Researchers have found that there is no one "cause" of AN but that there are a multitude of factors that increase an individual's risk of developing the disorder. Indeed, the etiology of AN comprises genetic/biological, psychosocial, and sociocultural factors (Le Grange, 2016).

Biological risk factors.

With respect to biological risk factors for AN, results of family and twin studies have demonstrated that genetics play a significant role in the development of AN. Specifically, individuals are at an increased risk of developing AN if they have a family member with AN (Machado, Gonçalves, Martins, Hoek, & Machado, 2014). Likewise, the rate of AN among identical twins is significantly higher than the rate of AN among fraternal twins (Holland, Sicotte & Treasure, 1988), thus further supporting a genetic influence.

Through the use of such technologies as positron emission tomography (PET) and magnetic resonance imaging (MRI), researchers have been able to illuminate a neuropathology related to AN. Specifically, researchers have demonstrated that regional

grey matter volume is significantly lower in the brains of individuals with AN than in

individuals without the disorder (Friederich et al., 2012; Suchan et al., 2010). Similarly,

although less consistently supported, neurobiological evidence has linked AN with

reductions in white matter volume (Bomba et al., 2015), increased cerebrospinal fluid

(CSF) volume (Bomba et al., 2015; Castro-Fornieles et al., 2009), and irregularities in the

cortico-limbo-striatal system including the anterior cingulate cortex and the thalamus

(Frank et al., 2012; Kaye et al., 2013). Furthermore, AN is associated with dysregulations

in neurotransmitters such as dopamine (DA) and serotonin (5-TH), both of which are

involved in regulating appetite, eating, and impulse control (Daw et al., 2002).

Psychosocial risk factors.

Researchers have also linked AN to various psychosocial risk factors. Specifically,

perfectionism (Fairburn, Cooper, Doll, & Welch, 1999; Machado et al., 2014), low self-

esteem (Fairburn et al., 1999; Halmi et al., 2000), and mood intolerance (Fairburn,

Cooper, & Shafran, 2003) have all been associated with the development and

maintenance of AN. Additional psychological factors that have been linked with the

development and maintenance of AN include obsessive-compulsive traits, interpersonal

difficulties, and positive beliefs about the value of the illness (Schmidt & Treasure, 2006;

Treasure & Schmidt, 2013). Furthermore, higher rates of AN have been found among

individuals who have experienced a history of childhood abuse or trauma, with a

particularly robust association between sexual abuse and AN (Reyes-Rodríguez et al.,

2011; Thompson & Wonderlich, 2004). Specifically, researchers have estimated that

approximately 47% of individuals with AN have a comorbid diagnosis of post-traumatic

stress disorder (PTSD) (Gleaves, Eberenz, & May, 1998), with approximately 64% of

participants reporting that the first traumatic event occurred prior to the onset of AN (Reyes-Rodríguez et al., 2011). Moreover, family environments characterized by over-protection (Taborelli et al, 2012) and high levels of conflict avoidance (Dare, Le Grange, Eisler, & Rutherford, 1994) have been shown to increase an individual's risk of developing AN. However, more recently researchers have conceptualized impairments in family functioning (e.g., over-protection) as a consequence of AN as opposed to a risk factor (Eisler, 2005).

Sociocultural risk factors.

Finally, sociocultural factors have also been linked with the development and maintenance of AN. Specifically, some studies have supported a cultural view of AN, arguing that individuals living in the Western world and being of a Caucasian descent are at greater risk of developing AN (Thompson-Brenner, Boisseau, & St. Paul, 2011). Proponents of this theory argue that societies that promote a 'thin ideal' place individuals at a greater risk of experiencing body dissatisfaction and engaging in dieting and other forms of restrictive eating. Advocates of this theory propose that appearance-related beliefs of peers, parents, and the media are of particular importance in influencing an individual's own appearance-related beliefs (Keery, van den Berg & Thompson, 2004). However, while some research has supported a cultural view of AN, findings from other studies have not supported this perspective. For example, Hoek, van Harten, van Hoeken and Susser (1998) found a comparable rate of AN in a sample of participants living in the Caribbean as the rate of AN found in samples of participants living in Western countries. Thus, it is not clear to what extent cultural factors influence the development of AN.

AN is also highly dependent on sex, as it is found approximately eight times more frequently in females than males (Hudson et al., 2007). Research has shown that the large majority of individuals with AN are adolescents and young adults, with the disorder having a mean age of onset of 18.9, and with very few cases beginning after age 27 years (Hudson et al., 2007). Additional risk factors that have been identified for the development of AN include childhood anxiety (Bulik, Sullivan, Fear, & Joyce, 1997; Meier et al., 2015), childhood negative affect (Stice, Gau, Rohde, & Shaw, 2017) and being bullied or teased as a child (Copeland et al., 2015), including being teased about one's weight and shape (Agras, 2003).

With a mortality rate of 5.9% per decade (Sullivan, 1995), AN has the highest mortality rate of all mental disorders (Steinhausen, 2002). The high mortality rate associated with this disorder is due, at least in part, to the individual's inaccurate perceptions of body size and beliefs that they do not have a problem which, in turn, inhibits the individual from seeking treatment (Keski-Rahkonen et al., 2007). In addition, the disorder is associated with a host of serious physical and medical complications including cardiac abnormalities (Winston & Stafford, 2000), anemia (Hütter, Ganepola, & Hofmann, 2009), electrolyte imbalances (Turner & Shapiro, 1992), renal failure (Takakura et al., 2006), as well as bone density loss and osteoporosis (Mehler, Cleary, & Gaudiani, 2011), all of which are implicated in the disorder's high mortality rate. Moreover, AN is associated with serious impairments in social and occupational functioning and significant deficits in quality of life (Tchanturia et al., 2013).

Despite its negative consequences, AN is a disorder that demonstrates resistance to treatment in many individuals (Hay, Touyz, & Sud, 2012), as well as a high rate of

relapse (Woodside, Carter, & Blackmore, 2004). Specifically, one review reported treatment recovery in approximately 46% of individuals treated and assessed at long-term follow-up (Steinhausen, 2002). In this review, 20% of participants developed a chronic disorder and 5% died from complications related to the disorder (Steinhausen, 2002). Finally, AN is associated with a significantly higher suicide rate than observed in the general public (Bulik et al., 2008), due largely to the significant emotional and social costs associated with the disorder. Overall, due to the deleterious effects of AN that exist across the spectrum of functioning (e.g., interpersonal, cognitive, physical, and emotional effects), combined with the limited treatment effectiveness of first-line treatment options for AN, there is a need for further research on the causes of and treatments for the disorder.

The Emotion Regulation Theory of Anorexia Nervosa

In her seminal writings, Bruch (1973, 1982) asserted that problems with emotion regulation, particularly difficulties differentiating and describing emotions, are the core deficit in AN. Recently, a growing body of theoretical and empirical evidence suggests that emotion regulation deficits may play a key role in both the development and maintenance of AN (Engel et al., 2013; Harrison, Sullivan, Tchanturia, & Treasure, 2010; Racine & Wildes, 2014; Schmidt & Treasure, 2006; Treasure & Schmidt, 2013). Indeed, several authors have theorized that AN *is* a disorder of emotion regulation and that the symptoms of AN, such as dietary restriction, excessive exercise, and binge/purge behaviors, represent maladaptive attempts to regulate aversive emotional states (Corstorphine, 2006; Fox, 2009; Wildes, Ringham, & Marcus, 2010). Examined from the perspective of the modal model of emotion regulation (Gross, 2015), behaviours such as

extreme dietary restriction, excessive exercising, and binging and purging can be viewed as a form of maladaptive response modulation.

In a recent review article, Lavender and colleagues (2015) examined the research evidence for applying Gratz and Roemer's (2004) multidimensional model of emotion dysregulation in conceptualizing emotion regulation difficulties in AN. This review uncovered the following findings: considerable evidence to support the application of this model to AN including evidence of broad deficits in adaptive emotion regulation skills in AN; some evidence of impulse control and distress tolerance difficulties in AN; substantial evidence of emotion awareness deficits in AN; and some evidence of emotional avoidance in AN.

Indeed, substantial evidence suggests that difficulties with emotion regulation are associated with eating disorder psychopathology (Haynos, & Fruzzetti, 2011; Treasure & Schmidt, 2013). In a recent meta-analysis, lack of adaptive emotion regulation strategies – particularly deficits in problem-solving skills, and greater use of avoidance, rumination and suppression – was associated with greater eating disorder psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Further, there is evidence that characteristic anxious avoidance, both of emotions and of interpersonal situations that may trigger emotional experiences in AN, often predates the illness and persists after recovery (Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007; Schmidt & Treasure, 2006; Troop, Holbrey, Trowler, & Treasure, 1994).

Several recent studies have found evidence that emotion regulation difficulties may also play a central role in the maintenance of AN. Acute AN is associated with high vulnerability to dysregulated emotions including impaired abilities to experience and

differentiate emotions, as well as difficulties with the attenuation and modulation of negative emotional states (Brockmeyer, Bents, et al., 2012; Brockmeyer, Holtforth, et al., 2012; Harrison, Sullivan, Tchanturia, & Treasure, 2009). In addition, several studies have found evidence of distress intolerance in AN; that is, the inability to accept and withstand negative emotional experiences (Corstorphine et al., 2007; Harrison et al., 2010). As observed by Lynch and colleagues (2013), emotional overcontrol has been linked with social withdrawal, cognitive rigidity, reward insensitivity, strong needs for structure and symmetry, and clinical perfectionism – traits which have been shown to be common among individuals with AN, and which may function to perpetuate the disorder (Cassin & von Ranson, 2005; Shafran, Cooper, & Fairburn, 2002; Treasure & Schmidt, 2013).

Emotion regulation in AN-BP and AN-R.

Studies that have examined differences in emotion regulation deficits between the two subtypes of AN have produced mixed results. In the AN-BP subtype, difficulties with emotion regulation tend to be characterized by impulsivity and difficulties inhibiting maladaptive behavior when experiencing negative emotions (Fischer, Smith, & Cyders, 2008). Similarly, negative emotions have been shown to be a strong proximal trigger for binge eating and purging episodes in AN-BP (Engel et al., 2005). Conversely, in the AN-R subtype, emotion regulation deficits tend to be characterized by emotional overcontrol, such as emotional inhibition and lack of emotion expression (Geller, Cockell, Hewitt, Goldner, & Flett, 2000).

In their study of inpatients with AN, Racine and Wildes (2013) examined whether specific aspects of the psychopathology of acute AN were uniquely associated with particular types of emotion regulation difficulties. They found that, impulse control

difficulties predicted unique variance in both binge eating and purging behaviors, over and above the effects of duration of illness, and depression and anxiety symptoms, respectively. Additionally, limited emotional awareness uniquely predicted the severity of eating disorder cognitions over and above duration of illness, and depression and anxiety symptoms. In another study of inpatients with AN, only one difference was found between patients with AN-R and AN-BP: AN-BP patients had higher impulsivity scores compared to those with AN-R (Haynos, Roberto, Martinez, Attia, & Fruzzetti, 2014). This finding was replicated by Mallorquí-Bagué and colleagues (2018) who found that their sample of patients with AN-BP had greater difficulties with impulse control and greater overall difficulties in emotion regulation when compared to their sample of patients with AN-R. Similarly, in their study of adolescent patients with AN, Weinbach, Sher, and Bohon (2017) found that individuals with AN-BP reported greater difficulties with impulse control, as well as greater deficits in goal-directed behavior and access to emotion regulation strategies, when compared to individuals with AN-R. Thus, it appears that while individuals with AN-R may have difficulty with emotional overregulation, individuals with AN-BP may struggle with emotional underregulation. Further research is needed to clarify differences between the two subtypes with respect to emotion regulation deficits since this may have important treatment implications.

Emotion regulation and weight restoration in AN.

While the presence of emotion dysregulation in AN may suggest that emotion dysregulation is involved in the development of AN (i.e., emotion dysregulation precedes AN), it is also possible that AN symptomatology (e.g., starvation, purging) increases susceptibility to emotion dysregulation (i.e., AN precedes emotion dysregulation). Indeed,

as far back as the 1944 Minnesota Starvation Experiment, researchers have demonstrated that starvation can induce emotional distress and self-injurious behavior in individuals who, at study baseline, lacked the drive for thinness and body misperceptions characteristic of individuals with AN (Franklin, Schiele, Brozek, & Keys, 1948). More recent research has shown that extreme caloric restriction can lead to a reduction in serotonin receptor functioning, likely contributing to feelings of low mood and irritability (Cowen, Anderson, & Fairburn, 1992). Similarly, though proximally related to reductions in negative emotions, certain symptoms of AN (e.g., binging and purging in AN-BP) are associated with feelings of shame in the longer term (Goss & Gilbert, 2002). Thus, these symptoms may create a vulnerability to emotion dysregulation through the formation of a shame-shame cycle wherein individuals engage in behaviors that both reduce feelings of shame (in the short-term) and elicit shame (in the longer-term) (Goss & Gilbert, 2002).

To elucidate the relationship between emotion dysregulation and AN symptoms, Racine and Wildes (2014) conducted a one-year longitudinal study of AN patients following treatment discharge. Using dynamic latent change scores, they revealed that emotion dysregulation at post-treatment predicted AN symptom severity at 12 months follow-up. Conversely, AN symptom severity at post-treatment did not significantly predict emotion dysregulation at 12 month follow-up. These results show that emotion dysregulation is implicated in the maintenance of AN symptoms while AN symptoms are not implicated in the maintenance of emotion dysregulation. Thus, their results suggest that emotion dysregulation precedes AN as opposed to the reverse. However, it is important to note that, to know for certain whether emotion dysregulation precedes the onset of AN (rather than AN preceding the development of emotion dysregulation),

individuals would have to be assessed and examined prior to the development of AN. To date, this has not been studied.

Like Racine and Wildes (2014), Haynos and colleagues (2014) and Ben-Porath, Federici, Wisniewski, and Warren (2014), were also interested in elucidating the relationship between emotion dysregulation and AN. As such, these two research teams conducted the only two studies to date to examine the association between weight restoration and emotion regulation in AN and found mixed results. In their study, Haynos and colleagues (2014) found that emotion dysregulation did not improve with weight restoration through specialized inpatient treatment consisting of individual and group therapy without a specific focus on emotion regulation. Conversely, Ben-Porath, and colleagues (2014) found that emotion dysregulation *did* improve with weight restoration through a specialized day treatment program including two hours of dialectical behavioral therapy (DBT) per week.

It is important to note that there are several apparent differences between Haynos and colleagues' (2014) study and Ben-Porath and colleagues' (2014) study that may account for the discrepancy in their findings. Most notably, while Haynos and colleagues (2014) recruited individuals diagnosed exclusively with AN, Ben-Porath and colleagues (2014) recruited individuals diagnosed with either AN or BN. As such, the mean admission BMI was greater in Ben-Porath and colleagues' study and not all participants in this study were underweight, making it difficult to compare findings from the two studies. Furthermore, when conducting their analyses, Ben-Porath and colleagues (2014) did not control for the influence of weight gain on changes in emotion dysregulation across treatment. As such, they were unable to extricate potential psychotherapeutic

effects from potential effects of weight gain on emotion regulation. Conversely, Haynos and colleagues (2014) focused exclusively on the influence of weight gain on changes in emotion regulation without exploring the role of psychotherapeutic treatment.

The Present Study

Additional research is necessary to elucidate the nature of the relationships between weight restoration, improvement in eating disorder psychopathology, and changes in emotion regulation difficulties. To date, a prospective evaluation of changes in emotion regulation across psychotherapeutic treatment in an exclusively AN sample, while controlling for the effects of weight gain, has not been conducted. Specifically, while it is possible that the discrepancy between the findings of Ben-Porath (2014) and Haynos (2014) is due to methodological differences between the studies (e.g., participant factors), it is also possible that the difference may allude to the importance of extricating psychotherapeutic effects from the effects of weight restoration. Ben-Porath's (2014) significant findings, combined with Haynos' (2014) null findings, may suggest that implementing DBT techniques is necessary to improving emotion regulation skills during treatment for AN.

Psychological science has recently shown a renewed interest in the area of study replication. Indeed, researchers have coined replication "the cornerstone of science" (Moonsinghe, Khoury, & Janssens, 2007), highlighting its importance in determining whether any given finding is a false positive or the result of sampling error or non-generalizable sample specific features (Maxwell et al., 2015; Moonsinghe et al., 2007). As such, the current study aimed to replicate and extend the research to date on

difficulties with emotion regulation in AN. This study has been published in the Journal of Eating Disorders (Rowsell, Macdonald & Carter, 2016).

Study aims.

This study had three aims. The first aim was to replicate previous research by comparing patients with AN-R and AN-BP in terms of the nature and extent of difficulties with emotion regulation at the time of admission to intensive treatment using the Difficulties in Emotion Regulation Scale (DERS) based on Gratz and Roemer's multidimensional model of emotion regulation and dysregulation. Given previous findings indicating greater impulsivity and more difficulties inhibiting maladaptive behaviors when experiencing negative emotions in AN-BP, it was hypothesized that individuals with AN-BP would report greater difficulties with emotion regulation overall, as well as greater difficulties with impulse control in particular. Because emotional overcontrol and associated traits are common in AN-R, it was hypothesized that patients with the AN-R subtype would have greater difficulties with lack of emotion awareness and non-acceptance of emotions than those with AN-BP.

The second aim of this study was to replicate and extend the work of Haynos and colleagues (2014), and Ben-Porath and colleagues (2014), by examining whether difficulties with emotion regulation changed during intensive eating disorder treatment among those who successfully completed the program. As mentioned previously, Ben-Porath and colleagues (2014) did not control for the influence of weight gain on changes in emotion dysregulation during treatment while Haynos and colleagues (2014) exclusively examined the role of weight gain on changes in emotion dysregulation. This study aimed to extend this research by examining the influence of weight gain on emotion

regulation skills in the context of the influence of psychotherapy (i.e., cognitive behavioural and DBT skills training). Thus, given the element of emotion regulation skills treatment in this program, the effects of weight gain across treatment were controlled to clarify the separate influences of weight gain and psychological treatment effects. It was hypothesized that, even after controlling for the effects of weight gain across treatment, the overall level of difficulties with emotion regulation would improve from pre-treatment to post-treatment. An additional exploratory aim was to examine whether there were improvements in the specific facets of emotion regulation difficulties measured by the DERS: awareness and clarity of emotions; emotion acceptance; ability to engage in goal-directed behaviors while experiencing negative emotions; tendency to engage in impulsive behaviors when upset; and access to emotion regulation strategies.

The final aim of this study was to examine whether changes in the various facets of emotion regulation difficulties were associated with changes in eating disorder psychopathology during treatment, after controlling for baseline negative affect and weight gain during treatment. Given previous findings suggesting that specific aspects of the psychopathology of AN are uniquely associated with particular types of emotion regulation difficulties, it was hypothesized that greater improvements in emotion regulation would be associated with greater improvements in eating disorder psychopathology, even after controlling for the effects of baseline negative affect and weight gain during treatment.

Method

Participants and Treatment

The present study was a secondary analysis of program evaluation data collected in the inpatient/day treatment unit of the Eating Disorders Program at the Toronto General Hospital. The data were collected between 2010 and 2014. The participants were 108 consecutive patients who met *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition, Text Revision* (DSM-IV-TR) criteria for AN based on assessment using the Eating Disorder Examination (EDE) interview (APA, 2000; Fairburn & Cooper, 1993). All participants had a BMI ≤ 17.5 at admission to the program. See Table 1 for demographic and clinical characteristics of the sample. This program is a specialized hospital-based program operated by an interdisciplinary team consisting of psychiatrists, psychologists, nurses, dieticians, social workers, and occupational therapists. The program goals include medical stabilization, weight restoration, normalized eating through staff-supported meals, as well as eradication of binge eating, purging, and excessive exercise. Although the underlying orientation of the program is cognitive-behavioural, patients attend a variety of groups including interpersonal therapy, anxiety management, and DBT skills training. Once patients reach a BMI of approximately 18, they are transferred from inpatient to day attendance. For the present study, post-treatment data were available for the 53 patients who completed the inpatient/day program and achieved a BMI ≥ 19.5 as well as remission from binge/purge behaviour, defined as no more than one binge/purge episode over the previous month at discharge. This study was approved by the UHN Research Ethics Board and all participants provided written informed consent to participate.

Table 1

Demographic and clinical characteristics of the AN sample (N = 108)

Characteristic	Mean (SD) or %
Female	96.3%
Age	29.9 (10.9)
Ethnicity	
Caucasian	88.1%
Asian	3.0%
Other[a]	10.9%
Marital Status	
Single	72.6%
Married/Common-Law	22.6%
Separated/Divorced	4.7%
Employment Status	
Student	30.4%
Employed	48.1%
Unemployed	21.6%
AN Subtype	
AN-R	41.5%
AN-BP	58.5%
Pre-treatment BMI	14.9 (1.4)
Binge episodes/month Pre-Treatment (AN-BP only)	12.3 (23.1)

Vomit episodes/month Pre-Treatment (AN-BP only)	37.9 (54.9)
Laxative episodes/month Pre-Treatment (AN-BP only)	10.6 (16.5)
Duration of Illness (Years)	10.6 (9.6)
Age of Onset	19.4 (7.7)
Length of Treatment (Weeks)	14.4 (7.1)
Weight Gain During Treatment (kg)	11.5 (6.1)

[a]Other reported ethnicities include Black, West Indian, East Indian, and Hispanic.

Measures

Eating Disorder Examination – Interview (EDE; Fairburn & Cooper, 1993).
The EDE is a clinician based diagnostic interview that assesses eating disorder
psychopathology (See Appendix A). The majority of interview questions ask interviewees
about their eating behaviours and attitudes during the preceding four weeks with some
questions asking about the preceding three months. Some items are rated on a seven-point
scale (i.e., 0 – 6) with 0 indicating an absence of the feature in question and six
representing its presence to an extreme degree. Other questions ask about the frequency
with which the individual engages in a particular eating behaviour (e.g., frequency of
binge eating, self-induced vomiting, and laxative misuse). The interview is comprised of
four subscales (Shape Concern, Weight Concern, Eating Concern, and Dietary Restraint)
and takes approximately 45-75 minutes to complete. The EDE can be used to attain
descriptive information and is considered the gold standard for diagnosing eating
disorders. The EDE has good construct validity as demonstrated by strong correlations
with measures assessing similar constructs and convergence with daily food records
(Loeb, Pike, Walsh, & Wilson, 1994). Additionally, the EDE has excellent inter-rater

reliability as demonstrated by inter-rater reliability coefficients > .90 across subscales

(Rizvi, Peterson, Crow, & Agras, 2000; Rosen, Vara, Wendt, & Leitenberg, 1990).

Furthermore, the EDE has good criterion validity as demonstrated by an ability to

distinguish between eating disorder and control groups (Wilfley, Schwartz, Spurrell, &

Fairburn, 2000).

Eating Disorder Examination – Questionnaire (EDE-Q; Fairburn & Bèglin, 1994). The EDE-Q is a 36-item self-report measure of eating disorder psychopathology

(See Appendix B). This questionnaire is based directly on the EDE interview and is

comprised of four subscales (Shape Concern, Weight Concern, Eating Concern, and

Dietary Restraint) that can be combined into one Global Score of eating disorder

psychopathology ranging from 0 (low) to 6 (high). The EDE-Q also contains items

assessing the frequency of eating disorder behaviors including binge eating and purging.

The EDE-Q has demonstrated good test-retest reliability and strong internal consistency

(Luce & Crowther, 1999). Additionally, using Cohen's Kappa values, moderate to large

diagnostic agreement between the EDE and EDE-Q has been revealed (Wolk, Loeb, &

Walsh, 2005). In the current sample, Cronbach's alpha for the Global Score was $\alpha = .91$

and $\alpha = .93$ at pre-and post-treatment, respectively.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The

Difficulties in Emotion Regulation Scale (DERS) is a 36-item self-report questionnaire

that measures various aspects of emotion dysregulation (See Appendix C). The DERS

provides a total score and six subscale scores including: 1) lack of emotional clarity

(Clarity); 2) lack of emotional awareness (Awareness); 3) non-acceptance of emotional

responses (Non-acceptance); 4) impulse control difficulties (Impulse); 5) difficulties

engaging in goal directed behavior in the presence of negative emotions (Goals); and 6)

limited access to emotion regulation strategies (Strategies). Each item is rated on a 5-

point scale ranging from "almost never (0-10%)" to "almost always (91-100%)".

