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# Intolerance of uncertainty and negative metacognitive beliefs as transdiagnostic mediators of repetitive negative thinking in a clinical sample with anxiety disorders

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Abstract

This study aimed to replicate and extend a hierarchical model of vulnerability to worry, with neuroticism and extraversion as higher-order factors and negative metacognitions and intolerance of uncertainty as second-order factors. The model also included a transdiagnostic measure of repetitive negative thinking (RNT) and depression symptoms as outcome variables to determine whether relationships would extend beyond worry, which has traditionally been studied within the context of generalized anxiety disorder (GAD). Participants (N = 99) were referrals to a specialist anxiety disorders clinic with a principal anxiety disorder who completed a battery of self-report questionnaires assessing neuroticism, extraversion, metacognitions, intolerance of uncertainty, worry, RNT, and depression symptoms. Mediational analyses using bootstrapping provided support for transdiagnostic and diagnosis-specific mediation effects. Negative metacognitions fully mediated the relationship between neuroticism and RNT for the whole sample and for subsamples with and without generalized anxiety disorder (GAD). Intolerance of uncertainty mediated the relationship between neuroticism and worry (for the whole sample and for those with GAD) and between neuroticism and RNT (for those with GAD). Implications for theory, treatment, and nosology are discussed.

*Key Words*: intolerance of uncertainty; metacognitions; worry; repetitive negative thinking; transdiagnostic

## 1.0 Introduction

Neuroticism, defined as a tendency to experience negative emotional states and sensitivity to stress (Costa & McCrae, 1987), is a relatively stable personality trait associated with a range of emotional disorders (Brown, Chorpita, & Barlow, 1998; Watson, 2005; Watson, Gamez, & Simms, 2005). Neuroticism is a risk factor for developing anxiety and depressive disorders (Krueger, Caspi, Moffitt, Silva, & McGee, 1996), although the pathway from neuroticism into emotional disorder is not well understood. Identifying mechanisms, or second-order factors, that explain why higher-order vulnerabilities such as neuroticism are expressed as emotional disorders for some individuals but not others is important for guiding efforts at prevention and treatment of emotional disorders. This study will investigate a hierarchical model with two potential mediators between neuroticism and worry, namely intolerance of uncertainty and negative metacognitions.

Intolerance of uncertainty (IU) has recently been defined as cognitive, emotional, and behavioral reactions to uncertainty that bias information processing and lead to faulty appraisals of heightened threat and reduced coping (see Carleton, 2012, for a comprehensive review of this and earlier conceptualizations). The Intolerance of Uncertainty Model (IUM) was initially developed with reference to generalized anxiety disorder (GAD; Dugas, Letarte, Rhéaume, Freeston, & Ladouceur, 1995; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994), which is characterized by excessive and uncontrollable worry (American Psychiatric Association, 1994). The IUM suggests that individuals with GAD find uncertainty distressing, which leads to the commencement of worrying when confronted with an uncertain or ambiguous situation (e.g. *What if* [something bad] happens?). There is considerable evidence that intolerance of uncertainty (IU) is a cognitive vulnerability factor for worry (Koerner & Dugas, 2008; Ladouceur, Gosselin, & Dugas, 2000;

Sexton, Norton, Walker, & Norton, 2003; van der Heiden, Melchior, Muris, Bouwmeester, Bos, & van der Molen, 2010) and an important maintaining factor for GAD (Behar, DiMarco, Hekler, Mohlman, & Staples, 2009; Dugas, Gagnon, Ladouceur, & Freeston, 1998). Intervention trials have found that changes in IU are associated with improvements in worry and anxiety symptoms during cognitive behavioral therapy (CBT, Dugas & Ladouceur, 2000; Dugas et al., 2003; Dugas et al., 2010).

