

RUNNING HEAD: Intolerance of uncertainty and eating disorders

Stomaching uncertainty: relationships among intolerance of uncertainty, eating disorder pathology, and comorbid emotional symptoms

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**Abstract**

Intolerance of uncertainty (IU) is proposed to be a transdiagnostic vulnerability factor for various emotional disorders. There is robust evidence for the role of IU in anxiety and depressive disorders, but a paucity of evidence in eating disorders (ED). This study evaluated the factorial validity, internal consistency, and convergent validity of the Intolerance of Uncertainty Scale - Short Form (IUS-12; Carleton, Norton, & Asmundson, 2007), and examined whether IU is associated with ED pathology and comorbid emotional symptoms, in a clinical sample with EDs ( $N = 134$ ). A unitary factor solution provided the best fit. The IUS-12 showed excellent internal validity, and good convergent validity. IU had an indirect effect on dietary restraint, purging, and emotional symptoms via overvaluation of eating, weight, and shape. The indirect effect was not significant for bingeing. Findings provide partial support for the notion that IU is a vulnerability factor for ED pathology and support the notion that IU is a transdiagnostic vulnerability factor for emotional symptoms. Limitations, research implications, and future directions for research are discussed.

**Key words:** intolerance of uncertainty; eating disorders; anxiety; depression; intolerance of uncertainty scale; anorexia nervosa; bulimia nervosa; transdiagnostic

## 1. Introduction

Eating disorders (EDs) are characterised by abnormal eating and eating-related behaviour (e.g., self-induced vomiting), and concerns over weight and shape (American Psychiatric Association [APA], 2013). EDs are distressing and disabling disorders that are associated with high rates of comorbidity with emotional disorders and mortality (Allen, Byrne, Oddy, & Crosby, 2013; Crow et al., 2009; Stice, Marti, & Rohde, 2013). Current evidence-based treatments for EDs are inefficacious for the majority of patients (Wilson, Grilo, & Vitousek, 2007), so it is critical that theoretical models are elaborated to include additional mechanisms that can be targeted to enhance treatment outcomes. Intolerance of uncertainty (IU), defined as the tendency to perceive and react negatively on a cognitive, emotional, and behavioural level to uncertain situations regardless of the actual probability of the feared outcome (Carleton, Norton, & Asmundson, 2007), may be an important yet relatively neglected construct within the ED literature. There is robust evidence implicating IU in the development and maintenance of anxiety disorders and depression (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013; Carleton et al., 2012; Mahoney & McEvoy, 2012). Despite theory and early evidence suggesting that IU may also increase vulnerability to EDs, research investigating this possibility is scarce (Sternheim, Startup, & Schmidt, 2011).

IU is theorised to increase vulnerability for a range of psychological disorders, particularly anxiety (Boswell et al., 2013). Anxiety is a common emotional response to beliefs that future threatening events are both possible and uncontrollable (Boswell et al., 2013). Individuals with IU tend to interpret uncertainty as threatening and stressful and therefore rely on maladaptive strategies such as worrying, obsessional doubt, compulsions, and avoidance in an effort to gain control and increase certainty that feared negative consequences will not occur (Boswell et al., 2013; Carleton et al., 2012). The

non-occurrence of negative outcomes is then attributed to these maladaptive strategies, which reinforces and increases the use of these strategies over time (Boswell et al., 2013). IU and associated avoidance and over-control are evident in various emotional disorders such as obsessive-compulsive disorder, social phobia and panic disorder (Boelen & Reijntjes, 2009; Boswell et al., 2013). IU and control are also evident in EDs, which are characterised by over-controlled eating or eating-related behaviours to increase certainty that rigid rules about eating, weight, and shape will not be violated, and to manage a perceived lack of control in life and negative affect (Einstein, 2014; Fairburn, Cooper, & Shafran, 2003a; Sternheim, Konstantellou, Startup, & Schmidt, 2011). IU is thus hypothesised to be a transdiagnostic mechanism that drives cognitions (e.g., worry and obsessions) and behaviours (e.g., compulsive checking, avoidance, dietary restraint) associated with various anxiety disorders and EDs (Roblek & Frank, 2012).

The 'triple vulnerabilities model' of emotional disorders proposes that there are common underlying biological and psychological vulnerabilities across disorders, along with more disorder-specific processes (Barlow, 2004). Within this framework, IU may be a transdiagnostic psychological vulnerability that increases the risk of multiple psychological disorders (Carleton et al., 2012; Harvey, Watkins, Mansell, & Shafran, 2004). The nature of the beliefs, assumptions, and associated behavioural strategies individuals develop to provide a sense of control and certainty may represent disorder-specific vulnerabilities that distinguish between symptom profiles of different disorders (Boswell et al., 2013; Thibodeau et al., 2015).