Reliability and validity of this instrument has been established (Fox, 2007). Specifically,

Cronbach's alpha values ranging from "acceptable" to "high" have been reported (Gross

& Roemer, 2004; Neumann, van Lier, Gratz, & Koot, 2010). Furthermore, the DERS has

good construct validity as demonstrated through strong correlations with conceptually

similar measures (i.e., measures assessing internalizing and externalizing symptoms;

Neumann et al., 2010). Good test-retest reliability has also been reported (Gratz &

Roemer, 2004; Staples & Mohlman, 2012). In the current sample, Cronbach's alpha for

the total scale was $\alpha = .96$, and for each of the six subscales it was $\alpha = .86$ (Clarity), $\alpha =$

.85 (Awareness), $\alpha = .94$ (Non-Acceptance), $\alpha = .90$ (Impulse), $\alpha = .88$ (Goals), and $\alpha =$

.92 (Strategies). At post-treatment, Cronbach's alpha for the total scale was $\alpha = .95$ and for

each of the six subscales it was $\alpha = .91$, $\alpha = .89$, $\alpha = .93$, $\alpha = .85$, $\alpha = .91$, and $\alpha = .92$

respectively.

   Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983). The Brief

Symptom Inventory (BSI) is a 53-item self-report questionnaire that assesses nine

clinically relevant psychological symptoms: 1) somatization (distress relating to

perceptions of bodily dysfunction); 2) obsessive–compulsive (distress relating to thoughts

and behaviors that are experienced as intrusive and unyielding); 3) interpersonal

sensitivity (distress relating to feelings of inferiority when comparing oneself to others);

4) depression (distress related to a dysphoric mood and affect); 5) anxiety (distress related

to symptoms of tension, and feelings of worry and panic); 6) hostility (distress related to anger-related thoughts, feelings, and actions); 7) phobic anxiety (distress related to an irrational hypervigilance towards a specific object or situation); 8) paranoid ideation (distress related to thoughts characterized by distrust and grandiosity); and 9) psychoticism (distress related to erratic thoughts and behaviors characteristic of schizophrenia). In addition, the 53 items comprising the BSI can be combined to form three global indices: 1) the General Severity Index (GSI); 2) the Positive Symptom Distress Index (PSDI); and 3) the Positive Symptom Total (PST). Each item of the BSI is rated on a 5-point likert scale ranging from "not at all distressed" (0) to "extremely distressed" (4). All nine subscales of the BSI have demonstrated strong internal consistency with Cronbach's alphas ranging from .71 (psychoticism) to .85 (depression) (Derogatis & Melisaratos, 1983). Test-retest reliability has also been established (Derogatis & Melisaratos, 1983). Furthermore, the BSI has good construct validity as demonstrated by strong correlations between the depression and anxiety subscales of the BSI and the Minnesota Multiphasic Personality Inventory (MMPI; Boulet & Boss, 1991).

In the current study, only the anxiety and depression subscales were examined as studies have indicated that these symptom dimensions are prominent in individuals with AN. The anxiety dimension includes six items. It has an internal consistency of .81 and a two week test-retest reliability score of .79 (Derogatis & Melisaratos, 1983). The depression dimension also includes six items. This dimension has an internal consistency of .85 and a two week test-retest reliability score of .84. In the current sample, Cronbach's alpha for the anxiety subscale was $\alpha = .86$ and $\alpha = .85$ at pre-and post-

treatment respectively; and Cronbach's alpha for the depression subscale was $\alpha = .88$ and $\alpha = .80$ at pre-and post-treatment respectively.

Procedure

Upon being admitted to the program, participants were assessed using the diagnostic items of the EDE interview (Fairburn & Cooper, 1993) by a trained interviewer, and objective weight and height were measured. This information was used by the program psychologist or psychiatrist for diagnosis and subtyping. Prior to beginning the program, all participants completed the EDE-Q, BSI, and the DERS. The treatment program was delivered as usual, and the EDE-Q, BSI and DERS were re-administered at the time of discharge.

Statistical Analyses

To determine whether there were any baseline differences between treatment completers and non-completers, these two groups were compared on several pre-treatment variables. Specifically, a series of independent samples *t*-tests were conducted to determine whether treatment completers and non-completers differed on: (a) emotion regulation difficulties at admission; (b) frequency of binge eating episodes, self-induced vomiting episodes, and episodes of laxative misuse at admission; and (c) BMI at admission. To reduce the distributional skewness of behavioral episodes (binge, vomit, and laxative), two univariate outliers (i.e., $z = +/- 3.29$) were identified and replaced with the next highest value in the distribution that was not an outlier (Tabachnick & Fidell, 2001). This method corrected distributional problems. Lastly, a chi square test was

conducted to examine whether completers and non-completers differed in terms of frequency of AN-subtypes.

In order to address the first aim, an analysis of variance (ANOVA) was conducted to compare the two AN subtypes (AN-R and AN-BP) on the total DERS score. Additionally, a multivariate analysis of variance (MANOVA) was conducted to compare the AN-R and AN-BP subtypes on the six DERS subscales. The overall multivariate effect, as well as the individual univariate effects, were examined.

Secondly, a mixed MANOVA was conducted for the subset of participants who completed treatment ($N = 53$) to evaluate: (a) whether difficulties in emotion regulation would significantly improve from pre-treatment to post-treatment; and (b) potential subtype by time interaction effects. Subsequently, a second mixed MANOVA was conducted to evaluate whether difficulties in emotion regulation would significantly improve from pre-to-post-treatment when controlling for the effect of weight gain during treatment. In this analysis, pre-to-post-treatment weight gain was included as a covariate.

Finally, the hypothesis that change in emotion regulation difficulties would be associated with change in eating disorder psychopathology was investigated using multiple regression analysis. For this analysis, the criterion variable was pre-to-post-treatment change in eating disorder psychopathology as measured by the Global EDE-Q score, and the predictor variables were change in each of the DERS subscales pre-to-post-treatment. Initially, a decision was made to include baseline anxiety and depression symptoms, as measured by the BSI, and weight gain during treatment, calculated as a change score, as covariates in this regression analysis. However, it was determined that change in EDE-Q Global score was not significantly related to the level of anxiety and

depression symptoms at pre-treatment ($r = .05$, $p = .72$) or to weight gain during treatment ($r = .11$, $p = .43$). As such, the analyses were conducted without controlling for these variables. First, a series of univariate regression analyses were conducted to determine whether improvement in each facet of emotion regulation was associated with improvement in eating disorder psychopathology across treatment. Based on the results of these separate univariate regressions, a stepwise multiple regression analysis was then conducted with all six DERS subscales included as potential predictors. Based on the results of this model, a second multiple regression analysis was performed, including only the predictors that provided a significant contribution to the initial stepwise model, entered together at the same step.

Results

Comparisons Between Completers and Non-Completers

With respect to potential differences between program completers and non-completers, there were no statistically significant pre-treatment differences between these two groups on difficulties engaging in goal-directed behaviour when experiencing strong emotions (i.e., DERS Goals), $t(106) = .07$, $p = .94$; difficulties inhibiting impulsive behaviours when experiencing strong emotions (i.e., DERS-Impulse), $t(106) = 1.38$, $p = .17$; difficulties in emotional awareness (i.e., DERS- Awareness), $t(106) = .07$, $p = .94$; difficulties engaging in behavioural strategies when experiencing strong emotions (i.e., DERS-Strategies), $t(106) = 1.61$, $p = .11$; difficulties in emotional clarity (i.e. DERS-Clarity), $t(106) = 1.35$, $p = .18$; and difficulties with accepting emotions (i.e., DERS-Non-acceptance), $t(106) = .62$, $p = .54$; and total, $t(106) = 1.20$, $p = .23$. Mean subscale and total

DERS scores were comparable, though somewhat higher, than previous reports of AN

samples (Haynos et al., 2014; Racine & Wildes, 2013). Furthermore, completers and non-

completers did not significantly differ in terms of pre-treatment frequency of binge

eating, $t(59) = .29$, $p = .78$, or self-induced vomiting, $t(59) = 1.15$, $p = .26$. However, non-

completers reported significantly more episodes of laxative misuse at pre-treatment than

completers, $t(59) = 2.59$, $p = .01$. Moreover, completers and non-completers did not differ

significantly in terms of AN subtype, $\chi^2 (1) = 3.60$, $p = .06$. Finally, completers and non-

completers did not significantly differ in term of pre-treatment BMI, $t(106) = -1.87$,

$p = .07$. Overall, these findings suggest that there were few meaningful differences

between completers and non-completers at the time of admission. See Table 2 for means

and standard deviations of pre-treatment variables for completers versus noncompleters.

Table 2

Means and standard deviations of baseline variables for completers (N = 72) and non-

completers (N = 36)

	Mean (SD)	
Variable	Completer	Non-Completer
DERS-Goals	18.99 (4.75)	19.06 (5.08)
DERS-Impulse	16.60 (6.64)	18.52 (7.20)
DERS-Awareness	20.97 (5.23)	21.06 (6.20)
DERS-Strategies	25.53 (8.63)	28.44 (9.31)
DERS-Clarity	16.40 (4.51)	17.72 (5.29)
DERS Non-Acceptance	20.01 (7.06)	20.94 (7.98)

DERS-Total	118.50 (26.42)	125.75 (34.91)
Binge episodes/month (AN-BP)	13.86 (30.35)	25.46 (63.79)
Vomit episodes/month (AN-BP)	33.58 (55.86)	54.58 (82.82)
Laxative episodes/month (AN-BP)	7.11 (16.00) *	24.80 (50.61) *
BMI	15.11 (1.33)	14.56 (1.54)

*Note. DERS = Difficulties in Emotion Regulation Scale; * = p < .05*

Subtype Comparisons

In accordance with the first hypothesis, results from the ANOVA indicated that there was a significant difference with respect to pre-treatment emotion regulation difficulties, as measured by the DERS total subscale, between AN-R and AN-BP subtypes, $F(1, 104) = 9.28$, $p = .003$, $R^{2} = .08$, with the AN-BP patients scoring significantly higher. Additionally, results from the MANOVA revealed significant differences in pre-treatment emotion regulation difficulties, as measured by DERS subscales, between the AN-R and AN-BP subtypes, Wilks's $\lambda = .83$, $F(6, 99) = 3.38$, $p = .004$. Examination of the univariate effects indicated that the AN-BP subtype reported significantly greater impairments with respect to the Impulse subscale, $F(1,104) = 16.63$, $p < .001$, $R^2 = .14$, and Strategies subscale, $F(1,104) = 10.48$, $p = .002$, $R^2 = .09$. This indicates that, when experiencing negative emotions, patients with the AN-BP subtype reported greater difficulties with impulse control and more limited access to adaptive emotion regulation strategies than those with the AN-R subtype. There were no significant group differences with respect to the remaining DERS subscales, ps > .05. See Table 3 for these DERS subscale scores by subtype, as well as DERS total scores.

Table 3

Means and standard deviations for the DERS subscales at baseline for AN-BP and AN-R

subtypes.

	Mean (SD)		*p*
Measure	AN-BP (*n = 62*)	AN-R (*n = 44*)	
DERS-Goals	19.52 (4.26)	18.02(5.43)	.12
DERS-Impulse	19.32(6.42)	14.18 (6.35)	< .001
DERS-Awareness	21.42 (5.19)	20.18 (6.01)	.25
DERS-Strategies	28.63 (7.46)	23.18 (9.87)	.002
DERS-Clarity	17.23 (4.18)	16.02 (5.45)	.24
DERS-Non-acceptance	21.31 (7.23)	18.55 (7.24)	.06
DERS-Total	127.42 (25.53)	110.29 (31.66)	.003

Note. DERS = Difficulties in Emotion Regulation Scale

Note. DERS Total scores were not included in the multivariate model but are provided in

the table for descriptive purposes. The p value for the total score comes from an

independent samples t test run for descriptive purposes only.

Pre-to Post Treatment Analyses

In accordance with the second hypothesis, the results from the first mixed

MANOVA showed an overall multivariate effect of time on participants' total emotion

regulation difficulties scores from pre-treatment to post-treatment, Wilks's $\lambda = .52$, $F(6,$

$46) = 7.01$, $p < .001$. Given that the multivariate effect of time on emotion regulation

difficulties was statistically significant, univariate effects were examined. The univariate

effects for time indicated significant differences for each of the DERS subscale change scores from pre-treatment to post-treatment, indicating that across subtypes, participants made significant improvements over time on all six of the DERS subscales: (1) Goals, $F(1, 51) = 4.94$, $p = .03$; (2) Impulse, $F(1, 51) = 26.50$, $p < .001$; (3) Awareness, $F(1, 51) = 16.18$, $p < .001$; (4) Strategies, $F(1, 51) = 10.06$, $p < .01$; (5) Clarity, $F(1, 51) = 15.51$, $p < .001$; and (6) Non-Acceptance, $F(1, 51) = 5.51$, $p = .02$. These results are presented in Figure 1. Additionally, the multivariate interaction effect of subtype and time was statistically significant, Wilks's $\lambda = .75$, $F(6,46) = 2.52$, $p = .03$, indicating that there were significant differences between AN-R and AN-BP in terms of degree of improvement in emotion regulation during treatment. The univariate effects indicated a significant group by time interaction on the Impulse subscale, $F(1, 51) = 13.71$, $p = .001$. Examination of the means indicated that AN-BP improved significantly more during treatment than AN-R, with respect to the ability to inhibit impulsive behaviors when experiencing intense emotions.

*$p < .01$
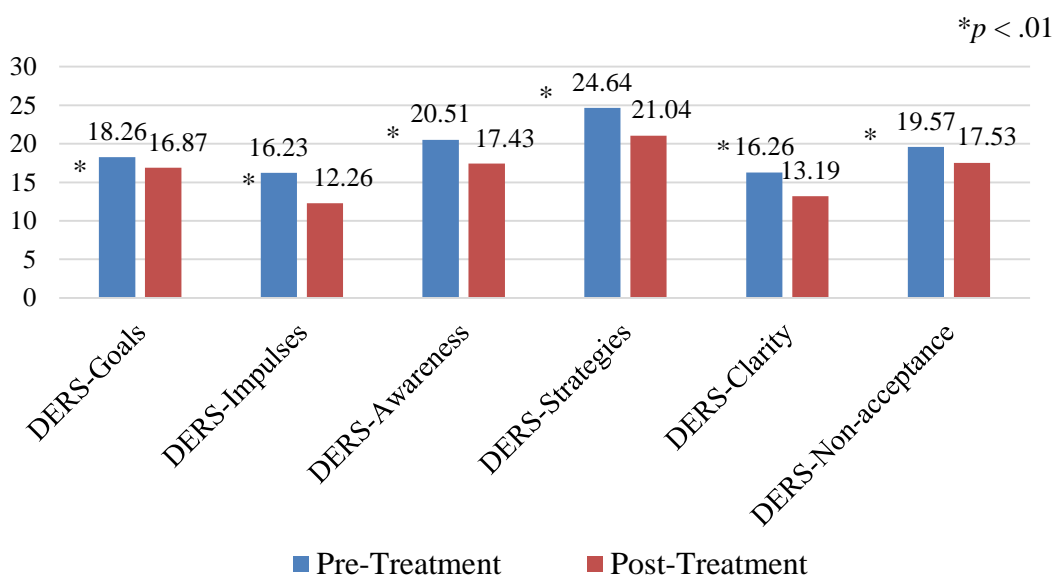
Figure 1: Means of DERS subscales from pre-to-post-treatment (N = 53)

Note. DERS = Difficulties in Emotion Regulation Scale

When pre-to-post treatment weight gain was included as a covariate in the second mixed MANOVA, there was no longer a multivariate effect of time on emotion regulation difficulties from pre-treatment to post-treatment, Wilks's $\lambda = .85$, $F(6, 45) = 1.32$, $p = .27$, indicating that across subtypes, patients did not exhibit overall improvements in emotion regulation after controlling for the effects of weight gain. However, the multivariate interaction effect of subtype by time remained statistically significant after controlling for the effects of weight gain, Wilks's $\lambda = .75$, $F(6, 45) = 2.54$, $p = .03$. In particular, this indicates that even after controlling for the effects of weight gain, a significant difference was observed between AN-R and AN-BP in terms of improvement on the Impulse subscale, $F(1,50) = 14.14$, $p < .001$. Examination of the means indicated that AN-BP improved significantly more during treatment than AN-R, with respect to inhibiting impulsive behaviors when experiencing negative emotions. There were no significant interactions for any of the other subscales.

Emotion Regulation Difficulties and Eating Psychopathology

To address the third aim of this study, a series of univariate regression models were conducted to assess whether pre-to-post-treatment change in each of the DERS subscales were predictors of change pre-to-post-treatment in eating disorder psychopathology (i.e., Global EDE-Q). Initially, plans were made to include pre-to-post-test change in weight as a covariate in these analyses; however, weight gain during treatment was not revealed as a significant predictor of improvements in eating disorder psychopathology, and therefore was not included as a covariate in these analyses.

Findings from these analyses indicated that for each DERS subscale, changes during treatment significantly predicted changes in eating disorder psychopathology across time, $ps < .05$. Next, a stepwise multiple regression analysis was conducted with all six DERS subscales included as potential predictors. As mentioned, since depression and anxiety scores were not associated with changes in EDE-Q Global score, they were not included as covariates in the following models. Results indicated that only changes in the Goals and Clarity subscales during treatment provided significant predictive contributions to the model, $ps < .05$. Accordingly, only these two subscales were included in a subsequent multiple linear regression model with the DERS Goals and Clarity subscales entered together. Overall, this model significantly predicted changes in eating disorder psychopathology during treatment, $F (2, 51) = 14.29, p < .001, R^2 = .36$ (See Table 4 for beta weights and other statistics for the individual predictors). This indicates that greater improvements during treatment with respect to emotional clarity and engagement in goal directed behaviours when upset accounted for approximately 36% of corresponding improvements in eating disorder psychopathology.

Table 4

Multiple regression model predicting improvements in EDE-Q Global score from improvements in DERS subscales during treatment (*N*= 53)

Model	Predictor	*B*	*SE*	β	*t*	*p*	*r*
1	DERS-Goals	.08	.03	.34	2.87	.006	.48
	DERS-Clarity	.08	.03	.39	3.25	.002	.51

Note. DERS = Difficulties in Emotion Regulation Scale

Discussion

This study examined difficulties with emotion regulation in a sample of patients with AN who were admitted to a specialized intensive hospital-based treatment program. The first objective was to compare the two AN subtypes (AN-BP and AN-R) in terms of emotion regulation deficits at pre-treatment. As predicted, it was found that patients with AN-BP reported greater difficulties with emotion regulation overall, and in particular with refraining from impulsive behaviors when experiencing negative emotions and accessing adaptive emotion regulation strategies. This is consistent with the findings of Fischer and colleagues (2008) who also found that the binge-purge subtype of AN was associated with greater impulse control difficulties but different from those of Haynos and colleagues (2014) who found no differences in emotion regulation difficulties between the two AN subtypes. However, it is important to note that although the AN-BP subtype reported greater difficulties refraining from impulsive behaviours when experiencing negative emotions than the AN-R subtype, difficulties with impulse control were still elevated among the AN-R subtype when compared to non-clinical samples (e.g., Gratz & Roemer, 2004). This suggests that this is still an area of concern for this population, even though it is not as pronounced as for AN-BP. Furthermore, contrary to predictions, patients with the AN-R subtype did not report greater difficulties with emotion awareness or non-acceptance of emotions compared to those with the AN-BP subtype. Instead, these emotion regulation difficulties appear to be equally common in both subtypes. This indicates individuals with both subtypes of AN struggle with a broad range of emotion regulation deficits with respect to understanding, accepting, and effectively managing their emotions. Greater difficulties with impulse control in AN-BP patients may reflect

the fact that by definition they are more likely to engage in impulsive and uncontrolled behaviors while under distress (i.e., binge eating and/or purging behaviour) as part of their disorder, whereas individuals with AN-R typically do not. Thus, although both groups experience significant difficulties with emotion dysregulation, these effects were particularly pronounced for patients with AN-BP, suggesting that this group may in fact be particularly impaired.

The second objective of this study was to examine whether emotion regulation difficulties improved during treatment among those who successfully completed the program. In contrast to the findings of Haynos and colleagues (2014), but in line with the findings of Ben-Porath and colleagues (2014) and consistent with the current predictions, patients with both AN subtypes made improvements with respect to all facets of emotion regulation from pre-treatment to post-treatment in this study. Although both groups made significant improvements during treatment, AN-BP patients made more pronounced improvements during treatment on impulse control, compared to AN-R patients. This may reflect the fact that AN-BP patients had higher pre-treatment difficulties with impulse control, therefore leaving them with greater room for improvement during treatment. Nevertheless, patients who completed treatment experienced improvements overall in their ability to use strategies to regulate their emotions, to more effectively inhibit impulsive behaviours, and to remain goal directed while under distress, and improved in their awareness of emotions, acceptance of emotions, and ability to differentiate between emotions.

After controlling for the effects of weight gain on pre-to-post treatment changes in emotion regulation difficulties, improvements in emotion regulation skills overall were no

longer statistically significant. However, the multivariate interaction remained significant, indicating that even after controlling for the effects of weight regain, the AN-BP group continued to experience greater improvements in impulse control compared to AN-R patients. The fact that pre-to-post treatment improvements in emotion regulation overall were no longer observed after controlling for the effect of weight gain may suggest that weight restoration improves emotion regulation difficulties independent of the effects of psychological therapy. However, this conceptualization is inconsistent with the results of Haynos and colleagues (2014) who found no improvement in emotion regulation skills following weight restoration. One possibility for these seemingly inconsistent findings is that weight restoration and emotion regulation skills training may work together to improve emotion regulation skills in individuals with AN. Treatment programs in both the current study and Ben-Porath and colleagues' (2014) study involved a substantial focus on psychological interventions including group DBT skills training. This approach is unique from the treatment program in Haynos and colleagues' (2014) study, which did not have an explicit emotion regulation focus. These between-study differences in treatment programs may explain why Haynos and colleagues (2014) did not observe emotion regulation improvements following weight restoration, whereas the present study and Ben-Porath and colleagues' study (2014) did show that emotion regulation improved following weight restoration. Unfortunately, a limitation of the current study is that there was no comparison treatment condition and therefore no way of knowing for certain whether the observed changes were due to differences in treatment programs or to other factors such as improved nutrition and weight status. Of note, since EDE-Q and DERS

data were not available for patients who dropped out of treatment or were discharged prematurely, these finding only apply to treatment completers.

The final objective of the current study was to examine whether changes in difficulties with emotion regulation predicted changes in eating disorder psychopathology during treatment. It was found that improvements in the ability to differentiate emotions, and the ability to remain goal-directed when experiencing negative emotions predicted improvements in eating disorder psychopathology from pre-treatment to post-treatment. These findings are consistent with recent research by Racine and Wildes (2013) who found that emotion regulation deficits predicted AN symptom severity over the year following intensive treatment. It is possible that eating disorder symptoms reduce emotional clarity, and with improvement to eating disorder psychopathology this emotional clarity also improves. Alternatively, it is possible that as individuals learn to identify and differentiate their emotions, they are better able to cope with them rather than engaging in eating disorder behaviours. Additionally, it is likely that during treatment, individuals learn strategies to inhibit urges and remain goal directed even while under distress, which may result in improvements both to emotion regulation and to eating disorder psychopathology. Although it cannot be determined from this study whether improvements in emotion regulation result in improved eating disorder psychopathology or vice versa, or whether in fact the treatment exerts separate but concurrent effects on both sets of problems, this finding demonstrates that changes in both variables are associated.

Taken together, the findings of this study suggest that while weight restoration may play an important role in the treatment of AN, individuals who make more

substantial improvements in a range of emotion regulation skills during treatment are also more likely to make improvements to their eating disorder psychopathology, and that this latter relationship appears to occur independently from weight regain. While causal conclusions cannot be drawn about the observed associations, the findings suggest that recovery from AN may be related to: 1) an initial focus on weight restoration; and 2) a subsequent emphasis on emotion regulation skills training.

