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The unique and interacting contributions of intolerance of uncertainty and rumination to individual differences in, and diagnoses of, depression

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Abstract

Intolerance of uncertainty (IU) and the tendency to repetitively think in a negative way about oneself are established contributors to depression, however, no study has yet examined the unique and interacting effects of these variables to depression symptoms and diagnoses amongst people with Major Depressive Disorder (MDD). People with MDD ($n = 48$) and controls ($n = 66$) completed self-report measures of depression, anxiety and IU, as well as constructive (focusing on how events occurred) and unconstructive (focusing on how events felt) rumination. In a linear regression, greater IU and diminished constructive rumination, and the interaction between IU and unconstructive rumination, each explained variance in depression symptoms, even when anxiety symptoms were accounted for. In a logistic regression, these variables did not contribute towards MDD diagnoses once anxiety symptoms were accounted for. Rumination about one's mood is associated with enhanced distress during uncertainty, with detrimental effects for one's depression symptoms.

Keywords: Depression; Anxiety; Ambiguity; Repetitive Thinking; Constructive.

1. Introduction

Intolerance of uncertainty is a common feature of many psychiatric diagnoses (Mahoney & McEvoy, 2012; White & Gumley, 2010) including Generalized Anxiety Disorder (GAD) and also Major Depressive Disorder (Gentes & Ruscio, 2011). Intolerance of uncertainty refers to the “dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty” (p. 31, Carleton, 2016). A meta-analysis of cognitive factors including intolerance of uncertainty and others, such as unconstructive forms of rumination or repetitive thinking about one’s mood and its causes and consequences, suggested that these problems have a mutually exacerbating effect on one another (Hong & Cheung, 2015). Recent theoretical reviews also suggest that rumination about one’s feelings may represent one method that people use to attempt to cope with the negative feelings evoked by uncertain situations (Shihata, Mcevoy, Ann, & Carleton, 2016). This aligns with suggestions that people who are intolerant of uncertainty overestimate the probability that problems will occur and that, due to their unconstructive rumination about the emotional causes and consequences of these problems, they are likely to underestimate their ability to cope with them (Yook, Kim, Suh, & Lee, 2010).

Although the separate contributions of intolerance of uncertainty and rumination to depression have been studied (Gentes & Ruscio, 2011; Olatunji, Naragon-Gainey, & Wolitzky-Taylor, 2013), only two studies have examined the relations between these variables. One of these studies involved healthy people with high levels of depressive symptomatology (de Jong-Meyer, Beck, & Riede, 2009) and the other compared people with diagnoses of MDD and diagnoses of GAD (Yook et al., 2010). More broadly, recent reviews in this area also highlight the transdiagnostic importance of intolerance of uncertainty whilst noting that there are relatively few studies that investigate the role of intolerance of

uncertainty within depression symptoms and diagnoses, and also which explore the relations between intolerance of uncertainty and other associated cognitive processes, such as rumination, within this context (Carleton, 2016a, 2016b; Shihata et al., 2016). As such, the present investigation provides the first examination of intolerance of uncertainty and rumination amongst people with MDD and diagnoses-free controls with a view to examining the contribution of these cognitive factors to depressive symptomatology and diagnoses.

It is of note that rumination is not a unitary construct; instead, theories delineate *unconstructive* rumination from *constructive* rumination (Watkins, 2008). Unconstructive rumination, such as that which has been introduced and which is typically being referred to when people talk about rumination, concerns one's mood and its causes and consequences (e.g., *I'm a terrible person who deserves to fail*). This form of rumination has been the subject of previous investigations examining the interaction between rumination and intolerance of uncertainty (de Jong-Meyer et al., 2009; Yook et al., 2010). Constructive rumination, however, refers to the tendency to engage in concrete thinking about the contents (e.g., smells, sounds and sights) of events and the means by which they occurred (e.g., *my failure on this occasion was due to several reasons that I will overcome in the future*). Recently, the 84-item self-report Cambridge-Exeter Repetitive Thought Scale (CERTS) was created and adapted into a smaller 16-item *Mini* version (Mini-CERTS)(Douilliez, Philippot, Heeren, Watkins, & Barnard, 2012) to capture both constructive and unconstructive rumination. Using this measure, elevated use of unconstructive rumination and diminished use of constructive rumination have been associated with perfectionism (Di Schiena, Luminet, Philippot, & Douilliez, 2012) alexithymia (Di Schiena, Luminet, & Philippot, 2011), elevated depression severity (Di Schiena, Luminet, Chang, & Philippot, 2013; Douilliez et al., 2014) and alcohol-dependence (Grynberg et al., 2016). To our knowledge no study has examined the contribution of these rumination sub-types to depression symptoms

or MDD diagnoses. Furthermore, no study has examined the association between these rumination sub-types and intolerance of uncertainty and their shared contribution to depression.