IU may represent a direct or indirect risk factor for ED psychopathology. For instance, IU is a transdiagnostic risk factor for clinically significant anxiety (Carleton, 2012), which may increase the risk of EDs (Frank et al., 2012). Anxiety disorders and EDs are highly comorbid and anxiety disorders tend to temporally precede EDs (Keel,

Klump, Miller, McGue, & Iacono, 2005). Thus, anxiety is considered to be a significant factor in the development and maintenance of EDs (Roblek & Frank, 2012). Women with EDs (Frank et al., 2012) and individuals with problematic eating attitudes (Konstantellou & Reynolds, 2010) report significantly higher levels of IU compared to controls. Together, these findings are consistent with IU being a shared underlying mechanism for both anxiety disorders and EDs.

The transdiagnostic model of EDs proposes that the core psychopathology of EDs is the overvaluation of eating, weight, and shape and their control, which leads to extreme weight control behaviours such as self-induced vomiting (purging) and dietary restraint (Fairburn et al., 2003a). The model further posits that additional mechanisms (clinical perfectionism, core low self-esteem, mood intolerance, and interpersonal difficulties) may interact with core ED pathology to further perpetuate the disorder (Fairburn et al., 2003a). A comparison study of two cognitive-behavioural treatments (CBT) of EDs, one targeting core ED symptoms (CBT-Ef) and the other targeting the additional mechanisms of EDs (CBT-Eb), found that while both were effective treatments, CBT-Eb resulted in greater improvements in ED pathology for individuals who presented with the additional maintaining features of EDs (Fairburn et al., 2009). In another study consisting of outpatients with EDs ( $n = 125$ ), enhanced CBT for EDs (CBT-E; Fairburn et al., 2003a) resulted in significant improvements in eating disorder pathology, anxiety, depression, stress, self-esteem, perfectionism, interpersonal difficulties, and quality of life (Byrne, Fursland, Allen, & Watson, 2011). These findings support the notion of transdiagnostic mechanisms maintaining ED pathology.

Incorporating IU as a transdiagnostic factor in theoretical models, case formulations and treatment plans has the potential to address common mechanisms across eating and comorbid disorders (Boswell et al., 2013; Einstein, 2014; Harvey et al., 2004).

However, more studies investigating IU in ED samples are needed. If individuals with EDs perceive themselves as unable to tolerate uncertainty in their life in general (e.g., I always want to know what the future has in store for me), or in relation to weight and shape in particular (e.g., uncertainty about meeting their targeted weight or standards of caloric restriction), and this contributes to anxiety and the development of rigid dietary rules and eating behaviours, then IU would represent an important transdiagnostic treatment target. Specifically, cognitive behavioural strategies could be implemented to challenge maladaptive beliefs about uncertainty and to promote more effective strategies for managing uncertainty than over-control (Roblek & Frank, 2012).

A significant impediment to understanding the relationship between IU and ED pathology is that existing measures of IU have not been validated in ED samples. It cannot be assumed that IU manifests similarly in eating, anxiety and depressive disorders. The psychometric properties IU measures might be similar for these disorders given the high rates of comorbidity (Keel et al., 2005) and if ED behaviours serve a similar function to emotional disorder behaviours, namely to reduce uncertainty and associated distress (Roblek & Frank, 2012). Alternatively, if IU is more specific to anxiety and depression than ED symptoms, or if particular aspects of IU are more relevant than others to the etiology or maintenance of ED psychopathology, then the properties of IU measures might differ between the disorders.

The short version of the IU Scale (IUS-12; Carleton et al., 2007) has demonstrated a more stable factor structure than the original version (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994) in samples with anxiety and affective disorders (McEvoy & Mahoney, 2011). In these samples the IUS-12 comprises two factors, prospective and inhibitory IU (McEvoy & Mahoney, 2011). Prospective IU, characterised as the cognitive domain of IU, is associated with fear and anxiety of future events, while inhibitory IU,

characterised as the behavioural domain of IU, is associated with inhibition of action in the face of uncertainty (Mahoney & McEvoy, 2012). In support of the convergent validity of the IUS-12, the subscales were significantly associated with symptom measures of various anxiety disorders and depression, neuroticism, and distress (McEvoy & Mahoney, 2011). Evidence of divergent validity was also found, as the prospective IU subscale was uniquely associated with repetitive negative thinking and OCD symptoms, whereas the inhibitory IU subscale was uniquely associated with symptoms of agoraphobia, social anxiety, panic disorder, and depression (McEvoy & Mahoney, 2011). In the framework presented here, IUS-12 items could assess vulnerability to emotional symptoms and compensatory controlling behaviours when uncertain events are encountered in general (e.g., “*I always want to know what the future has in store for me*”), but could also be applied to vulnerability to rigid dietary rules and compensatory behaviours upon exposure to body image-related triggers (e.g., *I always want to know what the future has in store for me [in terms of weight gain]*). Given the importance of investigating the potential role of IU in EDs, evidence of internal consistency, reliability and validity of the IUS-12 needs to be demonstrated within samples of individuals with EDs.