Study Limitations

The current study had a number of limitations. First, self-report questionnaire measures were used to assess eating disorder behaviors. Previous research has shown that self-report questionnaires are somewhat less reliable than interview measures of these symptoms (Carter, Aime, & Mills, 2001) suggesting that future research may benefit from a replication of this study employing interview measures of eating disorder behaviors. Second, post-treatment DERS and EDE-Q data were available for treatment completers only. Although there were minimal pre-treatment differences between completers and non-completers, it is possible that the results might have been different if non-completers were included in the analyses. Third, this was a correlational study and it is therefore important to be cautious about interpreting the results. Specifically, it is not possible to conclude that improvements in emotion regulation played a causal role in determining the level of improvement in eating disorder psychopathology. Fourth, there were no follow-up assessments of patients beyond the discharge assessment and therefore it is not clear whether the relationships that were observed persisted after treatment. Finally, this study was conducted using a sample of patients with AN attending an inpatient treatment program who are likely to represent more severe cases thereby limiting the

generalizability of the findings. It will be important to investigate in future studies whether the observed relationships hold true in a less severely ill sample, such as individuals receiving outpatient treatment in the community.

Study Implications

The present findings have a number of potential clinical implications. Some authors have argued that existing treatments for AN have paid insufficient attention to the issue of emotion dysregulation, particularly the ability to tolerate and effectively regulate emotions, and that this may partially explain the lack of effective treatments for adult AN (Haynos & Fruzetti, 2011; Lynch et al., 2013). To date, treatments designed to improve emotion regulation skills, such as DBT, have been tested almost exclusively in eating disorder patients with BN and binge eating disorder (Safer, Robinson, & Jo, 2010; Safer, Telch, & Agras, 2001; Telch, Agras, & Linehan, 2001). Interventions to target emotional over-control typical in AN has received almost no research attention (Lynch et al., 2013). The present findings suggest that increasing emotion awareness and improving the ability to tolerate distress and engage in adaptive behaviors when distressed is an important part of overcoming AN. Racine and Wildes (2013) have found evidence that improvements in emotion regulation are likely to have a positive impact on the longitudinal course of AN. The present results support this hypothesis and suggest that both weight restoration and improvements in emotion regulation are important targets of treatment in AN. In future research, it will be important to examine in randomized controlled studies whether integrating emotion regulation skills training into existing treatments for AN improves treatment outcome.

Study 2: Are Emotion Regulation Difficulties Associated with Binge Eating and

Weight Regain in Obesity?

Obesity

Obesity is a complex medical condition defined as having a body mass index (BMI) of at least 30 kg/m^2 (World Health Organization [WHO], 2003). Researchers have found that approximately 20% of Canadians currently meet the criteria for obesity (Statistics Canada, 2014), and that obesity affects 1.4 billion adults worldwide (WHO, 2003). The Public Health Agency of Canada (PHAC) and the Canadian Institute for Health Information (CIHI) issued a joint report that identified obesity as a major public health issue in Canada (PHAC, & CIHI, 2011). The report indicated that the prevalence of obesity in Canada almost doubled between 1978 and 2009; in 1978, approximately 14% of Canadian adults were considered obese and by 2009, approximately 25% of Canadian adults were considered obese (PHAC, & CIHI, 2011). Newfoundland and Labrador displayed the highest rate of obesity among the provinces and territories at 25.4%, while British Columbia displayed the lowest rate at approximately 12% (PHAC, & CIHI, 2011).

Obesity results from a long-term energy imbalance between calorie consumption and energy expenditure; excess energy is stored as body fat (Shields & Tjepkema, 2006). There is no one "cause" of obesity but rather several genetic/biological, psychological, and sociocultural factors work together to increase an individual's risk of becoming obese.

Biological risk factors.

With respect to biological risk factors for obesity, genetic variants have been found (Wang, Zuo, Pan, Xie, & Luo, 2015). Specifically, the LEP, LEPR, MC4R, and

PMOC genes have been shown to account for approximately 5-10% of cases of obesity

(O'Rahilly & Farooqi, 2008), with some of these gene variants demonstrating

associations with an increased intake of high energy foods (e.g., Stutzmann et al., 2009).

Additional research has demonstrated that genes implicated in dopaminergic and

serotonergic functioning may also be associated with obesity (Spitz et al., 2000). In

addition to genetic influences, researchers have shown that high levels of stress can

dysregulate the body's homeostasis and create metabolic dysfunction therein placing an

individual at risk for obesity. Stress can also increase the body's level of Ghrelin, a

hormone that promotes appetite, and consequently can heighten one's susceptibility to

obesity (Sinha & Jastreboff, 2013). Further, evidence has demonstrated that the quality

and quantity of nutrition received in the fetus can create a susceptibility to obesity in later

life (Lillycrop & Burdge, 2011).

Neel's (1962; 2009) Thrifty Gene Hypotheses purports that, from an evolutionary

perspective, humans have long been exposed to periods of feast or famine. Thus, from

this perspective, individuals with additional fat stores should have a higher chance of

survival and a greater probability of producing offspring. Proponents of this theory argue

that the genes responsible for the expression of the additional fat stores were selected for,

thereby increasing humanity's overall rate of survival. In today's society, however, where

famine is increasingly rare and an excess of high calorie, high palatable food is available,

this same evolutionary feature (i.e., a large number of fat stores) has become less adaptive.

Evidence for the thrifty gene hypothesis is mixed, with some researchers citing the link

between genetic polymorphisms and a predisposition to obesity as support for the theory

(Loos, 2009) and other researchers proposing criticisms (e.g., the heterogeneity of obesity) of the theory (Speakman, 2008).

Sociocultural risk factors.

Sociocultural risk factors for obesity have also been found. Specifically, food insecurity (i.e., limited access to a sufficient quantity of food for a healthy, active lifestyle) has demonstrated a strong correlation with obesity status (Adams, Grummer-Strawn, & Chavez, 2003; Emery et al., 2015; Martin & Ferris, 2007). Moreover, in two separate systematic reviews, comprised of both cross-sectional and longitudinal studies, a negative correlation between education and obesity was found (McLaren, 2007; Sobal & Stunkard, 1989). These findings suggest that fewer years of education and insufficient food resources are two important risk factors for obesity. Additionally, in a 50-year prospective longitudinal birth cohort study, researchers found that being bullied in childhood was a significant risk factor for being obese in adulthood (Takizawa, Danese, Maughan, & Arseneault, 2015).

Obesity researchers Wadden, Brownell, and Foster (2002) propose that, while genes certainly influence obesity, a "toxic environment" lies at the foundation of the obesity epidemic. Specifically, they argue that social and cultural forces encourage a diet that is energy-dense (Wadden et al., 2002). Furthermore, they propose that a combination of increased portion sizes, pervasive food advertising, and limited nutritious food options across several locations (e.g., school cafeterias, gas stations) have contributed greatly to the etiology and maintenance of obesity. Accordingly, they identify public policy choices as crucial to both the cause and the cure of the obesity epidemic.

Psychological risk factors.

Finally, with respect to psychological factors associated with obesity, a history of childhood sexual abuse (Alvarez, Pavao, Baumrind, & Kimerling, 2007; Aaron & Hughes, 2007), greater self-reported depressive symptomatology (Emery et al., 2015), and lower rates of self-esteem (Emery et al., 2015), have all been associated with adult obesity. Furthermore, results from a 10-year prospective longitudinal study revealed that body dissatisfaction and drive for thinness, perfectionism, and emotional eating at age nine significantly predicted the onset of obesity at age 19 (Rehkopf, Laraia, Segal, Braithwaite, & Epel, 2011).

Interacting factors.

Psychological and sociocultural factors can also interact to increase an individual's probability of becoming obese. For example, in one systematic review of risk factors for obesity, researchers found that maternal depressive symptomatology was a strong risk factor for offspring obesity in low SES families, while a permissive parenting style was a strong risk factor for offspring obesity in high SES families (Mech, Hooley, Skouteris, & Williams, 2016). Similarly, biological and sociocultural factors may interact to increase an individual's probability of becoming obese. For example, results from a Canadian research study revealed an important role of sex and socioeconomic status in obesity. Specifically, researchers found a *positive* association between obesity and income in males, and a *negative* association between obesity and income in females. These findings suggest that earning a higher income may be a risk factor for obesity in males while earning a lower income may be a risk factor for obesity in females. Taken together, these results demonstrate the complexity of obesity and point to its multifaceted origins.

Obesity and Health

Obesity is associated with several negative health complications. These include physical complications such as hypertension, cardiovascular disease, type two diabetes, cancer, osteoporosis, and stroke (Horton, 1990; Klein et al., 2004; Nock, Thompson, Tucker, Berger, & Li, 2008; Reilly & Kelly, 2011; Zhou, Liu, Chen, & Liu, 2014). In addition, obesity has also been linked with mental health concerns and cognitive decline (Cournot et al., 2006). Specifically, researchers have found associations between obesity and cognitive decline at five-year follow-up, even after controlling for possible confounding variables such as age, sex, education level, and various medical problems including high blood pressure and diabetes (Cournot et al., 2006). Other researchers have reported inverse correlations between obesity and various cognitive functions such as executive functioning, memory, attention, pre-morbid intelligence (assessed using a measure of word accentuation), verbal fluency, and verbal and logical memory (Benito-León, Mitchell, Hernandez-Gallego, & Bermejo-Pareja, 2013; Raman, Smith, & Hay, 2013; Smith, Hay, Campbell, & Trollor, 2011).

Obesity has also been linked with social stigma which is associated with negative mental health outcomes such as anxiety and depression. For example, it has been found that individuals who are obese are less likely than their non-obese counterparts to be hired for a job (Pingitore, Dugoni, Tindale, & Spring, 1994), and are less likely to be provided opportunities to further their career goals and aspirations (e.g., promotions) (Bellizzi & Hasty, 1998; Rothblum, Brand, Miller, & Oetjen, 1990). Obese individuals are also frequently stigmatized as being less motivated, intelligent, and conscientious than their non-obese counterparts (Pearl, Puhl, & Brownell, 2012).Similarly, obesity is associated

with internalized weight-based stigma (Puhl, Moss-Racusin, Schwartz, & Brownell, 2008; Schwartz, Vartanian, Nosek, & Brownell, 2006), or the directing of society's negative perceptions of obesity inwards, onto the self and onto others who are obese. In turn, internalized weight-based stigma is correlated with numerous negative health indicators including higher rates of eating pathology (e.g., binge eating and drive for thinness), low self-esteem, and symptoms of depression and anxiety (Pearl & Puhl, 2014).

Individuals who are obese report higher rates of depression and anxiety (Değirmenci, Kalkan-Oguzhanoglu, Sozeri-Varma, Özdel, & Fenkc, 2015; Gariepy, Nitka, & Schmitz, 2010; Luppino et al., 2010; Simon et al., 2006) and have higher lifetime and 12-month prevalence rates of mood and anxiety disorders than their non-obese counterparts (Simon et al., 2006). These associations hold true for men and women as well as adolescents and adults (Simon et al., 2006). Additionally, the relationship between depression and obesity is bidirectional with obesity predicting depression (Luppino et al., 2010; Roberts, Deleger, Strawbridge, & Kaplan, 2003) and depression predicting obesity (Hasler et al., 2004; Luppino et al., 2010). Taken together, the physical, cognitive, mental, and social consequences of obesity create an overall reduced quality of life for individuals who are obese (Hassan, Joshi, Madhavan, & Amonkar, 2003).

For these reasons, there is a need for continued research on the causes and treatment of obesity. Targeting and treating the underlying mechanisms associated with obesity has significant health implications at both a societal and individual level. At a societal level, reducing the overall prevalence of obesity will contribute to significantly lowering public health costs. At an individual level, reducing obesity will contribute significantly to increased quality of physical and mental health.

Obesity, Weight Loss, and Weight Regain

One of the main challenges in treating obesity is research and clinical evidence indicating that most individuals who lose weight will regain the lost weight within five years (Maclean, Bergouignan, Cornier, & Jackman, 2011). In their eight-year longitudinal obesity study, The Look AHEAD Research Group found that approximately 50% of participants who had lost weight in the first year of the study, had regained most or all of their weight by the 8th year of the program (Schwartz et al., 2014). Similarly, Jeffery and colleagues (2000) found that approximately 85% of individuals who were formerly obese and had lost a significant amount of weight, regained their weight (and in some cases exceeded their baseline weight) within a three-to-five year period. To date, studies have explored a number of possible factors associated with weight regain in obese samples. Processes associated with weight regain have included environmental factors such as sleep debt, iatrogenic effects of medications, and wide availability of low-cost, highly palatable high energy foods; biological and hormonal factors such as high ghrelin and low leptin levels, low resting metabolic rate, and high reward sensitivity to the rewarding properties of food (i.e., enhanced activation in the anterior cingulate gyrus and the amygdala); as well as behavioral factors such as low physical activity, a sedentary lifestyle, and reduced monitoring of dietary intake (Anderson, Simmons, & Milnes, 2005; Greenway, 2015; Ochner, Barrios, Lee, & Pi-Sunyer, 2013; Peterson et al., 2014; Vogels, Diepvens, & Westerterp-Plantenga, 2005).

The psychological factors associated with weight regain have received less research attention than the biological factors. Psychological factors that have been connected with weight regain include depressive symptomatology (Wing et al., 2008),

and a tendency to exhibit dichotomous weight-related thinking (e.g., "I view my attempts to diet as either successes *or* failures") (Byrne, Cooper, & Fairburn, 2004). Additionally, observations and assessments of individuals following post-bariatric surgery (i.e., a procedure associated with significant weight loss that works by restricting the stomach's capacity for food) have provided an opportunity to understand the psychological mechanisms involved in weight regain. Research from these studies has shown that between 20% and 50% of individuals regain their post-surgery weight loss within a two-year period (Shah, Simha, & Garg, 2006). An exploration of psychological factors underlying post-surgery weight gain revealed that poor self-reported post-operative well-being (Odom et al., 2010) and self-reported post-operative disinhibition (i.e., susceptibility to loss of control overeating) (Bond, Phelan, Leahey, Hill, & Wing, 2009) are implicated in greater post-bariatric weight gain.

Just as it is important to study factors implicated in the weight loss of individuals who are obese, it is equally important to examine factors implicated in weight loss maintenance. Identifying the mechanisms underlying weight regain among individuals with obesity who have lost weight may have significant health implications. Researchers have found that attaining and sustaining even a 5-10% weight loss can have significant positive effects on health and quality of life in obesity (Klein et al., 2014). Specifically, among obese individuals, losses of approximately 5% of one's initial body weight are associated with the improvement, and in some cases prevention, of such health conditions as type two diabetes mellitus (e.g., Sjostrom, Peltonen, Wedel, & Sjostrom, 2000), hypertension (e.g., Stevens et al., 2001), and autonomic nervous system dysfunction (e.g., Poirier, Hernandez, Weil, Shepard, & Eckel, 2003). Thus, elucidating the mechanisms

underlying weight regain in obese individuals who have lost weight is important as this information can be applied to public health research with the aim of reducing the overall prevalence of obesity and preventing a return to obesity status. Such interventions may contribute significantly to increased quality of physical and mental health.

Emotion Regulation, Emotional Overeating, and Obesity

Considerable research has focused on the emotion regulation model of overeating and/or binge eating, a model that views overeating or binge eating (i.e., the consumption of an unusually large amount of food in a short period of time coupled with a sense of loss of control over the behaviour; APA, 2013) as a maladaptive coping mechanism to regulate one's emotions (Wiser & Telch, 1999). Specifically, researchers have proposed that binge eating or emotional overeating (i.e., overeating that serves the function of distraction from – or reduction in the intensity of – overwhelming emotions and the situations that evoked them [Wiser & Telch, 1999]) may function to temporarily reduce or numb aversive emotions (Arnow et al., 1995; Wiser & Telch, 1999). Similarly, a number of researchers have reported inverse correlations between emotion regulation skills and susceptibility to obesity in community samples of individuals (e.g., Book & Berant, 2014). That is, vulnerable individuals who struggle with implementing adaptive behavioral strategies (i.e., doing something to regulate emotions) or cognitive strategies (i.e., thinking about something to regulate emotions), are more susceptible to becoming obese. Conversely, improvements in emotional eating have been associated with improved weight loss success among overweight individuals enrolled in a weight loss program (Braden et al., 2006). Researchers have also found that difficulties with emotion regulation significantly and uniquely predict the frequency of binge eating over and above

the effects of other variables such as sex, BMI, over-evaluation of weight and shape, and dietary restraint (Kenny, Singleton, & Carter, 2017; Whiteside et al., 2007). Of the various types of difficulties with emotion regulation, limited access to healthy emotion regulation strategies and a limited ability to identify and make sense of one's emotions are the emotion regulation difficulties that have been shown to most strongly predict binge eating episodes (Whiteside et al., 2007).

In a sample of individuals with obesity, significant correlations have been observed between: 1) negative affect and binge eating episodes (Goldschmidt, 2014), 2) difficulties with emotion regulation and emotional over-eating, and 3) difficulties with emotion regulation and eating psychopathology (e.g., over concern regarding dietary restraint, weight, shape, and eating) (Gianini, White, & Masheb, 2013; Kenny, Singleton, & Carter, 2017). The relationship between difficulties with emotion regulation and emotional over-eating has also been found in a community sample of obese (Rommel et al., 2012) and overweight (Steward et al., 2016) individuals. Taken together, these findings suggest that there may be a subgroup among obese individuals who overeat to regulate negative emotions, thus placing themselves at risk of weight gain and accordingly, obesity. Further, difficulties with emotion regulation may also place these individuals at higher risk of weight regain.

In a systematic review of 18 experimental studies analyzing the role of emotion regulation in binge eating, researchers found that negative emotions triggered binge eating behavior in a group of obese individuals with Binge Eating Disorder (BED; Leehr et al., 2015), a disorder characterized by recurrent and persistent episodes of binge eating combined with associated features such as eating rapidly, eating until comfortably full,

and eating alone; in addition to marked distress associated with binge eating (APA, 2013). Conversely, they found that negative emotions did not trigger binge eating in a group of obese individuals *without* BED (Leehr et al., 2015). In another systematic review, Schag and colleagues (2013) found that obese individuals with BED had significantly lower impulse control scores when compared to obese individuals without BED. It is perhaps not surprising that negative emotions have been shown to trigger binge eating as stress is known to increase levels of cortisol, a hormone that regulates appetite and ingestion (Gluck, 2006). However, it is not clear why the hormonal response is exaggerated in some individuals and not in others; why are some individuals inclined to engage in emotional eating when encountered with a stressful situation while others are not? The answer to this question is likely complex, including a myriad of biological, physiological, hormonal, behavioral, and psychological factors. Emotional regulation is likely to play an important role.

The Present Study

Additional research is necessary to elucidate the nature of the relationships between difficulties with emotion regulation, emotional eating, and weight regain among individuals with obesity who have recently lost weight. In the only study to date that has examined the relationship between emotion regulation difficulties and weight regain in a community sample of adults who had lost and regained weight in the preceding 12 months, emotion regulation difficulties were associated with greater weight regain at 12-month follow-up (Sainsbury et al., 2018). However, this study is associated with a number of potential limitations that may influence the interpretability and generalizability of the results. First, the authors of this study defined weight loss inclusively, as having

lost $\geq$ 0.45 kg (1 lb). This weight loss criteria is inconsistent with the criteria employed

by the majority of studies demonstrating the health benefits of weight loss among

individuals with obesity, most of which employed a minimum weight-loss cut off of 5%

of an individual's baseline body weight (e.g., Latner et al., 2013; Poirier et al., 2003;

Sjostrom et al., 2000; Wing et al., 2011). Wing and colleagues (2011) found that, among

individuals who are obese, minimum weight losses of 5% are recommended for

producing clinically relevant improvements in cardiovascular disease risk factors. These

findings suggest that a weight loss cut of 0.45 kg may not be sufficiently robust to

produce improved health outcomes. Second, the authors of this study used emotional

distress as a proxy measure for difficulties with emotion regulation; participants were

asked to report whether they attributed their eating behaviour to an emotional factor. This

particular definition of emotion regulation is limited in scope as it overlooks various

aspects of the emotion regulation construct including an individual's ability to experience,

differentiate, and accept emotions; implement strategies to modulate emotions; and

express emotions in a healthy manner. This is of particular importance given that, of the

various components of difficulties with emotion regulation, limited access to healthy

emotion regulation strategies and a limited ability to identify one's emotions are the

facets that most strongly predict binge eating episodes (Whiteside et al., 2007). These

components of emotional eating are not captured by the definition employed in Sainsbury

and colleagues (2018). Third, instead of objectively measuring participant weights, data

in this previous study were collected via the internet using participant self-report. Finally,

instead of recruiting exclusively obese individuals (i.e., BMI > 30), the authors of this

study recruited a combined sample of overweight (i.e., BMI > 25) and obese individuals.

As such, it is not possible to extrapolate the impact of difficulties with emotion regulation among individuals who are overweight from those among individuals who are obese. Due to the limitations mentioned, the current study aimed to replicate the research to date on difficulties with emotion regulation in obesity and extend on the research by Sainsbury and colleagues (2018) by adopting a more conservative, and clinically significant, definition of weight loss (i.e., at least 5% of one's baseline body weight), using a psychometrically valid measure of difficulties with emotion regulation, and obtaining objective measures of weight in an exclusively obese sample.

Study aims.

This study had four aims. First, to assess how the current sample's scores on the DERS related to the DERS scores of AN and non-clinical samples, the current sample's scores on the DERS was compared to the DERS scores of the 1) AN-R sample (reported in Study 1), 2) AN-BP sample (reported in Study 1), and 3) published norms for a nonclinical undergraduate sample (Gratz & Roemer, 2004). No *a priori* hypotheses were made for these comparisons.

The second aim of this study was to examine differences between "weight regainers" (i.e., participants who gained ≥ 5% of their study admission body weight during the 12-month follow-up) and "weight non-regainers" (i.e., participants who did not gain ≥ 5% of their study admission body weight during the 12-month follow-up, including participants who lost weight) on a series of demographic and clinical variables. No *a priori* hypotheses were made regarding demographic differences between these two groups, however it was hypothesized that regainers would exhibit a higher baseline BMI, as well as greater emotional eating scores at baseline, greater difficulties with emotion

regulation at baseline, and an increased frequency of binge-eating at baseline when compared with non-regainers.

The third aim of this study was to examine the relationship between difficulties with emotion regulation, emotional overeating and weight regain in an obese sample of individuals who had recently lost weight and were followed prospectively for 12 months. Given previous findings supporting significant positive correlations between: 1) difficulties with emotion regulation and emotional overeating; 2) difficulties with emotion regulation and eating disorder psychopathology (dietary restraint, weight concern, shape concern, and eating concern) in an obese sample of individuals with BED (Gianini et al., 2013) and community samples of obese individuals (Rommel et al., 2012; Kenny et al., 2017); and 3) self-reported emotional distress and weight regain in a community sample of obese individuals (Sainsbury et al., 2018), it was hypothesized that baseline difficulties in emotion regulation would predict: 1) six-month emotional eating scores; 2) 12-month emotional eating scores; and 3) baseline-to-12-month increases in BMI. Given previous findings supporting an association between internalizing symptoms (e.g., anxiety and depressive symptoms) and degree of obesity (Değirmenci et al., 2015; Gariepy et al., 2010; Luppino et al., 2010), internalizing symptoms, as measured by the depression anxiety and stress scale (DASS) were included as covariates in these analyses. It was hypothesized that these relationships would persist when controlling for the influence of anxiety and depressive symptoms.

The fourth aim of this study was to compare participants who reported binge eating with participants who did not report binge eating in terms of the nature and extent of difficulties with emotion regulation at baseline. Given previous findings showing

greater emotion regulation impairments in binge-eaters than non-binge-eaters (Kenny, Singleton & Carter, 2017; Leehr et al., 2015), it was hypothesized that participants who reported binge eating would report significantly greater difficulties with emotion regulation than participants who did not report binge eating. Additionally, due to previous reports of correlations between binge eating and impulse control difficulties (Racine & Wildes, 2015), and binge eating and impulse control scores more generally (Schag et al., 2013), it was hypothesised that group differences on the DERS-Impulse subscale would be particularly robust.

Method

Study Design

The current study was part of a wider study that examined psychological predictors of weight regain in a community sample of individuals with obesity who had recently intentionally lost weight through diet and exercise. A longitudinal, prospective cohort design was used to assess relationships between psychological factors and body weight over a one-year period.