For some people, their tendency to ruminate in an unconstructive way about their emotional response to events may be viewed as serving a beneficial function. Ruminating in this way is intended to support preparations for future events and manage feelings of uncertainty and distress (Nolen-Hoeksema, 2000) or one's fear of the unknown (Carleton, 2016a). As one begins to feel that they are unable to endure the feelings evoked by the unknown they may engage in rumination about this feeling and about past instances where similar feelings were experienced (Shihata et al., 2016). However, the high-level construals that underlie this form of unconstructive thinking make such experiences feel distant and abstract and as though one lacks the agency to control these situations (Watkins, 2008). Such thoughts are also likely to be overgeneral (Watkins, 2008), such that in the presence of the unknown one may focus on one's broad inability to deal with life's problems. Intolerance of uncertainty and unconstructive forms of rumination are therefore thought to exacerbate one another through the overidentification of problems and an underestimation of one's ability to manage them (Yook et al., 2010). Alternatively, constructive forms of rumination regarding the concrete causes for specific problems, and the ways to deal with them, may reduce a person's intolerance of uncertainty and so too their depression symptoms as a person is likely to feel like they have a sufficiently vivid representation of future experiences in order to cope with and manage any problems that might emerge.

Investigations with healthy and sub-clinical participants have found that intolerance of uncertainty, unconstructive ruminative tendencies and depression symptoms are all positively correlated with one another (de Jong-Meyer et al., 2009; Hong, 2013; Hong & Paunonen, 2011; Liao & Wei, 2011) and the relation between intolerance of uncertainty and

unconstructive rumination contributes towards elevated depression symptoms (Liao & Wei, 2011). De Jong-Meyer et al. (de Jong-Meyer et al., 2009) correlated unconstructive rumination, intolerance of uncertainty and depression symptoms amongst a community group with high levels of self-reported depression symptoms. Another study included participants with MDD and GAD diagnoses, and found that heightened unconstructive ruminative tendencies and intolerance of uncertainty contributed towards elevated depression symptoms (Yook et al., 2010). Although these investigations contributed valuable insights into the relations between intolerance of uncertainty and rumination to anxiety and depression symptoms, it is of note that they did not delineate unconstructive and constructive forms of rumination.

Also, in the correlational analysis performed by Yook et al. (2010), they grouped together participants with MDD and people with diagnoses of GAD and comorbid GAD and MDD. This is particularly problematic because both intolerance and rumination are both common features of anxiety disorders and anxiety and depression symptoms also typically co-occur (Gentes & Ruscio, 2011; Hong & Cheung, 2015; Mahoney & McEvoy, 2012). In an investigation amongst healthy participants and participants with GAD, when anxious symptoms were accounted for, depression and intolerance of uncertainty were not significantly associated with one another (Jensen, Cohen, Mennin, Fresco, & Heimberg, 2016). It is therefore unclear from previous examinations of the interaction between intolerance of uncertainty and rumination across people with MDD and GAD, whether the relations between these variables is determined by the occurrence of anxiety within depression. The present analysis of the contribution of intolerance of uncertainty and rumination to depression therefore takes individual differences in anxiety symptoms into account. As such, the present investigation echoes recent calls (Shihata et al., 2016) to examine disorder-specific effects of intolerance of uncertainty.