The first aim of this study was to evaluate the psychometric properties of the IUS-12 in an ED sample, including factorial validity, internal consistency, and convergent validity. It was hypothesised that the IUS-12 would replicate the two-factor structure found within anxiety disorders and depression (McEvoy & Mahoney, 2011). It was also expected that the IUS-12 would have significant positive associations with measures of depression, anxiety, stress, repetitive negative thinking, perfectionism, interpersonal problems, and ED pathology, and significant negative associations with self-esteem. The second aim was to evaluate whether IU has an indirect association with ED behaviours (dietary restraint, bingeing, purging) and emotional symptoms (anxiety, depression) via

overvaluation of eating, weight, and shape (see Figure 1). It was hypothesised that this indirect effect would be significant.

## 2. Method

### 2.1 Participants

Participants were patients aged 16 years or older who were referred to a specialist community-based outpatient ED clinic by medical practitioners. Patients provided informed written consent for their data to be used for research and quality improvement purposes. Parental consent from clients younger than 18 years old was required, unless the individual was deemed a 'mature minor'. Inclusion criteria included an ED diagnosis (DSM-5, 2013) and ongoing medical management from a general practitioner and/or psychiatrist. Individuals were excluded from the service and consequently this study if their body mass index (BMI) was below 14, they were considered to be at other medical risk, and/or were inpatients at another service.

Pre-treatment data from 134 participants (131 females, 3 males) were used in this study. The mean age of the sample was 24.34 years ( $SD = 7.69$ ). DSM-5 (APA, 2013) criteria for a principal ED diagnosis were applied using the Eating Disorder Examination (EDE Version 12; Fairburn & Cooper, 1993), which is considered to be the gold standard interview for assessing eating disorder diagnoses; AN ( $n = 25$ ), bulimia nervosa (BN;  $n = 60$ ), and Other Specified Feeding or Eating Disorder (OSFED,  $n = 49$ ). The Mini International Neuropsychiatric Interview (MINI, Sheehan et al., 1998) was used to assess comorbid DSM-IV (APA, 2000) anxiety and affective disorders. The MINI exhibits good convergent validity with lengthier diagnostic interviews such as the Structured Clinical Interview for DSM (SCID; First, Spitzer, Gibbon, & Williams, 1996, 2002) and the Composite International Diagnostic Interview (CIDI, Lecrubier et al., 1997; Sheehan et al., 1997a, b, 1998) and has excellent inter-rater and test-retest reliability (Sheehan et al.,

1998). Eighty-five participants (63.4%) met criteria for a secondary DSM-IV disorder, including an anxiety disorder ( $n = 30$ ), mood/affective disorder ( $n = 51$ ), mixed anxiety-depressive disorder ( $n = 1$ ), and alcohol abuse ( $n = 3$ ). The mean BMI was  $21.4 \text{ kg/m}^2$  ( $SD = 3.97$ ).

## 2.2 Measures

**2.2.1 Intolerance of Uncertainty Scale - Short Form (IUS-12; Carleton et al., 2007).** The IUS-12 measures negative beliefs and reactions about uncertainty and consists of 12 items. The IUS-12 has shown a strong correlation ( $r = .96$ ) with the original 27-item IUS and excellent internal consistency ( $\alpha = .91$ ). The IUS-12 also exhibits good convergent and discriminant validity in clinical samples with anxiety and depression (Carleton et al., 2007). The IUS-12 comprises two subscales; Prospective IU (cognitive anticipation, “*I always want to know what the future has in store for me*”) and Inhibitory IU (behavioral, “*when it’s time to act, uncertainty paralyzes me*”), although a total score is commonly used. Items are rated on a 5-point Likert scale from 1 (“*not at all characteristic of me*”) to 5 (“*entirely characteristic of me*”). Internal consistencies (Cronbach’s alphas) for all measures were high (see Table 2).

**2.2.2 Eating Disorder Examination Questionnaire Version 5 (EDEQ-5; Fairburn & Beglin, 1994).** The EDEQ-5 is a 28-item self-report questionnaire of disordered eating, attitudinal symptoms (eating, weight and shape concerns, and restraint), and frequency of bingeing and purging over the past 28 days. The EDEQ has demonstrated excellent internal consistency ( $\alpha = .78 - .93$ ) and test-retest reliability ( $r = .81 - .94$ ; Fairburn & Beglin, 1994). The EDEQ has good concurrent validity and acceptable criterion validity (Mond, Hay, Rodgers, Owen, & Beumont, 2004). The overvaluation of eating, weight, and shape items have been shown to form a single factor (Allen, Byrne, Lampard, Watson, & Fursland, 2011).