Participants

An *a priori* power analysis was performed to determine the minimum sample size needed to detect a medium sized effect when conducting multiple regression and correlational analyses using two independent variables [i.e. difficulties with emotion regulation and emotional eating]. With power set at 0.80 and at an alpha level of .05, a required sample size of 67 was revealed (Cohen, 1992). Thus, for optimal power, it was determined that the desired sample should have a minimum of 70 participants.

Participants were recruited from the community through the use of posters, pamphlets, and social media forums. Posters were placed in universities, colleges, hospitals, and fitness centers in St. John's; pamphlets were placed in the kit bags of runners participating in the Tely 10, an annual running race located in St. John's; and a brief description of the study was posted on Facebook, Kijiji, and a local radio station's webpage. The advertisements stated that researchers were recruiting individuals who had recently lost weight and potential participants were instructed to go to the study website or contact the phone number listed on the poster.

Potential participants completed an online screening questionnaire or participated in a telephone interview to assess the study inclusion and exclusion criteria. The online screening questionnaire was administered using *Fluid Surveys*, an online survey program. In *Fluid Surveys*, participants completed a short questionnaire that assessed their eligibility for the study according to the inclusion/exclusion criteria. The screening survey asked participants specific questions about their age, height, current weight, and weight before and after weight loss. Participants were also asked if they had received any medical weight loss treatments such as diet pills, bariatric surgery, or liposuction. Additionally, they were asked if they had ever been diagnosed with AN or BN, if they were currently diagnosed with a substance use disorder, or if they were diagnosed with any serious medical conditions that could affect weight or eating behaviour. If an individual was eligible to participate based on their responses to the screening questions, he or she was contacted by the researcher to schedule a baseline assessment appointment. If the participant did not meet the inclusion/exclusion criteria, the participant was politely informed that he or she was not eligible for the study and thanked for their interest.

Inclusion and exclusion criteria. Individuals were eligible to participate if they: 1) were between the ages of 19 and 60; 2) met obesity criteria (i.e., a BMI $\geq$ 30) prior to weight loss; and 3) had intentionally lost at least 5% of their body weight through diet and exercise. They were required to have reached this weight loss within the past four weeks. Individuals were excluded from participation if they: 1) had lost less than 5% of their body weight; 2) had a BMI less than 30 prior to weight loss; 3) had been diagnosed with AN or BN, a substance use disorder, or a serious medical condition that could affect eating or weight (e.g., hypothyroidism or Type II diabetes); 4) had attained weight loss through non-behavioral methods (e.g., surgery); 5) reported purging behaviours such as self-induced vomiting or laxative misuse within the past six months; 6) were currently pregnant; and/or 7) did not disclose their initial body weight or current body weight.

Six hundred and sixty individuals completed the screening survey. Of these, 500 were deemed ineligible for the study (See Table 5 for a breakdown of reasons why); and, of the remaining 160 eligible individuals, 79 did not respond to the researcher's email or voice mails inviting them to participate. Ultimately, 81 individuals participated in this study. At the data screening stage, data from six of these participants were removed for the following reasons: two participants were found to be inadvertently included in the study and were in fact not eligible to participate; one participant withdrew from the study during baseline data collection; one participant became pregnant before her second assessment; and two participants did not complete the initial study questionnaires. In total, 75 male and female participants were included in the final sample.

Table 5

Breakdown of reasons for participant exclusion.

N = 500	Reason for Exclusion
288	Weight loss >1 month ago
78	Weight loss < 5%
40	Initial BMI < 30
21	Weight loss > 1 month ago, Initial BMI < 30
13	Weight loss > 1 month ago, Weight loss < 5%
9	Medical condition affecting weight or eating
7	Weight loss < 5%, Unintentional weight loss
6	Age > 60
6	Unintentional weight loss
6	Incomplete screening survey
4	Initial BMI < 30 AND Weight loss < 5%
4	Weight loss > 1 month ago, Unintentional weight loss
4	Weight loss > 1 month ago, Weight loss < 5%, Unintentional weight loss
4	Accidental exclusion
1	Weight loss > 1 month ago, Substance use disorder
1	Weight loss > 1 month ago, Incomplete screening survey
1	Unintentional weight loss, Incomplete screening survey
1	Age < 19
1	Weight loss > 1 month ago, Age > 60
1	Weight loss < 5%, Incomplete screening survey

1	Weight loss < 5%, Weight loss > 1 month ago, BMI < 30
1	Engaged in non-behavioural weight loss methods
1	Current Eating disorder
1	Current Substance use disorder

Note. BMI = Body Mass Index.

Measures

Demographic information questionnaire. The demographic information questionnaire included questions relating to participant age, biological sex, relationship status, ethnicity, occupation, and highest level of education attained.

Weight history questionnaire. The weight history questionnaire included questions pertaining to the participant's current weight, height, date at which they started to lose weight, weight when they decided to lose weight, lowest attained weight and date at which they attained their lowest weight, as well as highest attained weight and date at which they attained their highest weight.

Eating Disorder Examination – Questionnaire (EDE-Q; Fairburn & Bèglin, 1994). The EDE-Q is described in detail in Study one (see page 21).

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The DERS is described in detail in Study one (see page 22).

Emotional Eating Scale (EES; Arnow, Kenardy, & Agras, 1992). The Emotional Eating Scale (EES) is a 25-item self-report questionnaire that measures an individual's desire to eat in response to emotional experiences (See Appendix D). The EES provides a total score and three subscale scores including: 1) a desire to eat in

response to feelings of anger/frustration; 2) a desire to eat in response to feelings of

anxiety; and 3) a desire to eat in response to feelings of depression. Each item is rated on

a 5-point likert scale ranging from "no desire to eat (0)" to "a strong desire to eat (4)."

Higher scores indicate an increased desire to eat in response to one's emotions. The EES-

anger/frustration subscale has eleven items and has demonstrated a coefficient alpha of

.78, the EES-anxiety subscale has nine items and has demonstrated a coefficient alpha of

.78, and the EES-depression subscale has five items and has demonstrated a coefficient

alpha of .72. The total score has yielded a coefficient alpha of .81 indicating good internal

reliability (Arnow et al., 1995). Additionally, the EES has demonstrated adequate two-

week test-retest reliability (.79), as well as construct validity and criterion-related validity

(Arnow et al., 1995). In the current study, the coefficient alpha values for the overall EES

were .92, .90, and .91 at baseline, six-month follow-up, and 12-month follow-up

respectively.

Depression Anxiety Stress Scale – 21 (DASS-21; Lovibond & Lovibond,

1995). The Depression Anxiety Stress Scale – 21 (DASS-21) is a 21-item self-report

questionnaire designed to assess symptoms common to both depression and anxiety (See

Appendix E). The DASS-21 provides a total score and three subscale scores

corresponding to the three symptom dimensions: 1) depression; 2) anxiety; and 3) stress.

Each item is rated on a 4-point likert scale ranging from "did not apply to me at all over

the last week" (0) to "applied to me very much or most of the time over the past week"

(3). Higher scores indicate increased symptom severity. The depression subscale has

demonstrated a coefficient alpha of .91, the anxiety subscale has demonstrated a

coefficient alpha of .84, and the stress subscale has demonstrated a coefficient alpha of

.90 indicating excellent internal reliability (Lovibond & Lovibond, 1995). In the current study, the coefficient alpha values were .93, .88, and .94 for the DASS-21 total score at baseline, six-month follow-up, and 12-month follow-up respectively. Additionally, the DASS-21 has good convergent validity as revealed by a strong correlation between the Beck Anxiety Inventory (BAI) and the anxiety subscale of the DASS-21, and between the Beck Depression Inventory (BDI) and the depression subscale of the DASS-21 (Lovibond & Lovibond, 1995). Furthermore, the cross-correlations (i.e., between the DASS-21 anxiety subscale and the BDI, and the DASS-21 depression subscale and the BAI) are much lower indicating strong discriminant validity (Lovibond & Lovibond, 1995).

Procedure

Participants who met the inclusion criteria listed above were invited to meet with a research assistant at the Craig L. Dobbin Genetics Research Centre in the Health Sciences Centre in St. John's, NL three times over the course of one year - an initial assessment and follow-up appointments six and 12 months later. Each meeting lasted about 1.5 hours. At the first visit, the research assistant scheduled the participants' second and third follow-up appointments. To increase retention rates, participants were emailed at three months and nine months to remind them of their follow-up appointments at six months and 12 months respectively. At this time, participants were asked to confirm the specified date and time.

At their baseline appointment, participants were first provided with a consent form explaining the purpose and nature of the study, anticipated risks and benefits, procedures involved, and an explanation of the follow-up assessments at six and 12 months (See Appendix F). At this time, participants were given an opportunity to ask questions about

the study. After signing the consent form, participants completed a demographic questionnaire asking them about their age, gender, education, occupation, and marital status. Additionally, they had their current weight and height measured using a medical scale to calculate BMI (kilograms/metres^2) and they were asked to self-report their lowest weight attained, and highest weight attained. Finally, participants completed self-report questionnaires assessing difficulties with emotion regulation, depression, anxiety, and emotional eating. All of the data collected were entered in *Fluid Surveys* to facilitate statistical input of data. The researcher scheduled the follow-up appointments, and thanked the participant for their time. As an incentive, participants were informed that they would be entered in a draw for a $100.00 gift card for a local shopping mall following completion of all study assessments. At six- and 12-month follow-up participants returned to the lab to have their weight measured and assessment batteries re-administered. All aspects of this study were approved by the local Heath Research Ethics Board.

Statistical Analyses

Missing data. The SPSS version 24 – missing values add-on software was used to analyze patterns of missing data. The results of this analysis indicated that 3.8% - 29.5% of data were missing across variables of interest. To examine whether data were missing completely at random (MCAR; i.e., missing values are independent of unobserved variables), missing at random (MAR; i.e., missing values may be predicted by observed variables but do not depend on any unobserved variables), or missing not at random (MNAR; i.e., missing values depend on unobserved variables), Little's MCAR test was conducted. Results of Little's MCAR test revealed that BMI data (i.e., BMI at baseline

and 12-month follow-up) were missing completely at random, χ^2 (5)= 3.25, $p = .66$.

Similarly, results revealed that questionnaire data (i.e., DASS-21, DERS, and EES) were

also missing completely at random, χ^2 (88) = 3.55, $p = 1.00$. These findings indicate that

missing data are independent of unobserved variables. Accordingly, multiple imputation

(MI), a widely-used approach for estimating missing data, was conducted (Rubin, 1987).

Specifically, the predictive mean matching (PMM) method was used. This method

ensures that imputed variables are within the range of original data by avoiding imputing

extreme outliers (Little, 1988; Schenker & Taylor, 1996). MI is comprised of three steps:

1) creating multiple datasets of imputed missing data; 2) pooling the imputed datasets;

and 3) conducting statistical analyses as planned using the pooled imputed data (Rubin,

1987). To conduct the analysis, all variables of interest (i.e., predictor variables, outcome

variables, and covariates) were included in the imputation model. Consistent with

previous research proposing that five imputations adequately achieve efficient estimates

(e.g., Schafer & Olsen, 1998), five imputations were conducted in the present analysis.

Comparison of DERS in current sample with AN-R, AN-BP, and nonclinical samples.

To address the first aim of this study, to assess how the current sample's scores on

the DERS compared to the scores of the AN and nonclinical undergraduate samples,

mean DERS scores for the obese sample were compared to mean DERS scores for the: 1)

AN-R sample (reported in Study 1), 2) AN-BP sample (reported in Study 1), and 3)

published norms for a nonclinical undergraduate sample (Gratz & Roemer, 2004). Mean

sample scores were compared using independent samples *t* tests, employing a Bonferroni correction to correct for six comparisons per DERS subtype ($p = .05/6 = .008$).

Baseline comparisons between weight regainers and weight non-regainers.

To address the second aim of this study, to examine differences between "weight regainers" (i.e., participants who gained $\geq 5\%$ of their study baseline body weight during the 12-month follow-up) and "weight non-regainers" (i.e., participants who did not gain $\geq 5\%$ of their study baseline body weight during the 12-month follow-up, including participants who lost weight), the two groups were compared on several variables. Specifically, a series of independent samples *t*-tests were conducted to determine whether regainers and non-regainers differed at baseline in terms of: 1) age; 2) BMI; 3) emotion regulation difficulties; and 4) emotional eating. Chi square tests were conducted to examine whether regainers and non-regainers differed with respect to the proportion of males and females, highest level of education attained, and presence/absence of binge-eating.

Emotion regulation difficulties, emotional eating, and weight change.

To address the third aim of this study, to test the hypothesis that emotion regulation difficulties at baseline would be associated with: 1) emotional eating at six month and 12-month follow-up, and 2) baseline-to-12-month increases in BMI, a series of inter-correlations were conducted. Initially, three separate regression analyses were planned (the DERS-total baseline score as the predictor variable in each analysis; baseline-to-12-month change in BMI, emotional eating at six months, and emotional eating at twelve months as the unique criterion variables; and baseline depression symptoms as measured by the DASS-21 as a covariate). However, as it was determined

that baseline depressive symptoms were not significantly related to baseline-to-12-month change in BMI ($r = -.19$, $p = .15$), emotional eating at six months ($r = .07$, $p = .63$), or emotional eating at 12 months ($r = -.04$, $p = .72$), and because bivariate correlations and univariate regressions without covariates yield equivalent results, only inter-correlations were examined.

Baseline comparisons between binge eaters and non-binge-eaters.

To address the fourth aim of this study, to test the hypothesis that participants who report binge eating at study admission would present with significantly greater overall emotion regulation difficulties, and more difficulties across all facets of emotion regulation, than participants who do not report binge eating, a multivariate analysis of variance (MANOVA) was planned. However, because MANOVA in SPSS-24 does not support multiply imputed datasets (IBM, 2011), a series of independent samples *t*-tests were conducted instead to compare mean DERS subscale scores for binge eaters and non-binge eaters. A Bonferroni correction was employed to correct for six comparisons per DERS subtype ($p = .05/6 = .008$).

Results

See Table 6 for demographic and clinical characteristics of the sample.

Table 6

Baseline characteristics of the obesity sample (N = 75)

Characteristic	Mean (SD) or %
Female	65.3%
Age	38.9 (10.4)

Ethnicity

Caucasian	94.6%
Middle Eastern	1.4%
Other	4.1%

Marital Status

Single	20.0%
Married/Common-Law	66.7%
Separated/Divorced	1.3%
In a Relationship	8.0%
Other	4.0%

Employment Status

Student	28.4%
Employed	81.3%
Unemployed	18.7%

Binge Eating Status

Presence of Binge Episode(s) at Baseline	39.2%
Absence of Binge Episode at Baseline	60.8%
Baseline Binge Episodes/Month[a]	3.9 (4.3)

Education

Highschool	1.3%
Some Post-Secondary	18.7%
College or Undergraduate	62.7%

Graduate University	17.3%
Baseline BMI	31.5 (5.1)
12-Month BMI	30.9 (5.4)
Baseline Weight (kg)	90.6 (16.4)
12-Month Weight (kg)	88.8 (18.1)
Weight Change (kg)	- 1.8 (7.8)

[a] Among individuals who report the presence of binge episode(s) at baseline

Aim 1: Comparison of DERS in current sample with AN-R, AN-BP, and Nonclinical Samples

First, to address the first study aim, the mean baseline DERS scores for the obese sample were compared separately to the mean baseline DERS scores for the: 1) AN-R, 2) AN-BP, and 3) nonclinical published norms for an undergraduate sample (see Table 7 for means and standard deviations in all four samples) (Gratz & Roemer, 2004). When compared with the AN-R sample, the obese sample reported significantly lower scores on the Goals, $t(59) = 4.86$, $p < .001$, Cohen's $d = 0.98$; Impulse, $t(53) = 2.75$, $p = .008$, Cohen's $d = 0.56$; Strategies, $t(52) = 4.86$, $p < .001$, Cohen's $d = 1.00$); Clarity, $t(49) = 4.18$, $p < .001$, Cohen's $d = 0.87$; and Non-Acceptance, $t(70) = 4.96$, $p < .001$, Cohen's $d = 0.98$, subscales. These results suggest that individuals in this sample experience fewer difficulties: 1) engaging in goal-directed behaviour; 2) controlling impulses; 3) accessing adaptive emotion regulation strategies; 4) clarifying emotions; and 5) accepting emotions than individuals with AN-R. Furthermore, there was no statistically significant difference between the AN-R and obese samples on the Awareness subscale, $p > .008$ (See Table 7), which suggests that individuals in the current sample experience deficits with emotional

awareness that are comparable to the deficits experienced by individuals with AN-R when experiencing intense emotions.

When compared to the AN-BP sample, the obese sample reported significantly lower scores on the Goals, t (107) = 9.02 p < .001, Cohen's d = 1.57; Impulse, t (81) = 8.99, p < .001, Cohen's d = 1.59; Strategies, t (91) = 12.26, p < .001, Cohen's d = 2.16; Clarity, t (82) = 8.29, p < .001, Cohen's d = 1.47; and Non-Acceptance, t (109) = 8.12, p < .001, Cohen's d = 1.41, subscales. Similar to above, these results suggest that individuals in the current sample experience fewer difficulties: 1) engaging in goal-directed behaviour; 2) controlling impulses; 3) accessing adaptive emotion regulation strategies; 4) clarifying emotions; and 5) accepting emotions than individuals with AN-BP. Consistent with the AN-R sample, there were no differences between the AN-BP and obese samples on the Awareness subscale, p > .008, suggesting that individuals in this sample experience deficits with emotional awareness that are comparable to the deficits experienced by individuals with AN-BP when experiencing intense negative emotions (See Table 7).

Lastly, when compared with the published nonclinical norms, the obese sample presented with significantly higher Awareness, t (109) = 10.45, p < .001, Cohen's d = 1.42, and Clarity, t (246) = 5.72, p < .001, Cohen's d = 0.61, subscale scores. These results indicate that individuals in this sample experience significantly greater deficits with emotional awareness and clarifying emotions than those observed in a nonclinical undergraduate sample. No differences were found between these samples on the Strategies, Non-Acceptance, Goals, and Impulse subscales, ps > .008 (See Table 7). These results suggest that, when compared to a nonclinical undergraduate sample,

individuals in this sample experience similar abilities to: 1) access adaptive emotion

regulation strategies; 2) accept emotions; 3) engage in goal-directed behaviour; and 4)

control impulses. Overall, these findings indicate that, for the obese sample, there are

elevated difficulties with emotional awareness and emotional clarity when compared to a

nonclinical undergraduate sample, and that difficulties with emotional awareness in the

obese sample are comparable to the difficulties observed in an AN sample.

Table 7

Comparison of baseline Difficulties in Emotion Regulation subscale scores for the AN-BP

and AN-R samples, the obese sample, and an undergraduate sample.

Measure	Mean (SD)			
	AN-BP (*n = 62*)	AN-R (*n = 44*)	Obese (*n = 75*)	Undergraduate[1] (*n = 260*)
DERS-Goals	19.52 (4.26)[a]	18.02 (5.43)[b]	13.69 (3.06)	14.41 (4.95)
DERS-Impulse	19.32(6.42)[a]	14.18 (6.35)[b]	11.39 (2.92)	10.82 (4.41)
DERS-Awareness	21.42 (5.19)	20.18 (6.01)	21.32 (5.23)	14.34 (4.60)[c]
DERS-Strategies	28.63 (7.46)[a]	23.18 (9.87)[b]	15.58 (4.20)	16.16 (6.19)
DERS-Clarity	17.23 (4.18)[a]	16.02 (5.45)[b]	12.46 (1.92)	10.61 (3.80)[c]
DERS-Non-acceptance	21.31 (7.23)[a]	18.55 (7.24)[b]	12.34 (5.31)	11.65 (4.72)

Note. AN-BP = Anorexia Nervosa-Binge Purge subtype; AN-R = Anorexia Nervosa-

Restricting subtype; [a]= *significant difference between AN-BP and obese samples at*

p<.008; [b]*=significant difference between AN-R and obese samples at p<.008;*

[c]*=significant difference between undergraduate and obese samples at p<.008*

1. Data from Gratz & Roemer (2004).

Aim 2: Baseline Comparisons between Weight Regainers and Weight Non-Regainers

To address the second study aim, the frequency of "regainers" and "non-regainers" at 12-month follow-up was examined. As mentioned previously, "regainer" was defined as gaining ≥ 5% of study admission body weight and "non-regainer" was defined as gaining < 5% of study admission body weight (including weight loss). The results revealed that 23.47% (*N* = 18) of the sample were regainers and 76.53% (*N* = 57) were non-regainers. Further examination of the two groups revealed that, among regainers, the mean increase in BMI was 3.38 (*SD* = 2.77) and, among non-regainers, the mean decrease in BMI was 1.38 (*SD* = 2.01).   These results indicate that, contrary to expectations, BMI was relatively stable over the one-year study period.

An independent samples *t*-test was conducted between weight gainers and weight non-regainers to determine possible differences in age scores. The results of this analysis showed no significant age differences between regainers and non-regainers, $t(91^1) = $ -1.28, *p* = .21, Cohen's *d* = 0.41 (See Table 8). However, while not statistically significant, the results of this analysis revealed a moderate effect size, suggesting that the age difference between the two groups may be clinically meaningful with regainers being

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[1] The results have been pooled from 5 imputed datasets. Accordingly, the degrees of freedom in the independent-samples t-tests are higher than expected. No corrections were applied in these analyses, however a discussion of possible corrections of the degrees of freedom for pooled estimates can be found in Van Ginkel (2010) or Barnard and Rubin (1999).

older than non-regainers. Thus, possibly due to the relatively small sample size the difference was not statistically significant. A second independent t-test was conducted to evaluate whether weight regainers and non-regainers differed significantly in overall difficulties in emotion regulation at baseline. Inconsistent with expectations, the results showed no significant differences in baseline difficulties in emotion regulation (i.e., total DERS scores) between regainers and non-regainers, $t(153) = .80$, $p = .43$, Cohen's $d = 0.26$ (See Table 8). A third independent samples t-test was conducted to examine potential differences in baseline BMI between weight regainers and weight non-regainers. Inconsistent with expectations, the results of this analysis yielded no significant differences in baseline BMI between regainers and non-regainers, $t(5801) = 0.49$, $p = .06$, Cohen's $d = 0.14$ (See Table 8). A fourth independent samples t-test was conducted to examine potential differences in baseline emotional eating scores between weight regainers and weight non-regainers. Inconsistent with the hypothesis, the results of this analysis yielded no significant differences in baseline emotional eating between regainers and non-regainers, $t(74) = -0.32$, p $= 0.75$, Cohen's $d = 0.10$ (See Table 8). A final independent t-test was conducted to examine potential differences in frequency of binge eating episodes between weight regainers and weight non-regainers. Inconsistent with the hypothesis, a significant difference was not found in the frequency of binge eating episodes between weight regainers and weight non-regainers, $t(54929) = -.36$, $p = .72$, Cohen's $d = 0.13$ (See Table 8). See Table 8 for means and standard deviations of baseline variables for regainers and non-regainers.

Table 8

Means and standard deviations of baseline variables for regainers (N = 18) and non-regainers (N = 57)

	Mean (SD)	
Variable	Regainers	Non-Regainers
Age	42.03 (8.84)	38.00 (10.64)
Baseline DERS-Total	84.36 (10.19)	87.54 (14.17)
Baseline BMI	30.97 (4.76)	31.67 (5.22)
Baseline EE-Total	28.95 (19.97)	27.10 (15.10)
Baseline Binge Episodes/Month[a]	4.32 (3.61)	3.70 (5.45)

[a] Among individuals who report the presence of binge episode(s) at baseline

Note. DERS = Difficulties in Emotion Regulation; EE = Emotional Eating

Subsequently, three separate chi square tests of independence were conducted to evaluate whether weight regainers and non-regainers differed in terms of sex, education, and presence/absence of binge-eating at baseline. Sex and weight gain status were not found to be significantly related, χ^2 (N = 75) = .27, p = .61, *Cramer's V* = .06. Similarly, education and weight gain status were not found to be significantly related, χ^2 (N = 75) = 3.00, p = .39, *Cramer's V* = .20. However, results of the chi square test of independence revealed a significant relationship between gainer status and presence/absence of binge-eating at baseline, χ^2 (N = 75) = 5.28, p < .05, *Cramer's V* =.26. In concordance with expectations, among regainers, there were significantly more participants that engaged in binge-eating than participants that did not engage in binge-eating. Conversely, among

non-regainers, there were significantly more participants that did *not* engage in binge-eating than participants that did engage in binge-eating. Specifically, among regainers, 11 participants (62.22%) engaged in binge-eating versus seven participants (37.78%) that did not engage in binge-eating. Among non-regainers, there were 18 participants (31.93%) that engaged in binge-eating versus 39 participants (68.77%) that did not engage in binge-eating. See Figure 2 for a visual representation of the frequency of regainers and non-regainers that engaged in binge-eating versus did not engage in binge-eating.