The present study provides the first investigation of the unique and interacting contributions of intolerance of uncertainty and constructive and unconstructive rumination to depression symptoms and diagnoses whilst accounting for individual differences in anxiety symptoms. Although intolerance of uncertainty and both forms of rumination were expected to contribute towards these depression outcomes, it was unclear to what extent these effects would persist once anxiety symptoms were accounted for. As such, this analysis used the same self-report index of anxiety that has previously been used to account for anxiety symptoms within an analysis of intolerance of uncertainty and depression (Jensen et al., 2016), the Trait Anxiety subscale of the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). In order to account for the aspects of IU and rumination that are common within anxiety, the present investigation therefore used a subscore of the STAI that represents the unique components of anxiety that are not associated with depression. The Mini-CERTS questionnaire was also used to explore the relations between the subtypes of rumination and intolerance of uncertainty and depression. In addition, the most common self-report measure of intolerance of certainty was used, the Intolerance of Uncertainty Scale (IUS)(Carleton, Norton, & Asmundson, 2007). Although researchers have attempted to delineate the IUS into subfactors for prospective and inhibitory IU, a confirmatory factor analysis amongst participants with MDD suggests that these subfactors do not fit the data any better than if only a single factor is used (Carleton et al., 2012). As such, intolerance of uncertainty was operationalized using the IUS total score.

2. Methods

2.1 Participants

Participants with diagnoses of Major Depressive Disorder (MDD; $n = 48$) were recruited from The University Hospital Complex of Albacete, Spain. Participants were initially diagnosed by an attendant psychiatrist using the Mini International Neuropsychiatric

Interview (MINI)(Sheehan et al., 2000). Participants who met Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)(American Psychiatric Association, 2013) diagnostic criteria for MDD, unique ($n = 20$) or recurrent ($n = 28$), were invited to participate and their diagnoses were confirmed by further interviewing with one of the authors. Exclusion criteria were substance abuse/dependence (except nicotine); personality disorders; schizophrenia or psychotic disorders; or, diagnoses of dysthymia or unspecified depressive disorder. 24 (50%) depressed participants were classified as meeting criteria for the anxiety specifier, four (8%) met criteria for the atypical specifier, three (6%) met criteria for the melancholic specifier, eight (17%) had mixed features and nine (19%) did not meet criteria for an additional specifier. 42 (88%) participants were taking anti-depressants (Selective Serotonin Reuptake Inhibitors (SSRIs), $n = 20$ (42%); Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs), $n = 22$ (46%)). Controls ($n = 66$) were recruited from advertisements placed in the area near to the University Hospital. Controls were interviewed by one of the authors to confirm that they were diagnosis-free.

2.2 Measures

2.2.1 Depression symptoms

Self-reported depression symptom severity was assessed with The Beck Depression Inventory Version II (BDI-II; (Beck, Steer, & Brown, 1996), a 21-item questionnaire where participants report their experience of typical cognitive, affective and somatic depression symptoms within the past two weeks. Higher scores reflect worse depression symptoms. The BDI-II showed strong internal consistency ($\alpha = .97$).

2.2.2 Trait anxiety

Self-reported anxious symptoms were assessed using seven items from the State-Trait Anxiety Inventory - Trait Version (STAI-T; Spielberger et al., 1983) that capture the unique components of anxiety that are not associated with depression (STAI-A). The items of the

STAI-A assess the general or chronic experience of anxious symptoms. The STAI-A items showed strong internal consistency ($\alpha = .92$).

2.2.3 Intolerance of uncertainty

The 12-item Intolerance of Uncertainty Scale (Carleton et al., 2007) was used to measure self-reports of the extent to which participants consider several cognitive, affective and behavioural reactions to uncertain situations to be characteristic of them. Participants are asked to respond on scales from 1 (Not at all characteristic of me) to 5 (Entirely characteristic of me) for each item, including, for example, “I always want to know what the future has in store for me” and “A small unforeseen event can spoil everything”. The IUS showed strong internal consistency ($\alpha = .92$).

2.2.4 Rumination

The 16-item Mini Cambridge-Exeter Repetitive Thought Scale (Mini-CERTS)(Douilliez et al., 2012) was used to measure participants’ reports of the frequency with which they use constructive and unconstructive forms of rumination when thoughts about themselves, their feelings or situations come to mind. For example, for constructive rumination participants are asked to what extent they tend to respond to thoughts by using problem-focused and creative thinking with items such as “My thinking tends to become open, loose, expansive and creative”. For unconstructive rumination, participants are asked to what extent they tend to dwell on their thoughts and feelings with items such as “I think I’m no good at all” or “I compare myself to other people”. Higher scores for each sub-score therefore reflect greater use of their respective form of rumination. Both sub-scores showed acceptable internal consistency ($\alpha_{\text{constructive}} = .65$; $\alpha_{\text{unconstructive}} = .76$).