**2.2.3 BMI.** BMI is calculated based on the formula  $kg/m^2$  and is a measure of the relative weight and height of a person (World Health Organization, 2015).

**2.2.4 Depression, Anxiety, and Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995).** The DASS-21 is a self-report measure assessing the severity of depression (e.g., “*I couldn’t seem to experience any positive feeling at all*”), anxiety (e.g., “*I felt scared without any good reason*”), and stress (e.g., “*I found it difficult to relax*”) over the past week. The DASS-21 uses a 4-point Likert scale including 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*”), and 3 (“*applied to me very much, or most of the time*”). Scores on the items from each subscale are summed and then subscale scores are multiplied by two to determine severity ratings. Convergent and construct validity have been demonstrated among clinical samples (Lovibond & Lovibond, 1995; Ng et al., 2007). Each subscale demonstrates excellent internal consistency ( $\alpha = .87 - .94$ ; Antony, Bieling, Cox, Enns, & Swinson, 1998).

**2.2.5 Clinical Perfectionism Questionnaire (CPQ; Fairburn et al., 2003b).** The CPQ is a 12-item measure of current levels of clinical perfectionism (e.g., “*Over the past month, have you been told that your standards are too high?*”). Items are rated on a 4-point Likert scale ranging from 0 (“*not at all*”) to 4 (“*a lot*”). The CPQ has demonstrated acceptable internal reliability, and discriminant, incremental and construct validity in an ED sample and community samples (Egan et al., 2015).

**2.2.6 Inventory of Interpersonal Problems (IIP-32; Barkham, Hardy, & Startup, 1996).** The IIP-32 is a 32-item measure of a range of current interpersonal difficulties, with higher scores indicating a higher degree of interpersonal problems (e.g., “*I fight with other people too much*”; “*It is hard for me to be show affection to other people*”). Responses are recorded on 5-point Likert scales, ranging from 0 (“*not at all*”)

to 4 (*“extremely”*). Higher scores indicate a higher degree of interpersonal problems. High internal consistency ( $\alpha = .87$ ) and acceptable reliability ( $\alpha = .70 - .88$ ) have been reported in community and outpatient samples. Two-month test-retest correlation for the overall scale was .70 (Barkham et al., 1996).

**2.2.7 Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989).** The RSES is a measure of global self-esteem (e.g., *“On the whole, I am satisfied with myself”*) that consists of 10 items. Responses are based on 4-point Likert scales, which range from 1 (*“strongly agree”*) to 4 (*“strongly disagree”*). Items 2, 5, 6, 8, and 9 are reverse-scored. Internal consistency for the RSES ranges from .72 to .88 (Robins, Hendin, & Trzesniewski, 2001). The RSES demonstrates good construct, concurrent, and predictive validity and correlates with other self-esteem measures (Rosenberg, 1989).

**2.2.8 Repetitive Thinking Questionnaire (RTQ-10; McEvoy, Thibodeau, & Asmundson, 2014).** The RTQ-10 is a transdiagnostic measure of engagement in repetitive negative thinking following distressing situations (e.g., *“I have thoughts or images that are difficult to forget”*; *“I know I shouldn’t think about the situation, but can’t help it”*). The RTQ was developed to capture the underlying construct of recurrent, negative thinking that is common to multiple disorders (e.g., depression, generalized anxiety disorder, social anxiety disorder) and measures, including the Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990), Ruminative Responses Scale (Treyner, Gonzalez, & Nolen-Hoeksema, 2003) and revised Post-Event Processing Questionnaire (McEvoy & Kingsep, 2006). The 10-item trait version has a unidimensional structure and distinguishes well between clinical and non-clinical samples (McEvoy et al., 2010; McEvoy et al., 2014). Responses are based on a 5-point Likert scale (*“0 = not true at all”*, *“5 = very true”*). The RTQ-10 demonstrates high internal consistency ( $\alpha = .89-.91$ ) and is highly correlated with the original 27-item scale ( $r = .95-$

.96). The RTQ-10 is also significantly associated with symptoms of anxiety disorders and depression in both non-clinical (McEvoy et al., 2010) and clinical (Mahoney, McEvoy, & Moulds, 2012) samples.

### **2.3 Procedure**

Referred patients were posted the questionnaire battery to complete before their initial assessment. During their initial assessment, clinical psychologists with specialist experience in the assessment and treatment of EDs administered the MINI. All assessments and diagnoses were discussed with the clinical team at weekly meetings and supervision sessions. Ethics approval to use the data was granted by the Western Australian Department of Health Human Research Ethics Committee (Reference No: Q1 2014\_21) and the Curtin University Human Research Ethics Committee (Approval No: PSY SP 2014/74).