In summary, regarding the second study aim, the findings suggest that there were few meaningful pre-existing differences between participants who regained some or all of the weight that they had lost prior to the start of the present study and participants who did not regain the weight (including participants who had lost weight) they had lost prior to the start of the study. However, one important difference was revealed: participants who regained weight across the 12-month follow-up period were significantly more likely to engage in binge-eating at baseline while participants who did not regain weight across the 12-month follow-up period were significantly more likely to not engage in binge-eating at baseline.
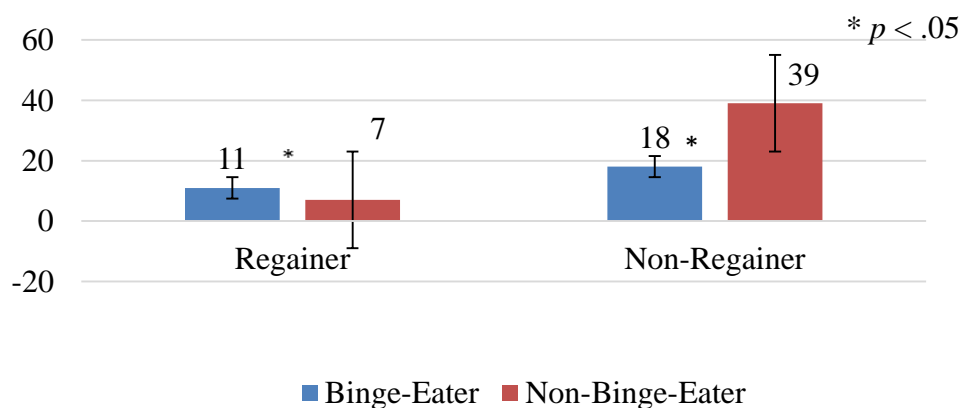
Figure 2: Frequency of the presence of binge-eating among weight regainers and non-regainers

Aim 3: Relationship between Emotion Regulation Difficulties, Emotional Eating, and BMI Change

Descriptive statistics, reliability, and correlations of full sample.

To address the third study aim, bivariate correlations for baseline DERS; baseline DASS; baseline, six-month, and 12-month EES; baseline and 12-month BMI; and 12-month change in BMI were conducted across the full sample (See Table 9). Means were calculated for BMI and emotional eating at baseline and 12-month follow-up (See Figure 3). Tests of internal consistency were conducted for all of the subscales and scales employed in the current study for the full sample. Excellent internal consistencies were found for the DERS-total scale ($\alpha = .83$), the DASS-total scale ($\alpha = .93$), the baseline EES-total scale ($\alpha = .92$), the six-month EES-total scale ($\alpha = .90$), and the 12-month EES-total scale ($\alpha = .91$).

In contrast with expectations, the results revealed that, on average, participants in the current sample lost weight over the 12-month study period. Specifically, the mean baseline-to-12-month change in BMI was -.60 for the sample as a whole, demonstrating that, on average, participant BMI decreased by .60 over the one-year study period.

Results from the correlations revealed that baseline and 12-month BMIs were significantly and positively correlated. Additionally, consistent with expectations, baseline, six-month, and 12-month emotional eating scores were significantly and

positively correlated. Moreover, difficulties with emotion regulation were significantly and positively associated with depression, anxiety, and stress scores. In contrast with expectations, baseline difficulties with emotion regulation were not significantly correlated with baseline or 12-month BMI (See Table 9).

Furthermore, significant positive correlations were revealed between emotional eating at baseline and baseline BMI; and between emotional eating at 12-month follow-up and BMI at 12-month follow-up (See Table 9). No additional significant relationships were yielded.

In summary, regarding the third study aim, the results revealed that, in contrast with predictions, baseline emotion regulation deficits were not associated with baseline-to-12-month change in BMI. Similarly, in contrast with predictions, baseline difficulties with emotion regulation were not associated with emotional eating at six-month follow-up or 12-month follow-up.

Table 9

Intercorrelations for baseline DERS; baseline DASS; baseline, six-month, and 12-month EES; baseline and 12-month BMI; and changes in BMI at 12 months

Measures	1	2	3	4	5	6	7	8
1. T1 DERS-Tot	---							
2. T1 DASS-Tot	.72**	---						
3. T1 EES-Tot	.07	.13	---					
4. T2 EES-Tot	-.01	.07	.37**	---				
5. T3 EES-Tot	.05	.06	.71**	.58**	---			
6. T1 BMI	-.10	-.01	.29*	.14	.27	---		

7.	T3 BMI	-.15	-.14	.20	.10	.33*	.87**	---	
8.	BMI change T1-T3	-.20	-.19	-.13	-.06	.06	-.27*	.30**	----

Note. DERS = Difficulties in Emotion Regulation Scale; DASS = Depression, Anxiety, Stress Scale; T1 = Time 1 (baseline); T2 = Time 2 (six-month follow-up); T3 = Time 3 (12-month follow-up); EES = Emotional Eating Scale; BMI = Body Mass Index
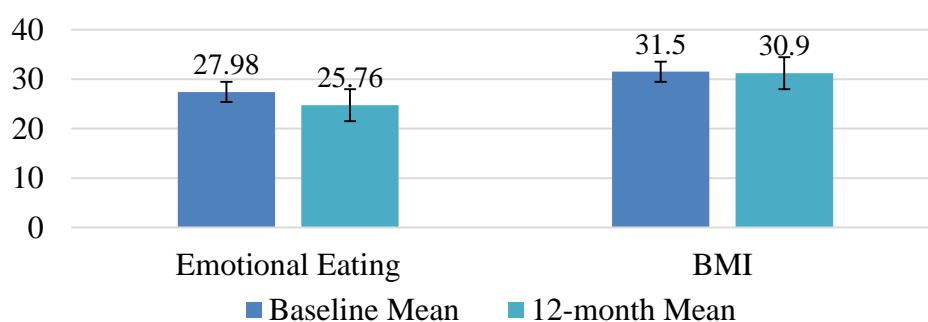
Figure 3: BMI and emotional eating at baseline and 12-month follow-up

Aim 4: Baseline Comparisons between Binge Eaters and Non-Binge-Eaters

The frequency of "binge eaters" and "non-binge eaters" at baseline was examined. As mentioned previously, "binge-eater" was used to refer to individuals who reported consuming an unusually large amount of food in a short period of time and experienced a sense of loss of control over the behaviour. "Non-binge-eater" was used to refer to individuals who did not consume an unusually large amount of food, or individuals who consumed an unusually large amount of food but did not feel a sense of loss of control over the behaviour. The results revealed that 38.70% (*N* = 29) of the sample met "binge-eater" classification and 61.30% (*N* = 46) met "non-binge-eater" classification.

To address the fourth aim of this study, whether participants who reported binge eating at baseline presented with significantly more emotion regulation difficulties at baseline than participants who did not report binge eating, an independent samples *t*-test was conducted. The results showed no significant difference in overall baseline difficulties in emotion regulation (i.e., DERS total score) between participants who reported binge eating and those who did not report binge eating, $t(167543) = .66$, $p = .51$. Furthermore, a small effect size was revealed, Cohen's $d = 0.17$.

Subsequently, independent *t*-tests were conducted to examine whether participants who reported binge eating at study admission also reported significantly greater difficulties across the facets of emotion dysregulation (i.e., DERS subscales). A Bonferroni correction was employed to correct for six comparisons per DERS subtype ($p = .05/6 = .008$). The results of these analyses revealed that there were no significant differences between participants who reported binge eating and participants who did not report binge eating on the DERS-Awareness subscale, $t(73) = 1.77$, $p = .08$, Cohen's $d = 0.47$; or the DERS-Clarity subscale, $t(73) = 1.89$, $p = .06$, Cohen's $d = 0.50$. While the results from these two analyses were not statistically significant, moderate effect sizes were yielded for both. An examination of group means and standard deviations revealed that participants who reported binge eating presented with fewer difficulties in emotional awareness ($M = 20.08$, $SD = 5.93$) and emotional clarity ($M = 11.94$, $SD = 1.95$) than participants who did not report binge eating ($M = 22.23$, $SD = 4.57$ and $M = 12.78$, $SD = 1.84$ respectively). Further analyses revealed that there were no significant differences between participants who reported binge eating and participants who did not report binge eating on the DERS-Goals subscale, $t(73) = .74$, $p = .46$, Cohen's $d = 0.13$; the DERS-

Impulsiveness subscale, $t(73) = -.70$, $p = .49$, Cohen's $d = 0.15$; the DERS-Strategies

subscale, $t(73) = -.78$, $p = .43$, Cohen's $d = 0.18$; or the DERS-Non-acceptance subscale,

$t(73) = -.15$, $p = .88$, Cohen's $d = .0.08$.

In summary, regarding the fourth study aim, the results revealed that, in contrast

with predictions, there were no statistically significant differences in emotion regulation

difficulties between individuals who reported binge eating at study admission and

individuals who did not report binge eating at admission. However, while the correlations

were not statistically significant, moderate effect sizes were found. Accordingly, a

meaningful difference in the degree of emotional awareness and clarity may exist

between participants who reported binge eating and participants who did not report binge

eating, with participants who reported binge eating also reporting fewer difficulties in

emotional awareness and clarity than participants who did not report binge eating. The

lack of statistical significance may be due to the relatively small sample size.

Discussion

This study examined difficulties with emotion regulation in a community sample

of obese (i.e., a BMI ≥ 30) adults who had lost at least 5% of their body weight within the

previous four weeks. The first objective of the study was to compare the sample of obese

individuals with a sample of individuals diagnosed with AN-R and AN-BP (See Study

one), and a nonclinical undergraduate sample (Gratz & Roemer, 2004) in terms of

emotion regulation deficits. The results revealed that the obese sample reported fewer

difficulties engaging in goal-directed behaviour; controlling impulses; accessing adaptive

emotion regulation strategies; clarifying emotions; and accepting emotions than

individuals with AN. However, the obese sample reported deficits in emotional awareness

that were comparable to deficits reported by the AN-R and AN-BP samples. These findings may lend partial support to the emotion regulation model of overeating, or the explanation of overeating as a maladaptive coping mechanism to regulate emotions (Wiser & Telch, 1999). Specifically, findings from the present study suggest that overeating may be particularly related to deficits in emotional awareness.

Individuals prone to obesity may experience difficulties with interoceptive awareness, or difficulty recognizing emotional states and discriminating between sensations (e.g., hunger) and feelings. This explanation is consistent with findings reported by Lundstedt, Edlund, Engström, Thurfjell, and Marcus (2006) who reported significantly greater deficits in interoceptive awareness in an obese sample than a non-obese sample. Similarly, in a study comparing psychological features across a range of eating disordered samples, researchers found comparable interoceptive awareness scores between a non-clinical obese sample, an AN-BP sample, and a BED sample, all of which reported significantly higher mean scores than the non-obese sample (Fassino, Piero, Gramaglia, & Abbate-Daga, 2004). When combined with the results of the present study, these findings suggest that difficulties with emotional awareness may be implicated in the onset or maintenance of obesity.

The second objective of this study was to examine potential differences in emotion regulation difficulties between weight "regainers" (i.e., participants who had gained ≥5% of baseline body weight) and "non-regainers" (i.e., participants who had gained < 5% of baseline body weight, including individuals who had lost weight); and to examine whether baseline emotion regulation deficits were associated with baseline-to-12-month increases in BMI. In contrast with predictions, no differences in emotion

regulation difficulties between regainers and non-regainers were found, and emotion

regulation difficulties were not associated with baseline-to-12-month increases in BMI.

While these results were unexpected, they may be interpreted in a number of ways. First,

it is important to note that participants in this study were categorized into "regainers" and

"non-regainers" based on whether they regained $\geq 5\%$ of their baseline weight (i.e.,

"regainers") or regained $< 5\%$, including those who lost weight over the 12-month study

period (i.e., "non-regainers"). While this decision to dichotomize participants into

"regainers" and "non-regainers" was based on previous research demonstrating that

weight changes as modest as 5% can predict health outcomes (Latner et al., 2013; Poirier

et al., 2003; Sjostrom et al., 2000; Wing et al., 2011), dichotomizing variables may reduce

statistical power, and accordingly an increase in null findings. As such, it is possible that

the decision to dichotomize weight change may have contributed to the null findings for

the predicted differences in emotion regulation difficulties between regainers and non-

regainers.

Another potential explanation for the non-significant relationship between

emotion regulation difficulties and BMI in the present study may be due to the fact that,

while participants were expected to gain weight over the 12-month study period, the

majority of them (76.53%) maintained or lost weight. While it is not entirely clear what

contributed to these unexpected findings, one possible explanation relates to the follow-

up duration chosen for the present study. That is, while previous studies have found that

the majority of individuals who lose a significant amount of weight will regain the weight

at a later date (Jeffery & Wing, 1995; Jeffery et al., 2000; Schwartz et al., 2014), most of

these studies were longer in duration than the present study. Specifically, previous studies

followed participants for a three-to-five year duration (Jeffery & French, 1999; Jeffery et al., 2000), and, in one study, up to an eight year period (Schwartz et al., 2014). Indeed, it is possible that, had participants in the present study been followed for a longer duration, greater increases in BMI may have been observed. Further support for this hypothesis can be seen through Weiss and colleagues' (2007) study wherein they examined 1,310 formerly obese U.S. adults who had lost 10% of their body weight within the year preceding study onset. Results from their study revealed that, similar to findings yielded in the present study, at one-year follow-up the majority of participants had either maintained or lost weight. Specifically, at one-year follow-up, 66.50% of their participants had maintained (i.e., stayed within 5% of their baseline body weight) or lost (i.e., lost >5% of baseline body weight) weight. In a similar longitudinal study, researchers found that, of participants who had recently lost weight and were followed for less than two years, only 23% had regained the weight. Conversely, when followed for greater than two years, 83% of participants in this study had regained the weight. When combined with results from the present study, results from these studies suggest that, while most individuals who lose a significant amount of body weight will regain the weight at a later date, this date is likely greater than one year for most individuals.

In addition to the relatively short follow-up period employed by the present study, and limited increases in BMI, another possible contribution to the null findings for the predicted relationship between emotion regulation difficulties and BMI in the present study may be related to unique characteristics of the present sample. Specifically, participants in the present sample reported a higher degree of educational attainment when compared to the average Canadian resident (Statistics Canada, 2016). Specifically,

all participants in this study reported receiving at least a high school education, with 80% of participants reporting at least a university undergraduate degree as their highest level of educational attainment. Statistics Canada (2016) reports indicate that, in 2016, 16.9% of employed Canadians had received less than a high school diploma and 49.40% of residents had received at least an undergraduate degree as their highest level of education attained. Support for the role of education in explaining the limited weight gain observed in the present study is strengthened by previous research demonstrating negative correlations between educational attainment and obesity (McLaren, 2007; Sobal & Stunkard, 1989). Thus, it is plausible that the negative association between education and obesity may extend to weight regain (i.e., an inverse correlation between education and weight regain may exist).

Although there were no significant differences in baseline emotion dysregulation, BMI, age, emotional eating, and frequency of binge-eating between weight "regainers" and "non-regainers" in this study, and no significant relationships between gainer status and sex or educational attainment were revealed, a significant relationship between 12-month gainer status (i.e., regainer versus non-regainer) and baseline presence/absence of binge-eating was found. This finding was consistent with expectations and is clinically meaningful as it suggests that the weight regain commonly observed among obese individuals who have lost weight may be attributed – at least in part – to binge eating behaviour. Accordingly, these findings suggest that targeting potential underlying mechanisms of binge-eating, such as emotion dysregulation and difficulties with interoceptive awareness, may be one important component of obesity treatment. Future

studies should seek to further examine psychological factors that underlie binge-eating to better understand targets for treatment.

The third objective of this study was to examine the relationship between baseline emotion regulation difficulties and emotional eating scores at six-month and 12-month follow-up. While it was hypothesised that emotion regulation difficulties at baseline would be associated with emotional eating scores at six-month and 12-month follow-up, this relationship was not found. While this finding may be interpreted as evidence against the emotion regulation model of binge eating or over-eating, it is also possible that the null findings are a result of the specific construct assessed by the Emotional Eating Scale (EES) employed in the present study (See Appendix D). Specifically, the measure used in this study assesses an individual's *desire* or *urge* to eat in response to strong emotions rather than the behaviour itself (i.e., eating in response to a strong emotion). While it may be assumed that individuals' desire to eat in response to strong emotions would correspond with their consumption of food in response to strong emotions (thereby increasing their chances of gaining weight), it is possible that, for many participants in the present study, the desire or urge to eat was not strongly associated with the actual behaviour (i.e., eating in response to the emotion). Thus, while difficulties in emotion regulation may be associated with emotional eating, they may not be related to one's urge to eat.

While it is possible that the absence of a relationship between baseline difficulties with emotion regulation and reports of emotional eating at six-month and 12-month follow-up may be a result of the construct assessed by the EES (i.e., assessing an *urge* to eat rather than eating itself), this explanation is likely insufficient due to the fact that

positive correlations were revealed between baseline emotional eating and baseline BMI. Furthermore, a significant relationship was found between emotional eating at 12-month follow-up and BMI at 12-month follow-up. Similarly, previous studies have reported relationships between: 1) emotional eating and BMI (Keller & Siegrist, 2015); 2) decreased emotional eating and weight loss (Annesi, Mareno, & McEwan, 2016; Braden et al., 2016); and 3) urges to eat in response to emotions and self-reported binge eating episodes (Arnow et al., 1995). Further support for this relationship has been demonstrated by previous researchers who have found that self-reported eating in response to feelings of anxiety significantly and moderately predicts food consumption when observed behaviourally in a laboratory setting (Schneider et al., 2012). Taken together, these results suggest that the urge to eat in response to emotions does appear to correspond with food consumed in response to emotions.

Regarding the null relationship between difficulties with emotion regulation and emotional eating in the present study, it is possible that individuals who are obese may not always be aware of, or have insight into, their urges to eat in response to emotions. As such, scores on this measure may be under-reported in the present study. This interpretation is consistent with previous literature described above indicating increased difficulties with interoceptive awareness and emotional awareness in obese samples of individuals when compared to non-obese samples. That is, because obese individuals may experience deficits with emotional awareness and interpretations of bodily sensations, they may experience corresponding deficits in the awareness of their desire or urges to eat in response to emotions – eating in response to emotions may be automatic and unconscious rather than intentional and conscious. At this time, this interpretation is

purely speculative; future research examining the relationship between emotional eating and urges to eat in response to emotions is warranted to further elucidate this finding.

The fourth objective of this study was to evaluate whether individuals who reported engaging in binge-eating would exhibit greater difficulties in emotion regulation than individuals who did not report engaging in binge-eating. The results of this analysis revealed that, contrary to expectations, there were no differences in emotion regulation difficulties between "binge-eaters" and "non-binge-eaters." This unexpected finding can be interpreted in a number of ways. First, this finding may be interpreted as evidence against the emotion regulation model of binge eating or over-eating. However, this interpretation is unlikely given that participants in this sample reported elevated rates of difficulties with emotional awareness and clarity when compared to a non-clinical undergraduate sample. Another possible explanation for the null findings between binge-eating and difficulties with emotion regulation relates to the relatively small percentage of participants in the present study who reported engaging in binge eating episodes. Specifically, only 38.70% ($N = 29$) of the sample met "binge-eater" classification, while 61.30% ($N = 46$) of participants fell into the "non-binge-eater" category. Similarly, the mean number of binge eating episodes reported by participants who endorsed binge eating was quite low (i.e., 3.9 binge-eating episodes per month). The frequency of binge-eating episodes reported in the present study is low when compared to both the mean number of binge-eating episodes reported by participants meeting DSM-5 criteria for binge eating disorder (e.g., Manasse et al., 2016; Masheb et al., 2016), as well as when compared to the mean number of binge-eating episodes reported by comparable community samples of participants (e.g., Herbozo, Schaefer, & Thompson, 2015; Kelly,

Cotter, & Mazzeo, 2014). For example, in their study of a community sample of undergraduates, Kelly and colleagues (2014) reported a mean binge-frequency of 5.88 episodes per month; and in their study of overweight and obese women endorsing binge-eating, Herbozo and coleagues (2015) reported a mean binge-frequency of 9.07 per month. Taken together, these findings indicate that participants recruited for the present study exhibited fewer episodes of binge eating when compared to comparable samples and, accordingly, may represent a group of individuals who exhibit fewer overall symptoms of eating pathology.

It is important to note that while there were no statistically significant differences in difficulties with emotion regulation between "binge-eaters" and non-binge-eaters," a moderate effect size was yielded between "binge-eaters" and "non-binge-eaters" on difficulties with emotional awareness and difficulties with emotional clarity. These findings suggest that with a larger sample size and greater statistical power, significant differences may have been found. Specifically, individuals who engaged in binge-eating may have reported fewer difficulties with emotional awareness and clarity than individuals who did not engage in binge-eating because binge-eating may have functioned as a maladaptive strategy to cope with these difficulties.

Overall, while participants in this study reported significantly greater deficits in emotional awareness and emotional clarity when compared to an undergraduate clinical sample, as well as comparable deficits in emotional awareness when compared to AN-R and AN-BP samples (See Study one), baseline emotion regulation difficulties were not associated with six-month and 12-month emotional eating scores or baseline-to-12-month increases in BMI. Furthermore, among participants in this study, regainer status was

associated with a higher probability of engaging in binge-eating than not engaging in binge-eating. However, "weight-gainers" did not report significantly greater difficulties with emotion regulation than "non-regainers." While these unexpected findings may be due to study specific variables such as those listed above, an alternative explanation of the results is that difficulties with emotion regulation may not play a significant role in the etiology or maintenance of obesity. However, more consistent with previous research demonstrating the role of emotion regulation difficulties in obesity and binge eating (Book & Berant, 2014; Kenny, Singleton, & Carter, 2017; Rommel et al., 2012; Whiteside et al., 2007; Wiser & Telch, 1999) is the possibility that difficulties with emotion regulation predict who will become obese, but not necessarily who will regain weight versus who will maintain the loss.

Although many of the study's findings are inconsistent with the hypotheses, it is important to note that participants in this study are a non-clinical sample. When conceptualized this way, the null results yielded in the present study may be interpreted as meaningful, and consistent with recent developments in the eating behaviours literature. Specifically, *Health at Every Size (HAES),* a theory introduced and promoted by the Association for Size Diversity and Health, maintains that the current stance towards weight and health is problematic and empirically lacking (WHO, 2009). Proponents of this theory have argued that while obesity is associated with a variety of health conditions and complications, BMI is a crude estimate of obesity that neglects the influences of body fat distribution and muscle mass. Furthermore, proponents of the theory emphasise the paucity of longitudinal research in this area, arguing that while obesity and health may be

negatively correlated, it is not clear whether obesity actually *causes* poor health (Campos, 2011).

Proponents of the HAES theory argue that while there is some evidence for a negative association between obesity and health, there is also evidence to disconfirm this association. For example, in their study comparing obese and "normal-weight" individuals, Wildman, Muntner, and Reynolds (2008) found that 31.7% of obese individuals met classification for "metabolic wellness" or "fitness," while only 23.5% of "normal-weight" individuals were deemed metabolically fit. Further evidence has demonstrated that weight and health are non-mutually exclusive; and researchers have found that rates of cardiovascular disease are higher among "normal-weight" individuals who endorse less frequent and intense engagement in physical activity than among obese individuals who endorse more frequent and intense engagement in physical activity (Blair & Church, 2008). Taken together, these findings suggest that, simply knowing that an individual is obese (i.e., has a BMI ≥ 30), does not provide sufficient information about their physical or psychological health.