2.3 Procedure

Ethical approval for the study was provided by the Research Committee of the Albacete, Spain, Health Area (05/2017CEIm). Participants attended the hospital complex and

completed the measures privately and individually in a clinic room. After providing informed consent, participants completed the self-report measures in the following fixed order: BDI-II, IUS, Mini-CERTS and STAI-A.

2.4 Statistical procedure

First, between-group differences comparing people with diagnoses of MDD and controls regarding their demographic characteristics and each of the study variables were analysed using *t* and chi-squared statistics, where appropriate. Second, correlations between study variables across all participants were examined. Third, several multiple linear regressions examined predictors of variance in self-reported depression symptoms. The first model tested for the relation between trait anxiety and depression symptoms. The second model added self-reported intolerance of uncertainty and unconstructive and constructive rumination use examine to what extent these variables explained unique variance over and above that which was explained by trait anxiety. Where there was evidence of significant effects in this regression, a second regression model was tested in which mean-centred interaction terms for intolerance of uncertainty and both forms of rumination were added as predictor variables. Predictor variables were added together in two steps, rather than in a fully, per-variable, step-wise approach, given that our hypotheses concerned the relations between each of these variables and depression even when the variance of the other predictor variables was accounted for. Adding the interaction terms in a second model then enabled us to examine the additional contribution of these interactions to explaining variance in depression symptoms. Finally, trait anxiety was removed in a final step in order establish if there were any differences between the final models, with interactions, if anxiety symptoms were not accounted for.

Multiple logistic regressions then examined the extent to which self-reported intolerance of uncertainty and unconstructive and constructive rumination were associated

with diagnoses of MDD. The presence of a MDD diagnosis was coded as 1 and the absence of such a diagnosis was coded as 0. Self-reported trait anxiety was included as a predictor with IU and rumination variables, given that logistic regression does not allow for us to test for change in the total amount of variance that is explained in depression symptoms as was possible in the first two linear regression models. Again, where there was evidence of significant effects in the first regression model, a second regression tested for interaction effects. Also, trait anxiety was removed from the models to examine if the variance explained by intolerance of uncertainty and rumination changed when anxiety was not accounted for.

3. Results

3.1 Between-groups comparisons

See Table 1 for means and standard deviations and between-group tests for each dependent variable. There was no difference between groups in their proportions of females or the mean age of participants.

Relative to controls participants, participants with MDD reported significantly more severe depression symptoms and trait anxiety. Also, relative to controls, participants with MDD reported significantly more intolerance of uncertainty, significantly less use of constructive rumination and significantly more use of unconstructive rumination.

3.2 Correlational analyses

Across all participants, those who reported higher levels of depression symptoms also reported higher trait anxiety ($r = .86, p < .001$), greater intolerance of uncertainty ($r = .67, p < .001$), less use of constructive rumination ($r = -.34, p = .001$) and more use of unconstructive rumination ($r = .66, p < .001$). Similarly, participants who reported higher levels of trait anxiety also reported greater intolerance of uncertainty ($r = .71, p < .001$), less use of constructive rumination ($r = -.22, p = .021$) and more use of unconstructive rumination ($r = .77, p < .001$).

Reports of greater intolerance of uncertainty were associated with reports of greater use of unconstructive rumination ($r = .62, p < .001$) but were not significantly correlated with self-reports of constructive rumination use ($r = -.07, p = .440$).

Self-reports of the extent to which participants used constructive rumination were not significantly related to their reports of using unconstructive rumination ($r = .10, p = .287$).

3.3 Regression analyses

3.3.1 Depression symptoms

In the first regression, trait anxiety explained a substantial amount of variance in depression symptoms, $b = 2.398, SE = 0.136, p < .001, 95\% CI[2.13, 2.67]$. In the second regression, self-reported intolerance of uncertainty, $b = 0.205, SE = 0.094, p = .030, 95\% CI[0.02, 0.39]$, and constructive rumination, $b = -0.904, SE = 0.230, p < .001, 95\% CI[-1.36, -0.45]$, each explained unique variance in individual differences in self-reported depression symptom severity. Self-reports of unconstructive rumination use did not explain a significant amount of variance, $b = 0.357, SE = 0.244, p = .147, 95\% CI[-0.13, 0.84]$. Self-reported trait anxiety continued to explain a significant amount of variance, $b = 1.750, SE = 0.244, p < .001, 95\% CI[1.27, 2.23]$. This model explained a large amount of variance in depression symptoms, $R^2 = .78, F(4,109) = 94.28, p < .001$, and this was significantly more than the model with only trait anxiety, $\Delta R^2 = .04, F(3, 109) = 6.54, p < .001$.