### **2.4 Analytic Strategy**

Confirmatory factor analysis was performed using MPLUS version 7.31 (Muthén & Muthén, 1998) to test if a one- or two-factor model provided the best fit for the IUS-12 data. For the one-factor model, all items loaded on a single latent variable labelled *IU*. For the two-factor model, items loaded on either a *Prospective IU* or an *Inhibitory IU* factor according to the factors identified by Carleton et al. (2007). Goodness-of-fit was assessed using the chi-square statistic and degrees of freedom (values should be  $< 2.0$ ), Comparative Fit Index (values should be  $> .95$ ), Root Mean Square Error of Approximation (values should be  $< .06$ ), Tucker-Lewis Index (values should be  $> .95$ ), Standardized Root Mean Square Residual (values should be  $< .08$ , Hu & Bentler, 1999). The chi-square statistic is highly sensitive to sample size and is less useful as a measure of fit. Smaller values of chi-square divided by degrees of freedom is indicative of better fit (Hu & Bentler, 1999). Pearson bivariate correlation coefficients were calculated to index

convergent validity between the IUS-12 and other measures. A Bonferonni correction was applied to control for family-wise error across the correlations between the IUS-12 and 15 scales and subscales ( $p = .05/15 = .003$ ).

The PROCESS macro for SPSS (Hayes, 2013) was used to test the indirect effect of IU on the outcome variables (emotional symptoms, dietary restraint, purging, bingeing) via overvaluation of eating, weight, and shape. PROCESS estimates the total effect of the independent variable on the outcome variable, the direct effect of the independent variable on the outcome variable, and the indirect effect via the intermediate variable along with a 95% confidence interval using at least 1000 bootstrap samples. It is important to note that estimation of indirect effects do not depend on a significant direct effect of the predictor (IU) on the outcome variables (Hayes, 2009). Bootstrapping is a re-sampling procedure that accounts for non-normality of the sampling distribution in estimating indirect effects (Preacher & Hayes, 2008). The indirect relationships between IU and emotional symptoms (DASS scores) were tested first, followed by the relationships between IU and dietary restraint, bingeing, and purging. Overvaluation of eating, weight, and shape was used as a single variable because psychometric evaluations of the EDE (Byrne, Allen, Lampard, Dove, & Fursland, 2010) and the EDEQ (Allen et al., 2011) have demonstrated that these items form a single factor.

### **3. Results**

#### **3.1 Data Screening**

Prior to data analyses, normality of the data was examined. Distribution, skewness and kurtosis values for all variables were within acceptable levels of +/- 2, which are indicative of a normal univariate distribution (George & Mallery, 2010), except kurtosis (2.16) for EDEQ-Shape subscale, and skewness (3.40) and kurtosis (14.59) for purging. The removal of three outliers resulted in acceptable skewness (-1.45) and kurtosis (1.91)

values for the EDEQ-Shape subscale. As purging was only examined as an outcome in the analysis of indirect effects, nine additional univariate outliers were removed prior to conducting the analysis, which resulted in acceptable skewness (.36) and kurtosis (.15) values. All analyses were conducted with and without outliers and the pattern of significant results did not change, therefore only analyses using all data are reported.

### **3.2 Confirmatory Factor Analysis, Scale Descriptive Statistics and Internal Consistency**

Goodness-of-fit statistics are reported in Table 1. The one-factor model provided a good fit to the data and was superior to the two-factor model across all indices. A chi-square difference test revealed that the one-factor model provided a significantly improved fit compared to the two-factor model,  $\chi^2_{\text{diff}}(1) = 30.77, p < .001$ . Means and standard deviations for all measures are reported in Table 2.

### **3.3 Convergent Validity**

Table 3 shows the Pearson's bivariate correlations between variables. Total IUS-12 scores had significant positive correlations with clinical perfectionism, DASS depression, anxiety, stress, and total scores, EDEQ global score and the restraint, eating, shape, and weight subscales, interpersonal problems, and repetitive negative thinking. Total IUS-12 scores had a significant negative correlation with self-esteem scores. IUS-12 scores were not significantly correlated with bingeing or purging.

### **3.4 Indirect Effects Models**

**3.4.1 Emotional symptoms.** The relationships between IU and emotional symptoms via overvaluation of eating, weight, and shape (henceforth referred to as 'overvaluation') were examined first. IU and overvaluation explained 54% of variance in DASS-total scores,  $F(2, 127) = 75.47, p < .001$ . The direct effect ( $\beta = 1.37, SE = .16, t = 8.42, p < .001, 95\% CI = 1.05 - 1.69$ ) and indirect effect were significant ( $\beta = .31, SE =$