When applied to the current study, proponents of the *Health at Every Size* model might argue that the results are not unexpected but rather are consistent with the underlying theory – it is not possible to predict psychological concerns based *solely* on an individual's BMI. Participants in this study reported symptoms of depression, anxiety, and stress that were in the "normal," non-clinical range (Lovibond & Lovibond, 1995); and, as such, there may be no reason to expect elevated symptoms of psychological distress, including difficulties with emotion regulation and emotional eating. Indeed, the present findings are consistent with the results of Leehr and colleagues' (2015) systematic

review demonstrating that negative emotions triggered binge eating in a group of obese individuals *with BED*, but did not trigger binge eating in a group of obese individuals *without BED* (Leehr et al., 2015). Taken together, the null findings revealed in the present study emphasise the need to avoid pathologizing obesity. Alternatively, a movement towards the extrication of health and weight may be necessary.

Limitations and Future Directions

The current study had a number of limitations. First, self-report questionnaire measures were used to assess eating behaviors and recent weight loss statistics. As mentioned in study one, previous research has shown that self-report questionnaires are somewhat less reliable than interview or laboratory measures of these symptoms (Carter, Aime, & Mills, 2001). It is important to note, however, that scores on self-report measures are often good predictors of observed behaviours (Schneider et al., 2012). For example, as mentioned previously, self-reported emotional eating scores have been found to significantly and positively predict observed eating in response to emotions (Schneider et al., 2012). Nevertheless, future research may benefit from a replication of this study employing interview or laboratory measures of eating behaviors and recent weight loss statistics.

Second, this study employed a single cohort design. As such, it is important to be cautious when interpreting the results and to refrain from making causal inferences. Third, as mentioned previously, participants in this study were only followed for a one-year interval; if participants had been followed longer, a greater increase in BMI would likely have been observed. Accordingly, a replication of this study using a longer follow-up period is warranted. Fourth, as referenced above, this study was conducted using a

non-clinical community sample of individuals. It will be important for future studies to

replicate these analyses in a sample of obese individuals with BED. Fifth, due to

challenges with participant recruitment, a relatively small sample size was used for the

present study. It is important to note that the results of the present study may have been

impacted by the sample size. For example, had the sample size been larger, the

moderately sized discrepancy in emotional clarity and awareness between "binge-eaters"

and "non-binge-eaters" may have reached statistical significance. Future studies should

strive to examine relationships as they exist within a larger sample.

A final limitation to the present study is the possibility of low external validity.

Because the results of the present study were obtained from a very specific sample of

individuals, they may not generalize to the population as a whole. That is, participants in

the current sample were predominantly middle-to-upper class citizens, highly educated,

and Caucasian (94.6%). In addition, they were recruited from a relatively narrow

geographic area. Future studies should strive to examine these relationships as they exist

in larger samples recruited from broader areas that are less educated, more ethnically

diverse, and composed of equal sizes of males and females to determine whether the

results remain consistent.

Study Implications

Although measurement limitations must be kept in mind when interpreting the

findings of this study and, as such, results must be discussed tentatively, the results

yielded here may propose a number of suggestions for interpreting and addressing obesity

in the community. Currently, the most common treatment for obesity is dieting, or the

extreme restriction of caloric intake (Mann et al., 2007). Current weight-loss programs

focus predominantly, if not exclusively, on eating behaviours, with a particular emphasis on food restriction. While dieting is associated with significant (i.e., an average of 5-10% of body weight) weight loss (Perri & Fuller, 1995), ample research has demonstrated that losses obtained by dieting are not maintained in the long term (Mann et al., 2007). Although participants in the current study maintained (and in some cases, continued losing) weight, as described in the studies above, losses are not typically maintained over longer durations. Thus, as a result of the current inadequate first-line treatment option for obesity, combined with the elevated difficulties with emotional awareness and emotional clarity reported by participants in this study, weight-loss maintenance programs may benefit from incorporating elements of emotion-focused training into their design. Helping individuals who have lost weight to accurately identify, label, and discern between emotions (e.g., anxiety) and other interoceptive sensations (e.g., hunger) may improve their long-term efforts at weight-loss maintenance.

Second, findings of the present study suggest that the current perspective towards health and BMI may be problematic. While it would be unwise to dismiss research demonstrating the negative consequences and complications of obesity altogether, it would be equally unwise to take these findings at face value without a critical examination and analysis of the results. As mentioned previously, the negative relationship between obesity and physical health reported in many studies may be inflated as a result of confounding variables such as the rate of one's physical activity, an individual's muscle mass and body weight distribution, and the psychological and emotional consequences of stigma experienced by individuals who are obese. The current view towards obesity conveys the message that, to be healthy, obese individuals must lose

weight. As an alternative perspective, it may be prudent to emphasize the growing literature demonstrating the de-emphasis of BMI on overall health status after controlling for associated health-related variables.

Overall Summary and Conclusions

Emotion regulation – that is, the ability to experience, differentiate, and accept emotions; implement strategies to attenuate and modulate emotions; and express emotions in an adaptive manner – is a psychological construct that has been associated with several psychological disorders (Chapman, Dixon-Gordon, & Walters, 2011; Hofmann et al., 2012; Lavasani, & Erami, 2015; Sharp et al., 2011). Recently, theoretical and empirical evidence suggest that difficulties with emotion regulation may be an important underlying factor in the onset and maintenance of eating disorders (e.g., Pearson, Wonderlich, & Smith, 2015). While some eating disorders, such as BN, have been strongly linked with emotional underregulation (i.e., an inability to control emotional impulses), other eating disorders, such as AN, have been more robustly associated with emotional overregulation (i.e., an inexpression or inhibition of emotions) (Lynch, 2013; van Dijke, 2012).

The purpose of the present dissertation was to examine the role of difficulties with emotion regulation in a treatment-seeking inpatient sample of individuals with AN as well as a non-clinical community sample of individuals who were obese. While obesity is not an eating disorder, it has been linked with constructs commonly reported by individuals with eating disorders such as deficits in interoceptive awareness, or difficulty recognizing emotional states and discriminating between sensations (e.g., hunger) and emotions (Fassino et al., 2004; Lundstedt et al., 2006), as well as body dissatisfaction, dietary restraint, and overvaluation of weight and shape (Rø, Reas, & Rosenvinge, 2012). Thus,

the overall aim of this dissertation was to examine emotion regulation deficits across both ends of the eating continuum (i.e., undereating vs. overeating) and to explore potential overlapping and unique features across participant groups.

When combined, the results of the current studies revealed that both the obese sample and the AN samples (i.e., AN-R and AN-BP) exhibited deficits in emotional awareness, thus suggesting that this psychological construct may be a common phenotype. Accordingly, consistent with previous research (e.g., Fassino et al., 2004; Lundstedt et al., 2006; Raccine & Wildes, 2013), results from the current study suggest that AN and obesity may be associated with a vulnerability to dysregulated emotions including impaired abilities to experience and differentiate emotions. Furthermore, the findings of study one propose that recovery from AN (including successful weight-gain maintenance) may be associated with the development or strengthening of emotion regulation skills. Conversely, the results of study two did not support the role of emotion regulation skills in successful weight loss maintenance among an obese sample. It may be that this is a population for whom different mechanisms are involved in eating-related concerns. As such, future researchers may want to examine other factors that might contribute to weight loss maintenance among obese individuals who have lost weight. For example, given the propensity for obese individuals to engage in dichotomous thinking (e.g., viewing attempts to diet as either successes *or* failures; thinking of things in 'black and white' terms; Antoniou, Bongers, & Jansen, 2017), it may be important to further examine the role of dichotomous thinking in weight regain among obese individuals who have recently lost weight.

Overall, increasing emotion awareness and improving the ability to tolerate distress, discern between emotions and other bodily sensations such as hunger, and engage in adaptive behaviors when distressed may be an important part of overcoming AN and addressing obesity. Future research should conduct randomized controlled studies to examine whether integrating emotion regulation skills training into existing treatments for AN and obesity improves outcome.

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Appendix A: Eating Disorder Examination – Interview

EATING DISORDER EXAMINATION
(Edition 16.0D)

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THE INTERVIEW SCHEDULE

ORIENTATION TO THE TIME PERIOD

What we are going to do is a partially structured interview in which I will ask you about your eating habits and your feelings about your shape, and weight. Because a standard set of questions is going to be asked, please note that some may not apply to you.

Most of the questions focus on the past four weeks (that is, the last 28 days), but there will be some that extend out to cover the previous three months. I know this will test your memory because the weeks tend to blend together.

What I have done to help you is to make this calendar for the last 28 days [show the blank calendar - see below]; it ends on yesterday because today is not over yet. So it goes from yesterday (day and date) to (day and date). I know it seems strange to have the weekends in the middle, but that is just the way it has worked out.

And here are the dates for the two months before that, (date) to (date). And to help you remember these periods, I have noted down the holidays (e.g., May Bank Holiday, Thanksgiving).

What I would like you to do now is tell me about any events that have happened in the past 28 days since this will help us discuss these four weeks. Have there been any events out of the ordinary .... such as celebrations of any type, trips away or days off work? Then we can note these down on the calendar.

[These should be noted on the calendar (see Table A.2) thereby allowing the interviewer and participant to use it as an aide memoire.]

TABLE A.2 TO FOLLOW ON NEXT PAGE

INTRODUCTORY QUESTIONS

[Having oriented the participant to the specific time period being assessed, it is best to open the interview by asking a number of introductory questions designed to obtain a general picture of the participant's eating habits. Suitable questions are suggested below.]

To begin with I should like to get a general picture of your eating habits over the last four weeks. What has been your usual eating pattern?

Have your eating habits varied much from day to day?

Have weekdays differed from weekends?

[The definition (and number) of weekdays and weekend days that best fits the patient's lifestyle needs to be established at this point (e.g., check if the participant's days off work regularly fall on weekdays).]

Have there been any days when you haven't eaten anything?

[Ask about months 2 and 3]

What about the previous two months (specify months) .... Were your eating habits much the same or were they different?

PATTERN OF EATING

*I would like to ask about your pattern of eating. Over the past four weeks which of these meals or snacks have you eaten on a regular basis?

- breakfast   [   ]
- mid-morning snack   [   ]
- lunch (mid-day meal)   [   ]
- mid-afternoon snack   [   ]
- evening meal   [   ]
- evening snack   [   ]
- nocturnal eating (i.e., an episode of eating after the participant has been to sleep)   [   ]

[Rate each meal and snack separately, usually accepting the participant's classification (within the guidelines above). Ask about weekdays and weekends separately. Meals or snacks should be rated even if they lead on to a "binge". "Brunch" should generally be classed as lunch. With the exception of nocturnal eating, rate up (i.e., give a higher rating) if it is difficult to choose between two ratings. Rate 8 if meals or snacks are difficult to classify (e.g., due to shift work).]

0 - Meal or snack not eaten
1 - Meal or snack eaten on 1 to 5 days
2 - Meal or snack eaten on less than half the days (6 to 12 days)
3 - Meal or snack eaten on half the days (13 to 15 days)
4 - Meal or snack eaten on more than half the days (16 to 22 days)
5 - Meal or snack eaten almost every day (23 to 27 days)
6 - Meal or snack eaten every day

[If participants report having had episodes of nocturnal eating, ask about their level of awareness (alertness) at the time and their recall of the episodes afterwards.]

When you ate ..... how awake were you and how well could you recall the episode the next day?

          0 - no nocturnal eating
          1 - nocturnal eating with no impairment of awareness (alertness) or recall
          2 - nocturnal eating with impairment of awareness (alertness) or recall

                                                                                                          [   ]

PICKING (NIBBLING)

*Over the past four weeks have you picked at (nibbled) food between meals and snacks. By "picking" (nibbling) I mean eating in an unplanned and repetitious way.

What about when cooking?

What have you typically eaten at these times?

Why would you not call these episodes snacks?

Have you known in advance how much you were going to eat?

[Rate the number of days on which picking (nibbling) has occurred. To count as picking (or nibbling) the episode of eating should have been unplanned, the amount eaten should have been uncertain at the time that the episode started, and the eating should have had a repetitious element to it. Typically what is eaten is incomplete (i.e., it constitutes part of something or a less-than-usual amount), but the total amount consumed should not have been minute (e.g., not simply one edge of a piece of toast). In general, participants themselves should view the episodes as examples of "picking" ("nibbling").

Picking (nibbling) may be contrasted with eating a "snack". A snack is an episode of eating in which the amount eaten was modest (smaller than a meal), known at the outset with some certainty, and did not have the repetitious element associated with picking. Episodes of picking which merge into snacks, meals or "binges" should not be rated. The rating of picking may require the re-rating of snacks.]

0 - No picking (nibbling)
1 - Picking (nibbling) on 1 to 5 days
2 - Picking (nibbling) on less than half the days (6 to 12 days)
3 - Picking (nibbling) on half the days (13 to 15 days)
4 - Picking (nibbling) on more than half the days (16 to 22 days)
5 - Picking (nibbling) almost every day (23 to 27 days)
6 - Picking (nibbling) every day   [ ]

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RESTRAINT OVER EATING   (Restraint subscales)

*Over the past four weeks have you been <u>consciously</u> <u>trying</u> to restrict (cut back) the overall amount that you eat, whether or not you have succeeded?

What have you been trying to do?

Has this been to influence your shape or weight, or to avoid triggering an episode of overeating?

[Rate the number of days on which the participant has *consciously attempted* to restrict his or her *overall* food intake (i.e., energy intake), whether or not he or she has succeeded. The restriction should have affected a *range of food items* and not just certain specific foods (c.f., "Food avoidance"). This restriction should have been intended either to influence shape, weight or body composition, or to avoid triggering an episode of overeating, although this may not have been the sole or main reason. It should have consisted of planned attempts at restriction, rather than spur-of-the-moment attempts such as the decision to resist a second helping.]

0 - No attempt at restraint
1 - Attempted to exercise restraint on 1 to 5 days
2 - Attempted to exercise restraint on less than half the days (6 to 12 days)
3 - Attempted to exercise restraint on half the days (13 to 15 days)
4 - Attempted to exercise restraint on more than half the days (16 to 22 days)
5 - Attempted to exercise restraint almost every day (23 to 27 days)
6 - Attempted to exercise restraint every day   [ ]

Some people <u>consciously</u> try to restrict their eating for another reason - to give them a sense of being control - of being in control in general.

Over the past four weeks has this applied to you?

[Rate again <u>only</u> taking this reason into account.]   [ ]

[Also rate number of days on which one or other, or both, of these reasons has applied.]
                              [ ]

AVOIDANCE OF EATING (Restraint subscales)

*Over the past four weeks have you gone for periods of eight or more <u>waking</u> hours without eating anything?

Has this been to influence your shape or weight, or to avoid triggering an episode of overeating?

[Rate the number of days on which there has been at least eight hours abstinence from eating food (soup and milkshakes count as food, whereas drinks in general do not) during waking hours. It may be helpful to illustrate the length of time (e.g., 9 a.m. to 5 p.m.). The abstinence must have been at least partly *self-imposed* rather than being due to force of circumstances. It should have been intended to influence shape, weight or body composition, or to avoid triggering an episode of overeating, although this may not have been the sole or main reason (i.e., fasting for religious or political reasons would not count). Note that the rating should be consistent with those made earlier for "Pattern of eating".]

0 - No such days
1 - Avoidance on 1 to 5 days
2 - Avoidance on less than half the days (6 to 12 days)
3 - Avoidance on half the days (13 to 15 days)
4 - Avoidance on more than half the days (16 to 22 days)
5 - Avoidance almost every day (23 to 27 days)
6 - Avoidance every day   [ ]

Some people avoid eating in this way ..... for eight or more waking hours ..... for another reason - to give them a sense of being control - of being in control in general.

Over the past four weeks has this applied to you?

[Rate again <u>only</u> taking this reason into account.]   [ ]

[Also rate number of days on which one or other, or both, of these reasons has applied.]
                                                                [ ]

EMPTY STOMACH   (Restraint subscales)

*Over the past four weeks have you wanted your stomach to <u>be empty</u>?

Has this been to influence your shape or weight, or to avoid triggering an episode of overeating?

[Rate the number of days on which the participant has had a *definite desire* to have a completely empty stomach for reasons to do with dieting, shape or weight. This desire should not simply be a response to episodes of perceived overeating; rather, it should exist between any such episodes. The rating of "Empty stomach" should not be confused with a desire for the stomach to *feel empty* or *be flat* (c.f., "Flat stomach".]

0 - No definite desire to have an empty stomach
1 - Definite desire on 1 to 5 days
2 - Definite desire on less than half the days (6 to 12 days)
3 - Definite desire on half the days (13 to 15 days)
4 - Definite desire on more than half the days (16 to 22 days)
5 - Definite desire almost every day (23 to 27 days)
6 - Definite desire every day   [ ]

Some people want to have an empty stomach for another reason - to give them a sense of being control - of being in control in general.

Over the past four weeks has this applied to you?

[Rate again <u>only</u> taking this reason into account.]   [ ]

[Also rate number of days on which one or other, or both, of these reasons has applied.]
                                                                                            [ ]

FOOD AVOIDANCE   (Restraint subscales)

*Over the past four weeks have you <u>tried</u> to avoid eating any foods which you like, whether or not you have succeeded?

What foods? Have you been attempting to exclude them altogether?

Has this been to influence your shape or weight, or to avoid triggering an episode of overeating?

[Rate the number of days on which the participant has *actively attempted to avoid eating specific foods* (which he or she likes, or has liked in the past) whether or not he or she succeeded. The goal should have been to *exclude the foods altogether* and not merely to restrict their consumption. Drinks do not count as food. The avoidance should have been planned and intended either to influence shape, weight or body composition, or to avoid triggering an episode of overeating, although this may not have been the sole or main reason.]

0 - No attempts to avoid foods
1 - Attempted to avoid foods on 1 to 5 days
2 - Attempted to avoid foods on less than half the days (6 to 12 days)
3 - Attempted to avoid foods on half the days (13 to 15 days)
4 - Attempted to avoid foods on more than half the days (16 to 22 days)
5 - Attempted to avoid foods almost every day (23 to 27 days)
6 - Attempted to avoid foods every day   [ ]

Some people avoid eating certain foods for another reason - to give them a sense of being control - of being in control in general.

Over the past four weeks has this applied to you?

    [Rate again <u>only</u> taking this reason into account.]   [ ]

[Also rate number of days on which one or other, or both, of these reasons has applied.]
                                                                                [ ]

DIETARY RULES   (Restraint subscales)

*Over the past four weeks have you tried to follow certain <u>definite</u> rules regarding your eating; for example, a calorie limit, pre-set quantities of food, or rules about what you should - or should not - eat, or when you should eat? What have you been trying to do?

If answered negatively:
Have there been occasions when you have been aware that you may have broken a dietary
     rule that you have set for yourself?
Have these rules been designed to influence your shape or weight, or to avoid triggering an
     episode of overeating?
Have they been definite rules or general guidelines? Examples of definite rules would be "I
     must not eat eggs" or "I must not eat cake", whereas you could have the general
     guideline "I should try to eat healthy food".

[Dietary rules should be rated as present if the participant has been attempting to follow "definite" (i.e., specific) dietary rules regarding his or her food intake. The rules should be self-imposed, although originally they may have been prescribed (i.e., prescribed rules can be rated if they have been adopted by the participant). They should have concerned what the participant should have eaten or when eating should have taken place. They might consist of a calorie limit (e.g., below 1,200 kcals), not eating before a certain time of day, not eating specific foods (c.f., "Food avoidance") or not eating at all. They should have been specific rules and not general guidelines. If the participant is aware that he or she has occasionally broken a personal dietary rule, this indicates that one or more specific rules has been present. In such cases the interviewer should ask in detail about the transgression in an attempt to identify the underlying rule. The rules should have been intended to influence shape, weight or body composition, although this may not have been the sole or main reason.
Rate 0 if no dietary rule can be identified. If there has been more than one rule straddling different time periods within the four weeks, these periods should be combined to make the rating.]

0 - Has not attempted to obey such rules
1 - Attempted to obey such rules on 1 to 5 days
2 - Attempted to obey such rules on less than half the days (6 to 12 days)
3 - Attempted to obey such rules on half the days (13 to 15 days)
4 - Attempted to obey such rules on more than half the days (16 to 22 days)
5 - Attempted to obey such rules almost every day (23 to 27 days)
6 - Attempted to obey such rules every day   [ ]

Some people attempt to follow dietary rules for another reason - to give them a sense of being control - of being in control in general. Over the past four weeks has this applied to you?
[Rate again <u>only</u> taking this reason into account.]   [ ]
[Also rate number of days on which one or other, or both, of these reasons has applied.]
                                                                               [ ]

PREOCCUPATION WITH FOOD, EATING, OR CALORIES

(Eating Concern subscale)

*Over the past four weeks have you spent much time between meals thinking about food, eating, or calories?.......

*..... Has thinking about food, eating, or calories underlined interfered with your ability to concentrate on things that you are actively engaged in, for example, working, following a conversation or reading? What has it affected?

[This definition of preoccupation requires the presence of concentration impairment. Concentration is regarded as impaired if there have been *intrusive thoughts about food, eating, or calories which have interfered with activities one is actively engaged in* rather than one's mind simply drifting off the matter at hand. Rate the number of days on which this has happened, whether or not bulimic episodes occurred.]

0 - No concentration impairment
1 - Concentration impairment on 1 to 5 days
2 - Concentration impairment on less than half the days (6 to 12 days)
3 - Concentration impairment on half the days (13 to 15 days)
4 - Concentration impairment on more than half the days (16 to 22 days)
5 - Concentration impairment almost every day (23 to 27 days)
6 - Concentration impairment every day   [ ]

FEAR OF LOSING CONTROL OVER EATING

(Eating Concern subscale)

*Over the past four weeks have you been afraid of losing control over eating?

[Rate the number of days on which a *definite fear* (common usage) of losing control over eating has been present, irrespective of whether the participant has felt he or she has been in control. *"Loss of control" involves a sense that one will not be able to resist or stop eating.* If the participant feels unable to answer this question because he or she has already totally lost control, rate 9.]

0 - No fear of losing control over eating
1 - Fear of losing control over eating present on 1 to 5 days
2 - Fear of losing control over eating present on less than half the days (6 to 12 days)
3 - Fear of losing control over eating present on half the days (13 to 15 days)
4 - Fear of losing control over eating present on more than half the days (16 to 22 days)
5 - Fear of losing control over eating present almost every day (23 to 27 days)
6 - Fear of losing control over eating present every day   [ ]

BULIMIC EPISODES AND OTHER EPISODES OF OVEREATING

(Diagnostic item)

Classificatory Scheme
[Four forms of episodic "overeating" are distinguished. The distinction is based upon the presence or absence of two characteristics:

    i) **loss of control** (required for both types of "bulimic episode")

    ii) **the consumption of what would generally be regarded as a "large" amount of food** (required for "objective bulimic episodes" and "objective overeating").

The classificatory scheme is summarised below.

	"Large" amount eaten (EDE definition)	Amount eaten not "large" but viewed by participant as excessive
"Loss of control" present	Objective bulimic episodes	Subjective bulimic episodes
No "loss of control"	Objective overeating	Subjective overeating

Guidelines for Proceeding Through the Overeating Section
The interviewer should ask about each form of overeating. It is important to note that *the four forms of overeating are not mutually exclusive*: it is possible for participants to have had several different forms within the time period being considered. With some participants it is helpful to explain the classificatory scheme.

There are five steps in making this series of ratings:
1.   In general it is best to start by asking the asterisked questions to identify the various types of perceived or true overeating that have occurred over the previous 28 days.
2.   Each form should be noted down on the blank section of the coding sheet.
3.   Then, detailed information should be obtained about a *representative example* of each form of overeating to decide whether or not it involved eating a "large" amount of food and whether or not there was "loss of control" (as defined below).
4.   The next task is to establish for each form of overeating the number of days on which it occurred and the total number of occasions. Where there is possibility of overlap (i.e., two types of episode may have occurred on the same day, this should be clarified since this will affect the "days" ratings).
5.   Finally, check with the participant to ensure that no misunderstandings have arisen (e.g., that no types of episode have been omitted).

It is advisable to make comprehensive notes.

Definition of Key Terms
"Loss of control". The interviewer should ask the participant whether he or she experienced a

sense of loss of control over eating at any point in the episode. If this is clearly described, "Loss of control" should be rated as present. Similarly, if the participant describes having felt "driven" or "compelled" to eat, "Loss of control" should be rated as present.