In the third regression (see Table 2), when the interaction terms were added, self-reported intolerance of uncertainty and constructive rumination continued to explain unique variance in individual differences in self-reported depression symptoms and self-reports of unconstructive rumination use did not explain a significant amount of variance. Regarding interaction effects, the interaction between intolerance of uncertainty and unconstructive rumination explained a significant amount of variance. The interaction between constructive rumination and unconstructive rumination also explained a significant amount of variance.

However, the interaction between intolerance of uncertainty and constructive rumination use did not explain a significant amount of variance in depression symptoms. This second model explained a substantial amount of variance in depression symptoms (80%) and explained significantly more variance than the previous model that did not include interaction terms, $\Delta R^2 = .02$, $F(3, 106) = 3.69$, $p = .014$.

When trait anxiety was removed from this final model the findings were mostly unchanged. Self-reported intolerance of uncertainty, $b = 0.546$, $SE = 0.103$, $p < .001$, 95% CI[0.34, 0.75] and constructive rumination, $b = -1.496$, $SE = 0.252$, $p < .001$, 95% CI[-2.00, -1.00], each explained significant amounts of variance and the interaction between intolerance of uncertainty and unconstructive rumination also continued to explain a significant amount of variance, $b = 0.030$, $SE = 0.015$, $p = .046$, 95% CI[0.00, 0.06]. The interaction between intolerance of uncertainty and constructive rumination also did not explain a significant amount of variance in depression symptoms, $b = 0.024$, $SE = 0.026$, $p = .362$, 95% CI[-0.03, 0.08]. However, some differences emerged between these final models. When anxiety was not included in the model, unconstructive rumination now explained a significant amount of variance, $b = 1.442$, $SE = 0.227$, $p < .001$, 95% CI[0.99, 1.89], and the interaction between constructive rumination and unconstructive rumination was no longer a significant predictor of variance, $b = -0.104$, $SE = 0.058$, $p = .074$, 95% CI[-0.22, 0.01].

Simple slopes analyses were conducted in order to examine the interaction effects that emerged in the third regression with trait anxiety included (see Figure 1). Amongst participants who reported high levels of unconstructive rumination (+1 standard deviation greater than the mean), self-reports of higher intolerance of uncertainty were associated with high levels of depression symptom severity, $b = 0.876$, $SE = 0.152$, 95% CI[0.58, 1.18], $p < .001$. The same association was also present for participants who reported lower levels of unconstructive rumination (-1 standard deviation lower than the mean), $b = 0.403$, $SE =$

0.139, 95% CI[0.13, 0.68], $p = .004$. A post-hoc contrast with a Tukey adjustment also suggested that the slopes differed significantly from one another, $b = 0.473$, $SE = 0.181$, $p = .010$. Using the same ± 1 SD splits, amongst participants who reported greater use of unconstructive rumination, less use of constructive rumination was associated with higher depression symptom severity, $b = -2.110$, $SE = 0.373$, 95% CI[-2.85, -1.38], $p < .001$, and the same association was present for participants who reported less use of unconstructive rumination, $b = -1.540$, $SE = 0.367$, 95% CI[-2.26, -0.81], $p < .001$. However, these slopes did not differ significantly from one another, $b = -0.577$, $SE = 0.504$, $p = .254$.

3.3.2 Depression diagnoses

In the multiple logistic regression analysis with diagnostic status (MDD = 1; Control = 0) as the dependent variable, only self-reported trait anxiety was a significant predictor of the probability of MDD diagnoses, $OR = 0.401$, 95% CI[0.21, 0.63], $X^2(1) = 87.39$, $p < .001$. Neither intolerance of uncertainty, $OR = 0.043$, 95% CI[-0.03, 0.12], $X^2(1) = 1.60$, $p = .207$, constructive rumination, $OR = -0.108$, 95% CI[-0.31, 0.08], $X^2(1) = 1.22$, $p = .269$, nor unconstructive rumination, $OR = 0.021$, 95% CI[-0.17, 0.22], $X^2(1) = 0.05$, $p = .824$, was a significant predictor of diagnostic status. A second regression including interaction terms was not conducted as intolerance of uncertainty and the ruminative sub-types did not show significant contributions to diagnostic status.