.08, 95% CI = .17 - .50). Similar models were run with DASS anxiety, depression, and stress subscale scores as outcome variables. IU and overvaluation explained 41% of variance in DASS-anxiety scores,  $F(2, 127) = 44.44, p < .001$ , and the direct effect ( $\beta = .46, SE = .07, t = 6.67, p < .001, 95\% CI = .32 - .60$ ) and indirect effect were significant ( $\beta = .09, SE = .03, 95\% CI = .04 - .16$ ). The model explained 42% of variance in DASS-depression scores,  $F(2, 127) = 45.88, p < .001$ , and the direct effect ( $\beta = .46, SE = .08, t = 5.98, p < .001, 95\% CI = .31 - .61$ ) and indirect effect were significant ( $\beta = .14, SE = .04, 95\% CI = .08 - .22$ ). The model explained 45% of variance in DASS-stress scores,  $F(2, 127) = 52.20, p < .001$ , and the direct effect ( $\beta = .45, SE = .06, t = 7.46, p < .001, 95\% CI = .33 - .57$ ) and indirect effect were significant ( $\beta = .08, SE = .03, 95\% CI = .03 - .14$ ).

**3.4.2 ED behaviour.** The relationship between IU, overvaluation, and ED behaviours (restraint, purging, and bingeing) were examined in separate analyses. IU and overvaluation explained 43% of variance in restraint,  $F(2, 127) = 48.08, p < .001$ , and the direct effect ( $\beta = .03, SE = .01, t = 2.84, p = .005, 95\% CI = .01 - .05$ ) and indirect effect ( $\beta = .03, SE = .01, 95\% CI = .02 - .04$ ) were significant. Similar models were run to examine purging and bingeing as outcomes. Participants who did not endorse either behaviour were excluded from the analyses, leaving 116 participants who engaged in purging and 90 who engaged in bingeing. IU and overvaluation explained a statistically significant 9% of variance in purging,  $F(2, 113) = 5.89, p = .004$ , and the direct effect was not significant ( $\beta = -.10, SE = .09, t = -1.16, p = .25, 95\% CI = -.28 - .07$ ), but the indirect effect was significant ( $\beta = .13, SE = .04, 95\% CI = .06 - .24$ ). The model explained a non-significant 3% of the variance in bingeing,  $F(2, 87) = 1.52, p = .22$ .

#### 4. Discussion

The first aim of this study was to evaluate the psychometric properties of the IUS-12 in an ED sample, including factorial validity, internal consistency, and convergent

validity. The second aim was to test an indirect effects model within which IU served as a vulnerability factor for overvaluation of eating, weight, and shape, as well as associated behaviours. Contrary to the hypothesis that IUS-12 would replicate the two-factor structure found within undergraduates (Carleton et al., 2007) and clinical samples with anxiety disorders and depression (McEvoy & Mahoney, 2011), a single-factor model provided the best fit to the data. This was the first study to examine the factor structure of the IUS-12 in an ED sample and the unitary structure suggests that prospective and inhibitory aspects of IU found in other emotional disorders are not separable within this population.

Consistent with previous research in undergraduate and clinical samples with anxiety and depression, in this study the IUS-12 showed excellent internal consistency (Carleton et al., 2007; Khawaja & Yu, 2010; McEvoy & Mahoney, 2011) and convergent validity with measures of anxiety and depression (Carleton et al., 2012; Dugas, Buhr, & Ladouceur, 2004; Mahoney & McEvoy, 2012; McEvoy & Mahoney, 2011, 2012), stress (Chen & Hong, 2010), repetitive negative thinking (McEvoy & Mahoney, 2013), perfectionism (Boelen & Reijntjes, 2009; Buhr & Dugas, 2006), and self-esteem (Boelen & Reijntjes, 2009). The IUS-12 was also associated with additional constructs within the transdiagnostic model of EDs (Fairburn et al., 2003a), including overvaluation of eating, weight, and shape, and interpersonal problems. The significant associations between IU and ED overvaluation and eating behaviors found in the current study are consistent with previous studies that have reported significantly higher levels of IU in ED samples compared to healthy controls (Frank et al., 2012; Sternheim, Startup, et al., 2011). IU has been found to be associated with poor problem-solving ability (Dugas et al., 2004), which, if extended to interpersonal problems, may explain the significant relationship between IU and interpersonal difficulties in the current study. Another possibility is that the

relationship between IU and interpersonal problems is indirect via eating disorder psychopathology (McEvoy, Burgess, Page, Nathan, & Fursland, 2013). Overall, the findings of this study support the validity and reliability of the IUS-12 in ED samples.