If the participant reports having had no sense of loss of control yet describes having felt unable to stop eating once eating had started or having felt unable to prevent the episode from occurring, "Loss of control" should be rated as present. If participants report that they are no longer trying to control their eating because overeating is inevitable, "Loss of control" should once again be rated as present. Thus "Loss of control" may be rated positively even if the episode had been planned (i.e., the participant knew that he or she was going to overeat and had made provision for this).

The decision whether or not "loss of control" was present should be made by the interviewer; it does not require the agreement of the participant. If the interviewer remains in doubt, "Loss of control" should be rated as absent.

"Large amount of food". The decision whether or not the amount eaten was "large" should also be made by the interviewer; it does not require the agreement of the participant. The notion of "large" may refer to the amount of any particular type of food consumed or the overall quantity of food eaten. The amount should have been unequivocally large but it does not have to have been enormous. In deciding whether the amount was "large", *the interviewer must take into account what would be the usual amount eaten under the circumstances.* This requires some knowledge of the eating habits of the participant's general, but not necessarily immediate, social group (e.g., those of female students, women in their 50s) as well as circumstances that tend to influence eating (e.g., Thanksgiving Day, Christmas Day). What else was eaten during the day is not taken into account when making this rating, nor is the speed of eating or whether or not the participant subsequently spat out or vomited the food.

If the interviewer remains in doubt, the amount should not be classified as "large".

Interviewers should not share with the patient their view on the amount eaten and they should avoid using potentially emotive terms such as such as "binge" and "large".

The number of episodes of overeating. When calculating the number of episodes of overeating, the participant's definition of separate episodes should be accepted unless, within a period of eating, there was an hour or more when the participant was not eating. In this case the initial episode should be regarded as having been completed. An exception is if the episode was temporarily interrupted by an outside event and then restarted afterwards, and it was experienced as one single episode (somewhat like operating the pause button on a recorder). When estimating the length of any gap, do not count the time spent vomiting. *Note that "purging" (self-induced vomiting or laxative misuse) is not used to define the end of individual episodes of overeating.*]

QUESTIONS FOR IDENTIFYING BULIMIC EPISODES AND OTHER EPISODES OF OVEREATING

[See preceding section "Guidelines for Proceeding Through the Overeating Section". The asterisked questions should be asked in every case.]

Main Probe Questions (to get the overall picture)

*I would like to ask you about any episodes of overeating, or loss of control over eating, that you might have had over the past four weeks.

*Different people mean different things by overeating. I would like you to describe any times when you have <u>felt</u> that you have eaten, or might have eaten, too much at one time.

*And any times you have felt you have lost control over eating?

Additional Probe Questions

*Have there been any times when you have felt that you have eaten too much, but others might not agree?

*Have there been any times when you have felt that you have eaten an ordinary amount of food but others might have regarded you as having overeaten?

[N.B. For subjective bulimic episodes to be eligible, they must have been viewed by the participant as having involved eating an excessive amount of food (i.e., they involved "overeating").]

Subsidiary Probe Questions (to classify any episodes of overeating)

To assess the amount of food eaten:
Typically what have you eaten at these times?

For subjective bulimic episodes (i.e., where the amount is not viewed by the interviewer as "large")
Did you view this amount as excessive?

To assess the social context:
What were the circumstances?
What were others eating at the time?

To assess "loss of control":
Did you have a sense of loss of control at the time?
Did you feel you could have stopped eating once you had started?
Did you feel you could you have prevented the episode from starting?

[For objective bulimic episodes, subjective bulimic episodes and episodes of objective overeating the following two ratings should be made:
    i) number of days (rate 00 if none)
    ii) number of episodes (rate 000 if none)

In general, it is best to calculate the number of days first and then the number of episodes. Rate 777 if the number of episodes is so great that their frequency cannot be calculated. Episodes of subjective overeating are not rated.]

Objective bulimic episodes
days [ ][ ]
episodes [ ][ ][ ]

Subjective bulimic episodes
days [ ][ ]
episodes [ ][ ][ ]

Episodes of objective overeating
days [ ][ ]
episodes [ ][ ][ ]

[Ask about each of the preceding two months referring back to the relevant dates and any events of note. For objective and subjective bulimic episodes, rate the number of episodes over the preceding two months and the number of days on which they occurred. Rate 0s if none and 9s if not asked.]

Objective bulimic episodes
days - month 2 [ ][ ]
month 3 [ ][ ]

episodes - month 2 [ ][ ][ ]
month 3 [ ][ ][ ]

Subjective bulimic episodes
days - month 2 [ ][ ]
month 3 [ ][ ]

episodes - month 2 [ ][ ][ ]
month 3 [ ][ ][ ]

[Also rate the longest continuous period in weeks free (not due to force of circumstances) from objective bulimic episodes over the past three months. Rate 99 if not applicable.]

[ ][ ]

DSM-IV "BINGE EATING DISORDER" MODULE

[Only enter this DSM-IV module if objective bulimic episodes have been present over the preceding 12 weeks. Use a respondent-based interviewing style, rather than the investigator-based style of the EDE.]

In line with the DSM-IV research criteria for "binge eating disorder", a six-month assessment needs to be made of the number of *days* (NB: not episodes) on which objective bulimic episodes have occurred. Therefore, having focused initially on the preceding two 28-day months (months 2 and 3), the interviewer needs to move back to the three earlier 28-day months (months 4 to 6). To help patients recall this far back, they need to be told the specific dates in question. They also need help to recall the specific time period (along the lines specified earlier).]

> *What about the three months prior to the three months that we have been talking about (specify the beginning and end dates)? ....
>
> .... Did you have episodes like .... (describe a representative objective bulimic episode)?
>
> Did you have any other equivalent episodes .... (refer, if applicable, to other types of objective bulimic episode that the participant reported)?
>
> Did they occur more or less often than in the past 28 days?
>
> Let's estimate together, on average over the past six months (specify months), how many days per week have you had episodes like .... (refer to the representative objective bulimic episode)?

[Estimate the average number of days per week on which objective bulimic episodes have occurred over the past six months (i.e., rate between 0 and 7). Rate 9 if not asked.]

[ ]

Features Associated with Binge Eating

[Only rate these items if, on average over the past six months, there have been at least two days per week on which episodes of binge eating have occurred. Otherwise rate 9.]

During these episodes (refer to objective bulimic episodes that are <u>representative</u> of those over the past six months), have you *typically* ....

... Eaten much more rapidly than normal? [ ]
... Eaten until you have felt uncomfortably full? [ ]
... Eaten large amounts of food when you haven't felt physically hungry? [ ]
... Eaten alone because you have felt embarrassed about how much you were eating? [ ]

... **Felt disgusted with yourself, depressed, or very guilty?**   [   ]

[Rate each feature individually using the binary scheme below.]
>   0 - Feature not present
>   1 - Feature present

Distress about Binge Eating

In general, over the past six months how distressed or upset have you felt about these episodes (refer to objective bulimic episodes that are <u>representative</u> of those over the past six months)?

[Rate the presence of marked distress about the binge eating. This may stem from the actual behaviour itself or its potential effect on body shape and weight.]
>   0 – No marked distress
>   1 – Marked

[   ]

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DIETARY RESTRICTION OUTSIDE BULIMIC EPISODES   (Diagnostic item)

[RETURN TO THE THREE-MONTH TIME FRAME and EDE STYLE OF QUESTIONING. Only rate this item if there have been at least 24 objective bulimic episodes over the past three months.]

Outside the times when you have lost control over eating ..... (refer to objective and subjective bulimic episodes), ... **how much have you been actually restricting (limiting) the amount that you eat? What have you eaten on a typical day?**

Has this been to influence your shape or weight?

[Ask about actual food intake outside the objective and subjective bulimic episodes. *Rate a typical day (whether or not it involves an episode of overeating)*. The dietary restriction should have been intended to influence shape, weight or body composition, although this may not have been the sole or main reason. Rate each of the past three months separately. Rate 9 if not asked.]

0 - No extreme restriction outside objective and subjective bulimic episodes
1 - Extreme restriction outside objective and subjective bulimic episodes
         (i.e., purposeful low energy intake (e.g., <1,200 kcals))
2 - No eating outside objective and subjective bulimic episodes (i.e., purposeful "fasting")

month 1 [ ]

month 2 [ ]

month 3 [ ]

SOCIAL EATING (Eating Concern subscale)

*Outside the times when ..... (refer to any objective bulimic episodes and episodes of objective overeating), over the past four weeks have you been concerned about other people seeing you eat?

How concerned have you been? Has this concern led you to avoid such occasions? Could it have been worse?

[NB: This is the first severity item. Rate the degree of concern about eating normal or less than normal amounts of food in front of others. *Do not consider objective bulimic episodes or episodes of objective overeating.* Also, do not consider concern restricted to family members who are aware that the participant has an eating problem. On the other hand the concern can stem from idiosyncratic eating habits (e.g., very slow eating; eating fewer courses than others; eating different types of food) or allied behaviour such as indecision when ordering in a restaurant. One index of the severity of such concern is whether it has led to avoidance. In common with all severity items, the rating should generally represent the *mode for the entire month*. If the possibility of eating with others has not arisen, rate 9.]

0 - No concern about being seen eating by others and no avoidance of such occasions.
1 -
2 - Has felt slight concern at being seen eating by others
3 -
4 - Has felt definite concern at being seen eating by others
5 -
6 - Has felt extreme concern at being seen eating by others   [ ]

EATING IN SECRET   (Eating Concern subscale)

*Outside the times when ..... (refer to any objective bulimic episodes and episodes of objective overeating), over the past four weeks have you eaten in secret?

[Rate the number of days on which there has been at least one episode of secret eating. *Do not consider objective bulimic episodes or episodes of objective overeating.* Secret eating refers to eating which is furtive and which the participant wishes to conceal because he or she does not want to be seen eating (i.e., it is not simply eating alone). Do not rate secrecy that stems from a desire not to be interrupted or a wish not to share food. Sensitivity about eating in front of others will have been rated under "Social eating" but it can result in eating in secret. If the possibility of eating with others has not arisen, rate 9.]

0 - Has not eaten in secret
1 - Has eaten in secret on 1 to 5 days
2 - Has eaten in secret on less than half the days (6 to 12 days)
3 - Has eaten in secret on half the days (13 to 15 days)
4 - Has eaten in secret on more than half the days (16 to 22 days)
5 - Has eaten in secret almost every day (23 to 27 days)
6 - Has eaten in secret every day   [ ]

GUILT ABOUT EATING   (Eating Concern subscale)

*Outside the times when ..... (refer to any objective and subjective bulimic episodes), over the past four weeks have you felt guilty after eating?

Have you felt that you have done something wrong? Why?

On what proportion of the times that you have eaten have you felt guilty?

[NB: This rating is based on occasions. Rate the *proportion of times* that feelings of guilt have followed eating. *Do not consider objective or subjective bulimic episodes,* but do consider other episodes of overeating. These feelings of guilt should relate to the effects of eating on shape, weight or body composition. *Distinguish guilt from regret:* guilt refers to a feeling that one has done wrong.]

0 - No guilt after eating
1 -
2 - Has felt guilty after eating on less than half the *occasions*
3 -
4 - Has felt guilty after eating on more than half the *occasions*
5 -
6 - Has felt guilty after eating on every *occasion*   [ ]

SELF-INDUCED VOMITING (Diagnostic item)

*Over the past four weeks have you made yourself sick as a means of controlling your shape or weight?

[Rate the number of discrete episodes of self-induced vomiting. If the participant denies that the vomiting is under his or her control, determine whether it has the characteristics that would be expected were it not self-induced (e.g., unpredictability, occurrence in public). If the available evidence suggests that the vomiting is under the participant's control (i.e., it is self-induced), then rate it as such. Accept the participant's definition of an episode. Rate 777 if the number of episodes is so great that it cannot be calculated. Rate 000 if no vomiting.]

[ ][ ][ ]

Outside the times when ..... (refer to objective and subjective bulimic episodes), over the past four weeks how many times have you made yourself sick as a means of controlling your shape or weight? ?

[Rate the number of episodes of "non-compensatory" self-induced vomiting. Accept the participant's definition of an episode. Rate 000 if no vomiting.]

[ ][ ][ ]

[Ask about the preceding two months. Estimate the number of discrete episodes of self-induced vomiting over each of the two preceding months.]

month 2 [ ][ ][ ]

month 3 [ ][ ][ ]

[Ask about the three months prior to that (to make diagnoses of binge eating disorder). Estimate the number of discrete episodes of self-induced vomiting over these three months.]

months 4 to 6 [ ][ ][ ]

LAXATIVE MISUSE   (Diagnostic item)

*Over the past four weeks have you taken laxatives as a means of controlling your shape or weight?

[Rate the number of episodes of laxative-taking as a means of controlling shape, weight or body composition. This should have been the *main* reason for the laxative-taking, although it may not have been the sole reason. Only rate the taking of substances with a true laxative effect. Rate 00 if there was no laxative use or there is doubt whether the laxative-taking was primarily to influence shape, weight or body composition.]

[ ][ ][ ]

[Rate the average number of laxatives taken on each occasion. Rate 999 if not applicable. Rate 777 if not quantifiable, e.g., use of bran.]

[ ][ ][ ]

[Note the type of laxative taken.]

Outside the times when ….. (refer to objective and subjective bulimic episodes), over the past four weeks how many times have you taken laxatives as a means of controlling your shape or weight? ?

[Rate the number of episodes of "non-compensatory" laxative misuse. Accept the participant's definition of an episode. Rate 000 if no laxative misuse.]

[ ][ ][ ]

[Ask about the preceding two months. Estimate the number of episodes of laxative misuse over each of the two preceding months.]

month 2 [ ][ ][ ]

month 3 [ ][ ][ ]

[Ask about the three months prior to that. Estimate the number of episodes of laxative misuse over these three months.]

months 4 to 6 [ ][ ][ ]

DIURETIC MISUSE   (Diagnostic item)

*Over the past four weeks have you taken diuretics as a means of controlling your shape or weight?

[Rate the number of episodes of diuretic-taking as a means of controlling shape, weight or body composition. This should have been the *main* reason for the diuretic-taking, although it may not have been the sole reason. Only rate the taking of substances with a true diuretic effect. Rate 00 if there was no diuretic use or there is doubt whether the diuretic-taking was primarily to influence shape, weight or body composition.]

[ ][ ][ ]

[Rate the average number of diuretic taken on each occasion. Rate 999 if not applicable.]

[ ][ ][ ]

[Note the type of diuretic taken.]

Outside the times when ..... (refer to objective and subjective bulimic episodes), over the past four weeks how many times have you taken diuretics as a means of controlling your shape or weight? ?

[Rate the number of episodes of "non-compensatory" diuretic misuse. Accept the participant's definition of an episode. Rate 000 if no diuretic misuse.]

[ ][ ][ ]

[Ask about the preceding two months. Estimate the number of episodes of diuretic misuse over each of the two preceding months..]

month 2 [ ][ ][ ]

month 3 [ ][ ][ ]

[Ask about the three months prior to that. Estimate the number of episodes of diuretic misuse over these three months.]

months 4 to 6 [ ][ ][ ]

DRIVEN EXERCISING   (Diagnostic item)

*Over the past four weeks have you exercised as a means of controlling your weight, altering your shape or amount of fat, or burning off calories?

*Have you felt driven or compelled to exercise?

Typically, what form of exercise have you taken? How hard have you exercised? Have you pushed yourself?

Have you exercised even when it might interfer with other commitments or do you harm?

Have there been times when you have been unable to exercise for any reason? How has this made you feel?

[Rate the number of days on which the participant has engaged in "driven" exercising. Such exercising should have been intense in character and have had a "compulsive" quality to it. The participant may describe having felt compelled to exercise. Other indices of this compulsive quality are exercising to the extent that it significantly interferes with day-to-day functioning (e.g. such that it prevents attendance at social commitments or it intrudes on work or exercising when it might do one harm (e.g., when possibly injured). Another suggestive feature is having a strong negative reaction to being unable to exercise. Only rate driven exercising that was *predominantly* intended to use calories or change shape, weight, or body composition. Exercising that was exclusively intended to enhance health or fitness should not be rated. Rate 00 if no such driven exercising.]

[ ][ ]

[Rate the *average* amount of time (in minutes) per day spent exercising in this way. Only consider days on which the participant has exercised. Rate 999 if no such exercising.]

[ ][ ][ ]

_____

[Ask about the preceding two months. Rate the number of days on which the participant has exercised in this manner over each of the two preceding months. If not asked, rate 99.]

month 2 [ ][ ]

month 3 [ ][ ]

_____

OTHER EXTREME WEIGHT-CONTROL BEHAVIOUR

*Over the past four weeks have you done anything else to control your shape or weight?

[Rate other noteworthy (i.e., potentially effective) dysfunctional forms of weight-control behaviour (e.g., spitting, insulin under-use, thyroid medication misuse). Rate number of days and nature of the behaviour. Rate 99 if no such behaviour.]

month 1 [ ] [ ]

month 2 [ ] [ ]

month 3 [ ] [ ]

PERIODS OF ABSENCE OF EXTREME WEIGHT-CONTROL BEHAVIOUR

[Only ask this question if at least one of the five main methods of weight-control behaviour has been rated positively at the specified severity level over the past three months (see the section on "Eating disorder diagnoses"). The five forms of behaviour are as follows:
    - fasting (rating of 1 or 2 on Dietary restriction outside bulimic episodes)
    - self-induced vomiting (on average at least once a week)
    - laxative misuse (on average at least once a week)
    - diuretic misuse (on average at least once a week)
    - driven exercise - ignore in this context]

Over the past three months has there been a period of two or more weeks when you have not ....

[Ask as for individual items. Ascertain the number of consecutive weeks over the past three months "free" (i.e., not above threshold levels) from all five forms of extreme weight-control behaviour. Do not rate abstinence due to force of circumstance. Rate 99 if not applicable.]

[ ] [ ]

I am now going to ask you some questions about your shape and weight ....

DISSATISFACTION WITH WEIGHT   (Weight Concern subscale)

*Over the past four weeks have you been dissatisfied with your weight (..... the number on the scale)? What has this been like?

Why have you been dissatisfied with your weight? Have you been so dissatisfied that it has made you unhappy? Could you have felt worse? How long has this feeling lasted?

[Only rate dissatisfaction due to weight being regarded as too high. Assess the participant's attitude to his or her weight and rate accordingly. In common with all severity items, the rating should generally represent the *mode for the entire month*. Only rate 4, 5 or 6, if there has been distress. Do not prompt with the terms "slight", "moderate" or "marked". This rating can be made with participants who do not know their exact weight. Only rate 9 with participants who are totally unaware of their weight.]

0 - No dissatisfaction
1 -
2 - Slight dissatisfaction (no associated distress)
3 -
4 - Moderate dissatisfaction (some associated distress)
5 -
6 - Marked dissatisfaction (extreme concern and distress; weight totally unacceptable)   [ ]

DESIRE TO LOSE WEIGHT   (Weight Concern subscale)

*Over the past four weeks have you wanted to weigh less (again I am referring to the number on the scale)?

Have you had a <u>strong desire</u> to lose weight?

[Rate the number of days on which there has been a *strong desire* to lose weight. This rating can be made with participants who do not know their exact weight. Only rate 9 with participants who are totally unaware of their weight.]

0 - No strong desire to lose weight
1 - Strong desire on 1 to 5 days
2 - Strong desire on less than half the days (6 to 12 days)
3 - Strong desire on half the days (13 to 15 days)
4 - Strong desire on more than half the days (16 to 22 days)
5 - Strong desire almost every day (23 to 27 days)
6 - Strong desire every day   [ ]

DESIRED WEIGHT

*On average, over the past month what weight have you wanted to be?

[Rate weight in kilograms. Rate 888 if the participant is not interested in his or her weight. Rate 777 if no specific weight would be low enough. Rate 666 if the participant is primarily interested in his or her shape but has some concern about weight (but not a specific weight). Rate 555 if cannot be rated.]

[ ][ ][ ]

WEIGHING
*Over the past four weeks how often have you weighed yourself?

[Calculate the approximate frequency that the participant has weighed himself or herself. If the participant has not weighed himself or herself determine whether this is the result of avoidance. Rate 777 if it is due to avoidance.]

[ ][ ][ ]

REACTION TO PRESCRIBED WEIGHING   (Weight Concern subscale)

*Over the past four weeks how would you have felt if you had been asked to weigh yourself once each week for the subsequent four weeks ..... just once a week; no more often and no less often?

[Rate the strength of negative reaction to the prospect of having to weigh once weekly (no more often, no less often) over the subsequent four weeks. This assumes that the participant would thereby be made aware of his or her weight. Positive reactions should be rated 9. In common with all severity items, the rating should generally represent the *mode for the entire month*. Ask the participant to describe in detail how he or she would have reacted and rate accordingly. Check whether other aspects of the participant's life would have been influenced. Do not prompt with the terms "slight", "moderate" or "marked". If the participant would not have complied with such weighing because it would have been extremely disturbing, rate 6.]

0 - No reaction
1 -
2 - Slight reaction
3 -
4 - Moderate reaction (definite reaction, but manageable)
5 -
6 - Marked reaction (pronounced reaction which would affect other aspects of the participant's life)

[ ]

SENSITIVITY TO WEIGHT GAIN

*Over the past four weeks what amount of weight gain, over a period of one week, would have definitely upset you?

[Ascertain what weight gain (from the participant's average weight over the past four weeks) would have led to a *marked negative reaction*. Check several numbers. Be particularly careful to code the number correctly. This should represent the average degree of sensitivity for the entire month.]

0 - 7 lb or 3.5 kg (or more) would have generated a marked negative reaction, or no amount of weight gain would generate this type of reaction
1 - 6 lb or 3 kg would have generated a marked negative reaction
2 - 5 lb or 2.5 kg would have generated a marked negative reaction
3 - 4 lb or 2 kg would have generated a marked negative reaction
4 - 3 lb or 1.5 kg would have generated a marked negative reaction
5 - 2 lb or 1 kg would have generated a marked negative reaction
6 - 1 lb or 0.5 kg (i.e., any weight gain) would have generated a marked negative reaction

[ ]

DISSATISFACTION WITH SHAPE   (Shape Concern subscale)

*Over the past four weeks have you been dissatisfied with your overall shape (your figure)? What has this been like?

Why have you been dissatisfied with your shape? Have you been so dissatisfied that it has made you unhappy? Could you have felt worse? How long has this feeling lasted?

[Only rate dissatisfaction with overall shape or figure because it is viewed as too large. This dissatisfaction may include concerns about relative proportions of the body but not dissatisfaction restricted to specific body parts. Do not rate concerns about body tone. Assess the participant's attitude to his or her shape and rate accordingly. In common with all severity items, the rating should generally represent the *mode for the entire month*. Only rate 4, 5, or 6, if there has been associated distress. Do not prompt with the terms "slight", "moderate" or "marked". Reports of disgust or revulsion should be rated 6.]

0 - No dissatisfaction with shape
1 -
2 - Slight dissatisfaction with shape (no associated distress)
3 -
4 - Moderate dissatisfaction with shape (some associated distress)
5 -
6 - Marked dissatisfaction with shape (extreme concern and distress; shape totally unacceptable)

[ ]

PREOCCUPATION WITH SHAPE OR WEIGHT
                                        (Shape and Weight Concern subscales)

*Over the past four weeks have you spent much time thinking about your shape or weight?.......

*..... Has thinking about your shape or weight <u>interfered</u> with your ability to concentrate on things that you are actively engaged in, for example, working, following a conversation or reading? What has it affected?

[This definition of preoccupation requires concentration impairment. Concentration is regarded as impaired if there have been *intrusive thoughts about shape or weight which have interfered with activities one is actively engaged in* rather than one's mind simply drifting off the matter at hand. Rate the number of days on which this has happened, whether or not bulimic episodes occurred.]

0 - No concentration impairment
1 - Concentration impairment on 1 to 5 days
2 - Concentration impairment on less than half the days (6 to 12 days)
3 - Concentration impairment on half the days (13 to 15 days)
4 - Concentration impairment on more than half the days (16 to 22 days)
5 - Concentration impairment almost every day (23 to 27 days)
6 - Concentration impairment every day   [ ]

IMPORTANCE OF WEIGHT, SHAPE AND STRICT CONTROL OVER EATING
(Diagnostic items, Weight and Shape Concern subscales)

<u>Weight</u>
*I am now going to ask you a rather complex question - you may not have thought about this before. Over the past four weeks has your <u>weight</u> (the number on the scale) been important in influencing how you feel about (judge, think, evaluate) yourself as a person?