The Self-Regulatory Executive Function model (S-REF, Wells & Matthews, 1996) posits that positive and negative metacognitive beliefs increase engagement in repetitive negative thinking (RNT). The S-REF model suggests that positive metabeliefs about RNT being helpful motivate engagement in RNT (e.g., "worrying about my problems helps me to cope"), after which negative metabeliefs about RNT being harmful, dangerous, and uncontrollable escalate perceptions of threat from RNT and result in maladaptive attempts to control negative thoughts which, in turn, further increases engagement in RNT. Research has demonstrated associations between various forms of RNT and metacognitive beliefs (McEvoy, Mahoney, & Moulds, 2010; McEvoy, Mahoney, Perini, & Kingsep, 2009; McEvoy, Moulds, & Mahoney, 2013; Roelofs, Huibers, Peeters, Arntz, & van Os, 2010), and evidence is emerging that metacognitive therapy, which aims to directly challenge positive and negative metacognitive beliefs, is associated with reductions in RNT and symptoms of anxiety and depressive disorders (Rees & van Koesveld, 2008; Wells et al., 2012; Wells & Colbear, 2012).

Building on previous research (Norton & Mehta, 2007; Norton, Sexton, Walker, & Norton, 2005; Sexton et al., 2003), van der Heiden and colleagues (2010) recently investigated a hierarchical model with neuroticism and extraversion as higher-order factors, IU and metacognitions as second-order factors, and worry as an

outcome variable within a clinical sample with GAD. Depression symptoms were also included as an outcome variable to determine whether direct and indirect effects were specific to the core feature of GAD (i.e., worry) or similar for comorbid symptoms. Extraversion was included as a higher-order variable to test if a direct association with depression found previously would be replicated, and to identify differential relationships between the two vulnerability factors (neuroticism and extraversion) and lower-order variables. These researchers found that together negative metacognitions and IU fully mediated the relationship between neuroticism and worry, and partially mediated the relationship between neuroticism and depression symptoms. Neuroticism and extraversion also demonstrated direct relationships to depression symptoms. van der Heiden et al. found that positive metacognitive beliefs did not mediate these relationships for worry or depression symptoms.

Importantly, van der Heiden et al. (2010) noted that most variables in their hierarchical model are transdiagnostic constructs and speculated that their model may extend to other emotional disorders. IU has been found to be associated with, and to mediate, symptoms of social anxiety disorder, panic disorder and agoraphobia, generalized anxiety disorder, obsessive-compulsive disorder, and depression (Boelen & Reijntjes, 2009; Carleton, Collimore, & Asmundson, 2010; Carleton, Mulvogue, Thibodeau, McCabe, Antony, & Asmundson, 2012; Dugas, Gosselin, & Ladouceur, 2001; Gentes & Ruscio, 2011; Holaway, Heimberg, & Coles, 2006; Lind & Boschen, 2009; Mahoney & McEvoy, 2012a, b; McEvoy & Mahoney, 2011, 2012). The S-REF model (Wells & Matthews, 1996) is a transdiagnostic model describing the contribution of metacognitions to engagement in the Cognitive Attentional Syndrome (CAS), which consists of RNT along with heightened self-focus, maladaptive coping behavior, and threat monitoring. The S-REF model argues that the CAS causally contributes to emotional disorder, and there is evidence that metacognitions are

associated with a range of symptoms and disorders including depression (Papageorgiou & Wells, 2003; Roelofs et al., 2007), anxiety (Yilmaz, Gencoz, & Wells, 2011), GAD (Wells & Carter, 2001), social anxiety disorder (McEvoy et al., 2009), obsessive compulsive disorder and panic disorder (Cucchi et al., 2012).