As none of the expected predictor variables showed a significant association with depression symptoms, trait anxiety was removed from the regression to examine the effects these variables had when anxiety symptoms were not accounted for. There, intolerance of uncertainty, $OR = 0.106$, 95% CI[0.05, 0.17], $X^2(1) = 46.77$, $p < .001$, constructive rumination, $OR = -0.245$, 95% CI[-0.42, -0.09], $X^2(1) = 6.86$, $p = .008$, and unconstructive rumination, $OR = 0.278$, 95% CI[0.14, 0.44], $X^2(1) = 18.10$, $p < .001$, were each significant predictors of diagnostic status. As such, an additional model was performed including

interaction terms, as in the linear regression models. Self-reported intolerance of uncertainty, $OR = 0.108$, 95% CI[0.05, 0.18], $X^2(1) = 46.77$, $p < .001$, constructive rumination, $OR = -0.221$, 95% CI[-0.41, -0.04], $X^2(1) = 6.86$, $p = .009$, and unconstructive rumination, $OR = 0.288$, 95% CI[0.14, 0.48], $X^2(1) = 18.10$, $p < .001$, continued to be significant predictors of diagnostic status. However, none of the interaction terms were significant predictors of diagnostic status (all $X^2 < 0.80$, smallest $p = .369$).

4. Discussion

This investigation examined the relations between intolerance of uncertainty and rumination and their contribution to depression symptoms and diagnoses. Participants completed self-report measures of depressive and anxious symptoms, intolerance of uncertainty, and a measure of constructive and unconstructive forms of rumination.

The findings of the between group analyses are consistent with the findings of meta-analyses and theories suggesting that people with MDD are significantly more intolerant of uncertainty and engage in significantly more unconstructive forms of rumination, compared to healthy controls (Carleton, 2016b; Gentes & Ruscio, 2011; Olatunji et al., 2013). We provide the first evidence, using the Mini-CERTS questionnaire, that people with MDD diagnoses also report less use of constructive rumination compared to controls. Previous studies in this area have examined the correlation between constructive and unconstructive rumination and depression symptoms in non-clinical samples (Di Schiena et al., 2013; Douilliez et al., 2014) but this is the first study to also include people with diagnoses of Depression.

Our findings also add support to the suggestion that constructive and unconstructive rumination are separable constructs (Watkins, 2008) as they did not correlate with one another, despite their correlations with depression symptoms. Although it is tempting to assume that if a person engages in less unconstructive rumination that they must instead be

engaging in constructive rumination, the absence of a negative correlation between these variables suggests otherwise. It is of note that in our regression analysis, the interaction between constructive and unconstructive rumination explained a significant amount of variance in depression symptoms. Simple slopes analysis suggested that participants who reported greater use of unconstructive rumination and diminished use of constructive rumination also showed more severe depression symptoms. Unconstructive and constructive rumination may be separable constructs but the co-occurrence of problematic levels of both may have a particularly detrimental effect on a person's depression symptoms. In particular, the findings presented here suggest that the ability to engage in constructive thinking may protect one against one's tendency to engage in more unconstructive forms of thinking.

The correlational findings presented here are also consistent with investigations with non-clinical groups (de Jong-Meyer et al., 2009; Hong, 2013; Hong & Paunonen, 2011; Liao & Wei, 2011) and comparisons across people with MDD and GAD (Yook et al., 2010) showing a relation between intolerance of uncertainty, unconstructive forms of rumination and depression. Expanding upon this existing research, we found that self-reports of intolerance of uncertainty were correlated with greater use of unconstructive rumination but were not correlated with constructive rumination use. In the linear regression analysis, constructive rumination use explained a significant amount of variance in depression symptoms but did not show a significant interaction with intolerance of uncertainty. However, unconstructive rumination showed a significant interaction with intolerance of uncertainty. Simple slopes analysis suggested that the combination of greater intolerance of uncertainty and greater use of unconstructive rumination has a particularly detrimental effect on depression symptoms. These findings again suggest that constructive and unconstructive rumination are separable constructs and not merely two ends of the same scale (Watkins, 2008). Also, in line with recent theoretical suggestions, these findings also indicate that

thinking in an abstract and repetitive manner about the effects of events on oneself is uniquely associated with feelings of distress in uncertain situations (Carleton, 2016b).