The second aim of this study was to evaluate whether IU had an indirect association with ED behaviour via overvaluation of eating, weight, and shape and their control. The hypothesis that the indirect effect would be significant was supported for restraint and purging, but not for bingeing. IU also demonstrated a significant direct association with restraint. The non-significant results for bingeing may be attributed to a smaller sample of individuals who binged and a limitation of the EDE-Q in underestimating objective binges (Mond et al., 2004). Alternatively, the functional relationships between IU and controlling behaviours such as dietary restraint and purging may not exist with bingeing, which, by definition, is characterised by the absence of control (Fairburn et al., 2003a). For instance, it is plausible that IU at least in part motivates the formation of rigid eating, weight and shape beliefs in an effort to achieve predictability and control, which then drive dietary restraint. At some point other processes unrelated to IU (e.g., situational stressors, biological processes associated with starvation, perceived breaking of dietary rules) may then lead to bingeing. Binge eating does not feature within the core psychopathology of eating disorders in Fairburn et al.'s (2003a) model, but rather this behaviour is seen as a consequence of breaking extreme dietary rules *per se*. After a binge episode, uncertainty about weight gain may again contribute to the desire to reinforce dietary rules to compensate for the binge episode, which then drives purging. The larger proportion of variance explained in restraint compared to purging could therefore reflect their relative temporal proximity to the beginning of this cycle. Other factors within the model might also play a relatively larger

role than IU in purging than restraint. These relationships remain speculative and should be investigated in future research.

IU was directly or indirectly related to overvaluation of eating, weight, and shape, and emotional symptoms in all models. These findings support the notion of IU as a transdiagnostic vulnerability factor for ED pathology and emotional symptoms in clinical samples with EDs (Carleton, 2012; Roblek & Frank, 2012). Over-concern about eating, weight, and shape may function as an attempt to gain certainty and control over distressing life events, which in turn leads to ED behaviour such as dietary restraint and purging (Frank et al., 2012). An important direction for future research is to directly assess 'need for control' as a potential moderator of the relationship between IU, emotional symptoms, and eating disorder psychopathology.

This study extends the literature by evaluating the psychometric properties of the IUS-12 in an ED sample, and by demonstrating that IU may serve as a vulnerability factor for ED pathology. The findings have theoretical and clinical implications. As a transdiagnostic factor, IU has the potential to extend current transdiagnostic models of EDs and anxiety by increasing our understanding of common mechanisms across disorders that can be targeted to enhance treatment outcomes and concurrently reduce comorbid symptoms (Boswell et al., 2013; Fairburn et al., 2003a; Harvey et al., 2004). For instance, cognitive interventions that challenge maladaptive beliefs about uncertainty (e.g., "*uncertainty about the caloric content of foods is unacceptable and intolerable*"), and behavioural strategies that increase tolerance of uncertainty per se (e.g., exposure to *uncertain* caloric content of foods while using adaptive emotion regulation strategies such as reappraisal and emotion surfing) could be implemented.

The cross-sectional design of this study prevents causal inferences about the directional influence of IU on ED pathology. Longitudinal research investigating the

relationship between IU and ED onset is required to determine temporal precedence. The study also did not account for other transdiagnostic factors (e.g., mood intolerance, perfectionism) in the indirect effects models that may have contributed to our understanding of the relationships between IU, ED pathology, and emotional symptoms (Fairburn et al., 2003a). Future research incorporating these additional elements of the transdiagnostic model and their interactions would be informative. Future studies may also benefit from using alternative measures of bingeing that can more clearly delineate objective from subjective bingeing and that do not rely on retrospective recall (e.g., daily monitoring). Finally, as this was the first study to examine the psychometric properties of the IUS-12 in an eating disorder sample, future replications with larger samples would be useful to strengthen our confidence of the unitary structure within this population.

This study demonstrated that the IUS-12 is a valid and reliable measure in an ED sample. Our findings also suggest that IU may be a transdiagnostic vulnerability factor for negative emotionality, overvaluation of eating, shape, and weight, and of dietary restraint and purging. It is for future research to determine if incorporating IU as a target in treatments can improve outcomes for individuals with EDs.

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Table 1

*Goodness-of-Fit Statistics for each Model.*

Model	Chi-square	df	RMSEA [90% CI]	CFI	TLI	SRMR
1-factor	75.25	54	.054 [.02-.08]	.977	.972	.035
2-factor	106.02	53	.086 [.06-.11]	.950	.938	.042

*Note:* df = degrees of freedom, RMSEA [90% CI] = Root Mean Square Error of

Approximation with 90% confidence intervals, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, SRMR = Standardised Root Mean Square Residual.