......*If you imagine the things which influence how you feel about (judge, think, evaluate) yourself - such as (your performance at work, being a parent, your marriage, how you get on with other people) - and put these things in order of importance, where does your weight fit in?

(If, over the past four weeks, your weight had changed in any way, would this have affected how you felt about yourself?)

(Over the past four weeks has it been important to you that your weight does <u>not</u> change? Have you been making sure that it does not change?)

<u>Shape</u>
*What about your shape? How has it compared in importance with your weight in influencing how you feel about yourself?

[NB: Make all the unadjusted "shape" and "weight" ratings at this point.]

<u>Strict Control over Eating</u>
*What about <u>maintaining strict control</u> over your eating? How has it compared in importance with your weight and shape in influencing how you feel about yourself?

[First gauge the degree of importance the participant has placed on body weight and its position in his or her scheme for self-evaluation. The rating can be made with participants who do not know their exact weight - the importance of their presumed weight can be rated. To make the rating, comparisons need to be made with other aspects of the participant's life which are of importance in his or her scheme for self-evaluation (e.g., quality of relationships, being a parent, performance at work or in leisure activities) including body shape and maintaining strict control over eating. In common with all severity items, the rating should generally represent the *mode for the entire month*.

The three "Importance" items can be difficult to rate. It is best to start by discussing weight and then address shape. At this point ratings of the importance of weight and shape should be made. Then, maintaining strict control over eating should be added to the equation and the importance of all three domains rated (i.e., importance of weight and shape are rated twice).

When starting with weight, it is recommended that the two mandatory probe questions be asked in tandem. Then the interviewer should help the participant formulate his or her answer. After that it is good practice to repeat the two probe questions to ensure that the participant has fully

grasped the concept that is being assessed. The questions in brackets should only be asked if the participant is denying that weight is important yet his or her behaviour suggests otherwise. Do not prompt with the terms "some", "moderate" or "supreme".]

0 - No importance
1 -
2 - Some importance (definitely an aspect of self-evaluation)
3 -
4 - Moderate importance (definitely one of the main aspects of self-evaluation)
5 -
6 - Supreme importance (nothing is more important in the participant's scheme for self-evaluation)

Weight (unadjusted rating) [   ]

Shape (unadjusted rating) [   ]

[Ask about each of the preceding two months. Rate 9 if not asked.]

Weight (unadjusted) month 2 [   ]
Weight (unadjusted) month 3 [   ]
Shape (unadjusted) month 2 [   ]
Shape (unadjusted) month 3 [   ]

Maintaining strict control over eating [   ]

Weight (adjusted for strict control over eating) [   ]

Shape (adjusted for strict control over eating) [   ]

FEAR OF WEIGHT GAIN   (Diagnostic item, Shape Concern subscale)

*Over the past four weeks have you been <u>afraid</u> that you might gain weight?

[With participants who have recently gained weight the question may rephrased as "...... have you been afraid that you might gain *more* weight".]

How afraid have you been?

[Rate the number of days on which a <u>definite fear</u> (common usage) has been present. Exclude reactions to actual weight gain.]

0 - No definite fear of weight gain
1 - Definite fear of weight gain on 1 to 5 days
2 - Definite fear of weight gain on less than half the days (6 to 12 days)
3 - Definite fear of weight gain on half the days (13 to 15 days)
4 - Definite fear of weight gain on more than half the days (16 to 22 days)
5 - Definite fear of weight gain almost every day (23 to 27 days)
6 - Definite fear of weight gain every day   [ ]

[With participants whose weight might make them eligible for the diagnosis of anorexia nervosa, ask about each of the preceding two months. Rate 9 if not asked.]

             month 2 [ ]

             month 3 [ ]

DISCOMFORT SEEING BODY   (Shape Concern subscale)

*Over the past four weeks have you felt uncomfortable seeing your body, for example, in the mirror, in shop window reflections, while undressing, or while taking a bath or shower?

What have you felt like at these times? Could you have felt worse? Have you avoided seeing your body?

[Only rate discomfort about overall shape or figure because it is viewed as too large. The discomfort should not stem from sensitivity about specific aspects of appearance (e.g., acne) or from modesty. One index of the severity of such discomfort is whether it has led to avoidance (ask for examples, e.g., when washing). In common with all severity items, the rating should generally represent the *mode for the entire month.*]

0 - No discomfort about seeing body
1 -
2 - Some discomfort about seeing body
3 -
4 - Definite discomfort about seeing body
5 -
6 - Extreme discomfort about seeing body (e.g., viewed as loathsome)   [   ]

DISCOMFORT ABOUT EXPOSURE   (Shape Concern subscale)

*Over the past four weeks have you felt uncomfortable about <u>others seeing your body</u>, for example, in communal changing rooms, when swimming, or when wearing clothes that show your shape? What about your partner or friends seeing your body?

What have you felt like at these times? Could you have felt worse?

Have you avoided others seeing your body? Have you chosen to wear clothes that disguise your shape?

[Only rate discomfort arising from concerns about overall shape or figure (because it is viewed as too large). Do not consider discomfort restricted to family members who are aware that the participant has an eating problem. The discomfort should not stem from sensitivity about specific aspects of appearance (e.g., acne) or from modesty. One index of the severity of such discomfort is whether it has led to avoidance (ask for examples, e.g., when dressing). If the possibility of exposure has not arisen, rate 9. In common with all severity items, the rating should generally represent the *mode for the entire month*.]

0 - No discomfort about seeing body
1 -
2 - Some discomfort about seeing body
3 -
4 - Definite discomfort about seeing body
5 -
6 - Extreme discomfort about seeing body   [ ]

FEELING FAT   (Diagnostic item, Shape Concern subscale)

*Over the past four weeks have you "felt fat"? [With participants who have already acknowledged such feelings, this question may need to be prefaced by an apology.]

[Rate the number of days on which the participant has "felt fat" in general (not with respect to a particular body part) accepting his or her use of this expression. Distinguish "feeling fat" from feeling bloated premenstrually, unless this is experienced as feeling fat.]

0 - Has not felt fat
1 - Has felt fat on 1 to 5 days
2 - Has felt fat on less than half the days (6 to 12 days)
3 - Has felt fat on half the days (13 to 15 days)
4 - Has felt fat on more than half the days (16 to 22 days)
5 - Has felt fat almost every day (23 to 27 days)
6 - Has felt fat every day   [ ]

[With participants whose weight might make them eligible for the diagnosis of anorexia nervosa, ask about each of the preceding two months. Rate 9 if not asked.]

month 2 [   ]

month 3 [   ]

REGIONAL FATNESS

*Over the past month have you felt that any <u>particular part</u> of your body is too fat?

[Rate the number of days on which the participant has thought that one or more specific parts of his or her body are definitely too "fat". This does not preclude also thinking that his or her entire body is too "fat".]

0 - No regional fatness
1 - Regional fatness on 1 to 5 days
2 - Regional fatness on less than half the days (6 to 12 days)
3 - Regional fatness on half the days (13 to 15 days)
4 - Regional fatness on more than half the days (16 to 22 days)
5 - Regional fatness almost every day (23 to 27 days)
6 - Regional fatness every day   [ ]

VIGILANCE ABOUT SHAPE

*Over the past four weeks have you been actively monitoring your shape ..... for example, by scrutinising yourself in the mirror, by measuring or pinching yourself, or by repeatedly checking that certain clothes fit?

[Rate the number of days on which the participant has *actively monitored* his or her shape with the intention of detecting any changes. The participant should believe that the method used is capable of detecting change.]

0 - No vigilance
1 - Vigilance on 1 to 5 days
2 - Vigilance on less than half the days (6 to 12 days)
3 - Vigilance on half the days (13 to 15 days)
4 - Vigilance on more than half the days (16 to 22 days)
5 - Vigilance almost every day (23 to 27 days)
6 - Vigilance every day   [ ]

FLAT STOMACH   (Shape Concern subscale)

*Over the past four weeks have you had a definite desire to have a completely flat stomach?

[Rate the number of days on which the participant has had a <u>definite desire to have a flat or concave stomach</u>. Demonstrate by holding a pen vertically. Participants who already have a flat stomach can be rated, whereas the desire to have a "flatter" (i.e., less protruding) stomach should not be rated.]

0 - No definite desire to have a flat stomach
1 - Definite desire to have a flat stomach on 1 to 5 days
2 - Definite desire to have a flat stomach on less than half the days (6 to 12 days)
3 - Definite desire to have a flat stomach on half the days (13 to 15 days)
4 - Definite desire to have a flat stomach on more than half the days (16 to 22 days)
5 - Definite desire to have a flat stomach almost every day (23 to 27 days)
6 - Definite desire to have a flat stomach every day   [ ]

BODY COMPOSITION

*Over the past four weeks have you thought about the actual composition of your body .....
the percentage of fat as compared with muscle ..... the way you are under the skin?

How concerned have you been about the composition of your body?

[Rate the strength of the participant's concern about the proportion of fat in his or her body. *Do
not rate concern about "being fat" or concerns about particular parts of the body.* Do not
prompt with the terms 'slight', 'moderate' or 'marked'. In common with all severity items, the
rating should generally represent the *mode for the entire month.*]

0 - No concern about body composition
1 -
2 - Slight concern about body composition (aware of the notion, but it is not of personal
importance to the participant)
3 -
4 - Moderate concern about body composition (clearly interested in composition of body and
regularly thinks about it)
5 -
6 - Marked concern about body composition (extreme interest in actual make-up of body and
frequently thinks about it)   [ ]

WEIGHT AND HEIGHT   (Diagnostic item)

[The participant's weight and height should be measured.]   Weight in kg [ ][ ][ ]

                                                                Height in cm [ ][ ][ ]

MAINTAINED LOW WEIGHT   (Diagnostic item)

[Rate for participants whose weight might make them eligible for the diagnosis of anorexia nervosa. If in doubt, make this rating.]

Over the past three months have you been trying to lose weight?

If no: Have you been trying to make sure that you do not gain weight?

[Rate presence of attempts either to lose weight or to avoid weight gain. Rate 9 if not asked.]

0 - No attempts either to lose weight or to avoid weight gain over the past three months
1 - Attempts either to lose weight or to avoid weight gain over the past three months for reasons concerning shape or weight
2 - Attempts either to lose weight or to avoid weight gain over the past three months for other reasons

[ ]

MENSTRUATION   (Diagnostic item)

*Have you missed any menstrual periods over the past few months?

How many periods have you had?

*Are you taking an oral contraceptive (the "pill")?

[With post-menarchal females, rate number of menstrual periods over the past three and six months. Rate 33 if the participant has never menstruated; rate 44 if she has been taking an oral contraceptive during the months in question; rate 55 if she has been pregnant or breast feeding; rate 66 if she is not menstruating because of a gynaecological procedure (e.g., a hysterectomy); rate 77 if she is clearly post-menopausal; and rate 88 if participant is male.]

months 0-3 [   ][   ]

months 0-6 [   ][   ]

_____

END OF EDE SCHEDULE
_____

Appendix B: Eating Disorder Examination Questionnaire

ID: **Date:**

EATING QUESTIONNAIRE

Instructions: The following questions are concerned with the past four weeks (28 days) only. Please read each question carefully. Please answer all of the questions. Please only choose one answer for each question. Thank you.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days) only.

	On how many of the past 28 days ……	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
8	Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11	Have you felt fat?	0	1	2	3	4	5	6
12	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days).......

13	Over the past 28 days, how many <u>times</u> have you eaten what other people would regard as an <u>unusually large amount of food </u>(given the circumstances)?	
14	....On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?	
15	Over the past 28 days, on how many <u>DAYS</u> have such episodes of overeating occurred (i.e. you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	
16	Over the past 28 days, how many <u>times</u> have you made yourself sick (vomit) as a means of controlling your shape or weight?	
17	Over the past 28 days, how many <u>times</u> have you taken laxatives as a means of controlling your shape or weight?	
18	Over the past 28 days, how many <u>times</u> have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat or to burn off calories?	

Questions 19-21: Please circle the appropriate number. <u>Please note that for these questions the term "binge eating" means</u> eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

		No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
19	Over the past 28 days, on how many days have you eaten in secret (ie, furtively)?......Do not count episodes of binge eating	0	1	2	3	4	5	6

		None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
20	On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? ......Do not count episodes of binge eating	0	1	2	3	4	5	6

		Not at all		Slightly		Moderately		Markedly
21	Over the past 28 days, how concerned have you been about other people seeing you eat? ......Do not count episodes of binge eating	0	1	2	3	4	5	6

Questions 22-28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days)

On how many of the past 28 days ……	Not at all	Slightly		Moderately		Markedly	
22 Has your <u>weight</u> influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23 Has your <u>shape</u> influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24 How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25 How dissatisfied have you been with your <u>weight</u>?	0	1	2	3	4	5	6
26 How dissatisfied have you been with your <u>shape</u>?	0	1	2	3	4	5	6
27 How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28 How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

What is your weight at present? (Please give your best estimate).   ....

What is your height? (Please give your best estimate).   ....

If female: Over the past three-to-four months have you missed any menstrual periods? ....

If so, how many?   ....

Have you been taking the "pill"? ....

THANK YOU

Appendix C: Difficulties in Emotion Regulation Scale

Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item:

1------------------------2------------------------3------------------------4------------------------5
almost never   sometimes   about half the time   most of the time   almost always
(0-10%)   (11-35%)   (36-65%)   (66-90%)   (91-100%)

_____ 1) I am clear about my feelings.

_____ 2) I pay attention to how I feel.

_____ 3) I experience my emotions as overwhelming and out of control.

_____ 4) I have no idea how I am feeling.

_____ 5) I have difficulty making sense out of my feelings.

_____ 6) I am attentive to my feelings.

_____ 7) I know exactly how I am feeling.

_____ 8) I care about what I am feeling.

_____ 9) I am confused about how I feel.

_____ 10) When I'm upset, I acknowledge my emotions.

_____ 11) When I'm upset, I become angry with myself for feeling that way.

_____ 12) When I'm upset, I become embarrassed for feeling that way.

_____ 13) When I'm upset, I have difficulty getting work done.

_____ 14) When I'm upset, I become out of control.

_____ 15) When I'm upset, I believe that I will remain that way for a long time.

_____ 16) When I'm upset, I believe that I'll end up feeling very depressed.

_____ 17) When I'm upset, I believe that my feelings are valid and important.

_____ 18) When I'm upset, I have difficulty focusing on other things.

_____ 19) When I'm upset, I feel out of control.

_____ 20) When I'm upset, I can still get things done.

_____ 21) When I'm upset, I feel ashamed with myself for feeling that way.

1----------------------------2----------------------------3----------------------------4----------------------------5

almost never	sometimes	about half the time	most of the time	almost always
(0-10%)	(11-35%)	(36-65%)	(66-90%)	(91-100%)

_____ 22) When I'm upset, I know that I can find a way to eventually feel better.

_____ 23) When I'm upset, I feel like I am weak.

_____ 24) When I'm upset, I feel like I can remain in control of my behaviors.

_____ 25) When I'm upset, I feel guilty for feeling that way.

_____ 26) When I'm upset, I have difficulty concentrating.

_____ 27) When I'm upset, I have difficulty controlling my behaviors.

_____ 28) When I'm upset, I believe that there is nothing I can do to make myself feel better.

_____ 29) When I'm upset, I become irritated with myself for feeling that way.

_____ 30) When I'm upset, I start to feel very bad about myself.

_____ 31) When I'm upset, I believe that wallowing in it is all I can do.

_____ 32) When I'm upset, I lose control over my behaviors.

_____ 33) When I'm upset, I have difficulty thinking about anything else.

_____ 34) When I'm upset, I take time to figure out what I'm really feeling.

_____ 35) When I'm upset, it takes me a long time to feel better.

_____ 36) When I'm upset, my emotions feel overwhelming.

Appendix D: Emotional Eating Scale

APPENDIX 1

Emotional Eating Scale

We all respond to different emotions in different ways. Some types of feelings lead people to experience an urge to eat. Please indicate the extent to which the following feelings lead you to feel an urge to eat by checking the appropriate box.

	No Desire to Eat	A Small Desire to Eat	A Moderate Desire to Eat	A Strong Urge to Eat	An Overwhelming Urge to Eat
Resentful					
Discouraged					
Shaky					
Worn Out					
Inadequate					
Excited					
Rebellious					
Blue					
Jittery					
Sad					
Uneasy					
Irritated					
Jealous					
Worried					
Frustrated					
Lonely					
Furious					
On edge					
Confused					
Nervous					
Angry					
Guilty					
Bored					
Helpless					
Upset					

Appendix E: Depression Anxiety Stress Scale-21

DASS-21

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

0 = Did not apply to me at all
1 = Applied to me to some degree, or some of the time
2 = Applied to me to a considerable degree, or a good part of time
3 = Applied to me very much, or most of the time

		Not at all	To some degree	To a considerable degree	Very much
1.	I found it hard to wind down.	0	1	2	3
2.	I was aware of dryness of my mouth.	0	1	2	3
3.	I couldn't seem to experience any positive feeling at all.	0	1	2	3
4.	I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).	0	1	2	3
5.	I found it difficult to work up the initiative to do things.	0	1	2	3
6.	I tended to over-react to situations.	0	1	2	3
7.	I experienced trembling (e.g., in the hands).	0	1	2	3
8.	I felt that I was using a lot of nervous energy.	0	1	2	3
9.	I was worried about situations in which I might panic and make a fool of myself.	0	1	2	3
10.	I felt that I had nothing to look forward to.	0	1	2	3
11.	I found myself getting agitated.	0	1	2	3
12.	I found it difficult to relax.	0	1	2	3
13.	I felt down-hearted and blue.	0	1	2	3
14.	I was intolerant of anything that kept me from getting on with what I was doing.	0	1	2	3
15.	I felt I was close to panic.	0	1	2	3
16.	I was unable to become enthusiastic about anything.	0	1	2	3
17.	I felt I wasn't worth much as a person.	0	1	2	3
18.	I felt that I was rather touchy.	0	1	2	3
19.	I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).	0	1	2	3
20.	I felt scared without any good reason.	0	1	2	3
21.	I felt that life was meaningless.	0	1	2	3

Appendix F: Informed Consent Form

How Biological and Psychological Factors

Influence Eating Behavior and Weight Loss

Consent to Take Part in Research

IINVESTIGATORS: Dr. Jacqueline Carter, Psychology Department, MUN
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You are invited to take part in a research project, and this form is part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any other information given to you by the researcher.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction and Purpose:

We are conducting a research study to explore how psychological and biological factors affect eating behavior and body weight over time among people who have recently lost at least 10% of their body weight through diet and exercise. We are studying how different factors such as mood, personality, and the level of certain hormones affect weight loss maintenance.

We will measure weight-related hormones (e.g., leptin and ghrelin) secreted by various organs and tissues that affect appetite. In addition, we will examine if DNA sequences (i.e., genetics) affect weight loss maintenance. We are trying to understand how these biological factors work together with psychological factors to affect weight loss maintenance over time among people who have intentionally lost weight.

What you will do in this study:

This study will involve meeting with a research assistant at the Health Sciences Centre 3 times over the course of one year - an initial assessment and follow up appointments 6 and 12 months later. Each meeting will last about 1.5 hours. At the first visit, we will schedule your second and third follow-up appointments to take place 6 and 12 months later. Three months after your initial visit we will send you a very brief survey via e-mail to complete at home.

At the first appointment, you will be asked to provide a blood sample (approximately 3 tablespoons) so that we can measure the level of weight-related hormones and extract DNA from your blood. Next, you will be asked to fill out a few short questionnaires asking about your mood, personality, and eating behavior, and then complete a brief behavioral task on the computer. You will have your body weight and height, as well as body composition, measured by a certified staff member.

At the 6- and 12-month follow-up appointments, you will fill in a brief subset of the questionnaires, have your body composition measured again, and be asked to provide a blood sample.

Before each follow-up appointment, the researcher will contact you approximately one week prior to the scheduled meeting to confirm the time and date.

PARTICIPANTS ARE REQUIRED TO FAST FOR 12 HOURS (OVERNIGHT) PRIOR TO BLOOD SAMPLE This is necessary for the accurate measurement of weight-related hormones. If you do not wish to provide a blood sample and/or have your percent body fat measured, you may still participate in the other components of the study.

The results of this study are expected to contribute to the development of better weight loss treatments.

Possible benefits and risks: There are no known personal benefits guaranteed for participating in this study. However, it is possible that participation could assist your efforts to maintain weight loss over time. Possible risks associated with participation in this study are minimal, but may include some discomfort about revealing sensitive information about mood, eating behavior or weight history. There is little risk when sampling blood. There is a possibility of bruising at the site and a slight chance of infection. There will be a very low dose of X-ray exposure when you receive measurement of body fat.

You should not participate in body composition measurement if you think you might be pregnant.

Withdrawal from the study: You can withdraw from participation in this study at any point without giving any reason. There are no consequences for withdrawal. If you decide to withdraw, you will be given the opportunity to remove previously collected data from the study. Data cannot be withdrawn once the study has been completed and the results are aggregated.

Confidentiality and Anonymity: Your participation in this study will be kept strictly anonymous and confidential. The information gathered will be seen solely by the researchers involved in this study, and will be used solely for research purposes. Questionnaire data and blood samples will be identified only by ID number, and will not have any identifying information on them. Contact information and associated ID numbers will be kept in a separate secure digital file. This will allow the researchers to contact you to schedule follow up appointments, while keeping your information confidential and anonymous.

Confidentiality and Storage of Data: We will be collecting and storing questionnaire data via the online survey company FluidSurveys. As such, it is subject to Canadian privacy laws. If you choose to participate in this study, you understand that your responses will be stored in Canada. FluidSurveys ensures that they will not use the collected data, and that we, the researchers, retain ownership of it. The questionnaire data will be stored as a password protected digital file. The blood samples will be securely stored in Dr. Sun's laboratory. The blood samples will be identified only by ID number. Only Drs. Carter and Sun or researchers who signed the oath of confidentiality can access the data.

The security and privacy policies of FluidSurveys can be accessed at the following links:

http://fluidsurveys.com/about/privacy/

http://cdn1.fluidsurveys.com/wp-content/uploads/2013/02/FluidSurveys_Security2.pdf

Memorial University requires that the data be stored for a minimum of 5 years after publication of the study findings. The blood samples will be stored for at least 10 years because new hormones related to obesity might be available in the near future.

Reporting of Results: The findings from this study will be submitted for publication in academic journals and for presentation at scientific meetings. The data will be reported in group format only.

Sharing of Results with Participants: We would be happy to provide you with a summary of the research findings after this study is completed if you provide us with your e-mail address. Since this is a long-term project, this may be up to 5 years from now. Please indicate below if you would like to receive a summary of the research findings.

☐ I would like a summary of the research findings. E-mail:_____

Questions: You are welcome to ask any questions at any time during your participation in this research study. If you would like more information about this study, please contact Dr. Jacqueline Carter (contact information at the beginning of this form.)

Compensation: In the event that you suffer injury as a direct result of taking part in this study, necessary treatment will be available at no additional cost to you.

If you feel distressed after your participation in this study, you can contact one of the following resources:

For MUN Students: University Counselling Centre
                                5th Floor University Centre, UC-5000
                                Memorial University of Newfoundland
                                St. John's, NL
                                A1C 5S7

                                Tel: (709) 864-8874
For Non-MUN students: Canadian Mental Health Association Crisis Line
                                Tel: (709) 737-4668
                                Toll Free: 1-888-737-4668

The protocol for this research study has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent:

Your signature on this form means that:

- You have read the information about the research.
- You have been given the opportunity to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.
- If you decide to withdraw, you will be given the opportunity to remove any previously collected data (including blood samples) from the study. Data cannot be removed once the study has been completed and the results are aggregated.
- For females – you are not pregnant.

If you sign this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your signature:

I have read and understood what this study is about and appreciate any risks and benefits. I have had adequate time to think about this and have had the opportunity to ask questions and my questions have been answered.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

A copy of this Informed Consent Form has been given to me for my records.

_____   _____

Signature of participant   Date

Researcher's or Research Assistant's Signature:

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study, and he or she has freely chosen to be in the study.

_____   _____

Signature of Research Assistant   Date

_____   _____

Signature of Researcher   Date