Contrary to previous studies in healthy participants (Jensen et al., 2016) the effects on depression symptoms were present even when accounting for anxiety symptoms. It could be that in studies with healthy participants there is insufficient variability in depression symptoms for the unique contributions of these cognitive variables to be examined once anxiety symptoms are accounted for. However, in the present study, although there were significant group differences in intolerance of uncertainty and both forms of rumination, and these variables were related to diagnostic status when anxiety symptoms were not accounted for, the relations between these variables and depression diagnoses were not significant when anxious symptoms were accounted for. Intolerance of uncertainty and rumination contribute towards depression symptoms independently of their relation with anxiety but the extent to which they contribute to MDD diagnoses seems to be better accounted for by the presence of anxious symptoms within MDD.

Future studies that examine the causal relations between intolerance of uncertainty and rumination are now needed, perhaps by manipulating the use of constructive and unconstructive rumination in groups of participants to examine the effects of this on intolerance of uncertainty. One way to achieve this would be through testing interventions which modify ruminative tendencies, such as rumination-focused cognitive behavioural therapy (Watkins et al., 2011) and to examine whether this in turn improves intolerance of uncertainty and depression symptoms. Relatedly, our findings support the suggestion by Carleton et al. (2016b) that treatments which have been shown to be efficacious in improving rumination may also be effective in improving intolerance of uncertainty given their shared association.

The present investigation's main limitation, and others within this field (Shihata et al., 2016), is its use of self-report indices. As Shihata et al. (2016) remark, behavioural measures of intolerance of uncertainty are needed in future studies, and the same is true for measures of rumination. Regarding intolerance of uncertainty, tasks taken from behavioural economics, such as the beads task (Jacoby, Abramowitz, Reuman, & Blakey, 2015), which involve probability judgements in uncertain or ambiguous situations and where the distress and impairment that accompanies these judgements is quantified, might have some utility.

In overview, the present investigation expands upon existing research by showing that, independent of their relations with anxious symptoms, intolerance of uncertainty and rumination contribute towards depression symptoms but not diagnoses. Our findings also highlight the importance of delineating unconstructive from constructive forms of rumination as they were differentially related to intolerance of uncertainty and depression symptoms. In particular, intolerance of uncertainty was found to interact with unconstructive rumination, but not constructive rumination, in contributing towards elevated depression symptoms. Future investigations are needed where ruminative tendencies and intolerance of uncertainty are manipulated and where these variables are quantified with behavioural indices rather than self-reports.

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Table 1. Means, standard deviations and tests for group differences

	MDD	Control	Test	<i>P</i>	95% CI	<i>Cohen's d</i>
Females	67%	64%	$\chi^2(1) = .11$.738	[-0.30, 0.43]	0.06
Age	50.42 (12.08)	47.12 (15.19)	$t(112) = -1.24$.216	[-8.55, 1.95]	-0.24
BDI-II	39.02 (11.47)	9.64 (7.80)	$t(112) = -16.28$	<.001	[-32.96, -25.81]	-2.91
STAI-A	23.75 (3.32)	14.11 (4.41)	$t(112) = -12.74$	<.001	[-11.14, -8.14]	-2.53
IU	44.25 (9.26)	29.86 (10.24)	$t(112) = -7.71$	<.001	[-18.09, -10.69]	-1.49
CR	15.19 (3.78)	17.18 (3.75)	$t(112) = 2.79$.006	[0.58, 3.41]	0.53
UR	25.19 (4.08)	16.76 (4.59)	$t(112) = -7.23$	<.001	[-8.02, -4.57]	-1.41