Table 2

*Means, Standard Deviations and Cronbach's Alphas ( $\alpha$ ) for Measures.*

Measure	<i>n</i>	Mean	SD	$\alpha$
IUS-12	134	26.91	11.95	.94
Prospective	134	16.04	7.04	.91
Inhibitory	134	10.87	5.49	.88
EDEQ				
Global	131	4.20	1.25	.93
Restraint	131	3.69	1.57	.77
Eating	130	3.90	1.36	.75
Shape	131	4.77	1.37	.90
Weight	131	4.40	1.46	.83
Purging	116	9.87	11.13	-
Bingeing	90	12.34	8.33	-
DASS-21	132	63.60	29.55	.94
CPQ	132	32.68	7.07	.82
IIP-32	134	2.04	.66	.90
RSES	133	20.93	5.81	.80
RTQ-10	134	37.79	8.66	.91

*Note:* IUS-12 = Intolerance of Uncertainty-Short Form, EDEQ = Eating Disorders

Examination Questionnaire, DASS-21 = Depression, Anxiety, and Stress Scale-21, CPQ =

Clinical Perfectionism Questionnaire, IIP-32 = Inventory of Interpersonal Problems, RSES =

Rosenberg Self-Esteem Scale, RTQ-10 = Repetitive Thinking Questionnaire-10.

Table 3

Pearson's Bivariate Correlations.

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 IUS-12	-	.49**	.59**	.61**	.65**	.69**	.44**	.41**	.36**	.39**	.47**	.03	.17	.54**	-.54**	.51**
2 CPQ		-	.39**	.43**	.42**	.46**	.38*	.40**	.40**	.43**	.47**	.04	.01	.34**	-.44**	.42**
3 DASS-Depression			-	.62**	.67**	.88**	.42**	.46**	.47**	.47**	.53**	.19*	.15	.51**	-.75**	.44**
4 DASS-Anxiety				-	.75**	.89**	.35**	.46**	.39**	.41**	.47**	.25**	.10	.39**	-.59**	.48**
5 DASS-Stress					-	.90**	.36**	.45**	.42**	.41**	.47**	.25**	.16	.48**	-.58**	.51**
6 DASS-Total						-	.43**	.52**	.48**	.49**	.55**	.26**	.15	.52**	-.73**	.54**
7 EDEQ-Restraint							-	.57**	.58**	.58**	.80**	.10	.01	.25**	-.37**	.23**
8 EDEQ-Eating								-	.70**	.66**	.84**	.40**	.24*	.18*	-.46**	.33**
9 EDEQ-Shape									-	.90**	.91**	.20*	.05	.28**	-.47**	.42**
10 EDEQ-Weight										-	.90**	.21*	.10	.30**	-.49**	.49**
11 EDEQ-Global											-	.26**	.11	.30**	-.52**	.42**
12 EDEQ-Purging												-	.44**	-.12	-.18*	.02
13 EDEQ-Bingeing													-	.02	-.04	.07
14 IIP-32														-	-.51**	.42**

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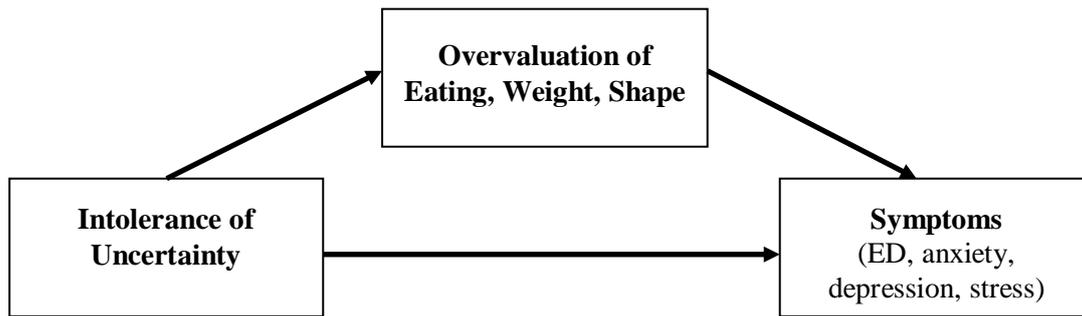
15 RSES	-	-.49**
16 RTQ		-

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*Note:* IUS-12 = Intolerance of Uncertainty-Short Form, CPQ = Clinical Perfectionism Questionnaire, Depression Anxiety Stress Scale

(DASS)-Depression = DASS-depression subscale, DASS-Anxiety = DASS-anxiety subscale, DASS-Stress = DASS-stress subscale, DASS-Total = DASS-total scale, Eating Disorder Examination Questionnaire (EDEQ)-Restraint = EDEQ-restraint subscale, EDEQ-Eating = EDEQ-eating subscale, EDEQ-Shape = EDEQ-shape subscale, EDEQ-Weight = EDEQ-weight subscale, EDEQ-Global = EDEQ-total scores, IIP-32 = Inventory of Interpersonal Problems, RSES = Rosenberg Self-Esteem Scale, RTQ-10 = Repetitive Thinking Questionnaire-10.

\* $p < .05$ , \*\* $p < 0.01$ .



*Figure 1.* Hypothesised model showing the direct relationship between intolerance of uncertainty and ED and emotional symptoms, and the indirect relationship via core ED pathology. ED = Eating Disorder.