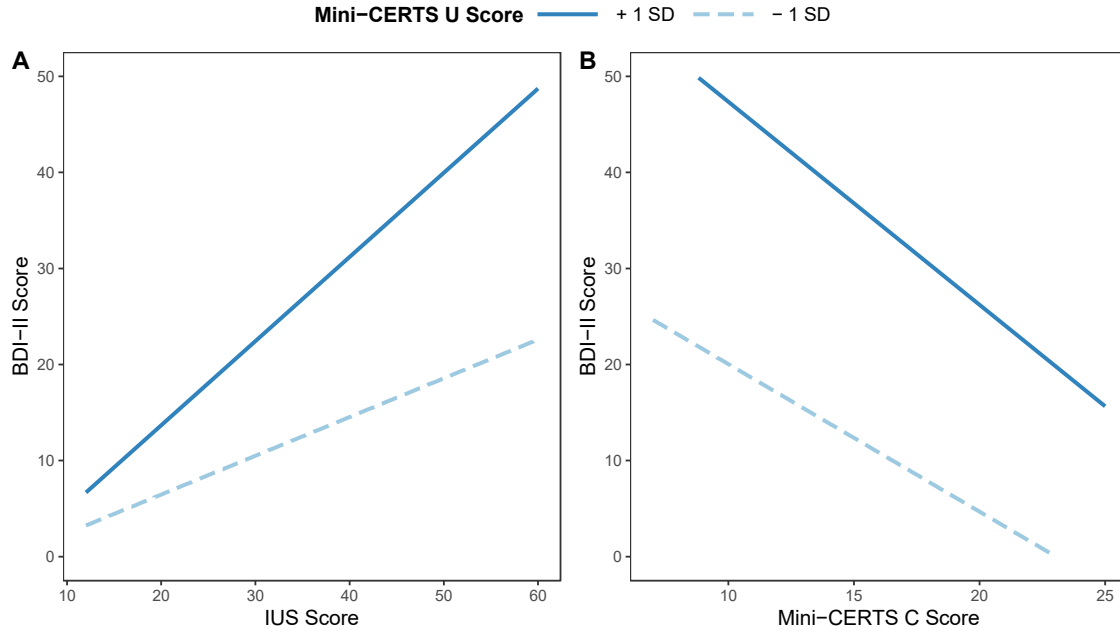
Note. Differences between participants with diagnoses of Major Depressive Disorder (MDD) and controls in demographic characteristics and self-report measures of psychopathology symptoms (BDI-II: Beck Depression Inventory Version II; STAI-A: State Trait Anxiety Inventory – Trait Anxiety subscale), intolerance of uncertainty (IU) and rumination (CR: The Mini Cambridge-Exeter Repetitive Thought Scale – Constructive Rumination subscale; UR: The Mini Cambridge-Exeter Repetitive Thought Scale – Unconstructive Rumination subscale).

Table 2. Regression analyses

Dependent variable: <i>BDI-II</i>	<i>B</i>	<i>SE</i>	<i>P</i>	<i>95% CI</i>	
				<i>Lower</i>	<i>Upper</i>
STAI-A	1.775	0.237	< . 001	1.31	2.25
IU	0.245	0.093	.010	0.06	0.43
UR	0.244	0.244	.321	-0.24	0.73
CR	-0.799	0.225	< . 001	-1.24	-0.35
IU by UR interaction	0.025	0.012	.037	0.00	0.05
IU by CR interaction	0.027	0.021	.218	-0.02	0.07
UR by CR interaction	-0.127	0.047	.008	-0.22	-0.03
$R^2 = .80, F(7, 106) = 59.45, p < .001$					

Note. Linear regression predicting BDI-II (Beck Depression Inventory Version II) scores, with mean-centred scores on the STAI-A (State Trait Anxiety Inventory – Trait Anxiety subscale) Intolerance of Uncertainty Scale (IU) and constructive (CR: The Mini Cambridge-Exeter Repetitive Thought Scale – Constructive Rumination subscale) and unconstructive forms of rumination (UR: The Mini Cambridge-Exeter Repetitive Thought Scale – Unconstructive Rumination subscale) and interactions between these variables.

Figure 1. Simple slopes



Note. Simple slopes analysis of the relations between depression symptoms and (A) intolerance of uncertainty (Total Intolerance of Uncertainty Scale (IUS) Scores) and (B) constructive rumination (The Mini Cambridge-Exeter Repetitive Thought Scale – Constructive Rumination subscale). Lines for +1 standard deviation (SD) and -1 SD for scores on The Mini Cambridge-Exeter Repetitive Thought subscale for unconstructive rumination are shown.

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