van der Heiden et al. (2010) used worry as the primary outcome variable given that their focus was on the core feature of GAD. However, recent research has suggested that worry shares many features with other forms of RNT, including depressive rumination and post-event processing (McEvoy et al., 2010; Watkins, Moulds, & Mackintosh, 2005). Watkins et al. (2005) found that worry, which is typically studied within the context of GAD, and rumination, which is commonly studied within the context of depression, were more similar than different. These forms of RNT have been found to be associated with various emotional disorders cross-sectionally, experimentally, and longitudinally (Nolen-Hoeksema, 2000; Nolen-Hoeksema & Morrow, 1993; Nolen-Hoekseema, Wisco, & Lyubomirsky, 2008; Borkovec, Alcaine, & Behar, 2004; McEvoy et al., 2009), and there is evidence that they are associated with symptoms of multiple emotional disorders (McEvoy & Brans, 2013; Segerstrom, Tsao, Alden, & Craske, 2000). McEvoy et al. (2010) found that after diagnosis-specific confounds were removed from the instructions and items in various well-validated measures of RNT (i.e., worry, rumination, and post-event processing) items loaded on a single RNT factor in a clinical sample with anxiety and depressive disorders. This common factor has been found to be associated with a range of emotions within an undergraduate sample (McEvoy et al., 2010) and with symptoms of various emotional disorders within a clinical sample (Mahoney, McEvoy, & Moulds, 2012). Therefore, there are strong theoretical and empirical reasons to expect that van der Heiden et al.'s hierarchical model would replicate with forms of RNT other than worry, and with emotional disorders other than GAD.

The aim of this study was to replicate and extend van der Heiden et al.'s (2010) study. We sought to replicate the relationships found between the higher-order factors of neuroticism and extraversion, the second-order factors of IU and negative metacognitions, and the outcome variables of worry and depression symptoms. van der Heiden et al. found that positive metacognitions were unrelated to the outcomes, so only negative metacognitive beliefs were considered in this study. We extended van der Heiden et al.'s study in three important ways. First, we used transdiagnostic versions of the second-order factors. Specifically, we modified the Metacognitions Questionnaire (MCQ) by substituting the term 'worry' in 13 items with more generic terms such as 'thinking about my problems', because using this diagnosis-specific term could artificially inflate the relationship between metacognitions and the outcome measure of worry in particular. Similarly, we used a more recently validated short version of the Intolerance of Uncertainty Scale (IUS-12; Carleton, Norton, & Asmundson, 2007), which has been found to have a more stable factor structure than the original version (Carleton, 2012; Carleton et al, 2007; Khawaja & Yu, 2010; McEvoy et al, 2011). Second, in addition to worry and depression symptoms we included a transdiagnostic measure of RNT as an outcome variable so that we could determine whether the mediation effects were particular to worry or were common to RNT more generally. Third, we used a mixed-diagnosis clinical sample and tested whether the hierarchical relationships would be common across subsamples with and without GAD. These extensions enabled us to identify whether IU and metacognitions were mediators of worry in patients with GAD in particular, or for RNT and emotional disorders in general. Identifying transdiagnostic mediators of RNT is crucial to guide the development of transdiagnostic treatments and to determine how current diagnosis-specific treatments could be used to effectively and efficiently treat a broader array of emotional disorders.

The primary aim of this study was to test an extended hierarchical model with neuroticism and extraversion as higher-order factors, IU and negative metacognitions as second-order factors, and RNT, worry, and depression symptoms as outcomes. Based on van der Heiden et al.'s (2010) findings, we hypothesized that (1) negative metacognitions and IU would fully mediate the relationship between neuroticism and worry and between neuroticism and RNT, (2) IU would partially mediate the relationship between neuroticism and depressive symptoms, and (3) extraversion would only have a direct relationship to depressive symptoms (see Figure 1). Consistent with the transdiagnostic hypothesis we expected that these relationships would replicate in patients with and without a diagnosis of GAD.

## 2.0 Method

### *2.1 Participants*

Participants (N = 99, 53% women) were referred to a specialist anxiety disorders treatment service by General Practitioners or Psychiatrists. At the initial assessment participants completed a standard questionnaire battery and were administered the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994). All participants met criteria for a principal anxiety disorder. Principal diagnoses included social phobia (n = 51), panic disorder with or without agoraphobia (n = 23), generalized anxiety disorder (GAD, n = 18), obsessive compulsive disorder (n = 4), post-traumatic stress disorder (n = 2), and specific phobia (n = 1). Around one quarter of patients had one (23%), two (28%), or three (29%) disorders, with 20% meeting criteria for four or more disorders. In total, 46 patients (46.5%) met criteria for principal or comorbid GAD, and 24 (24.2%) met criteria for either major depressive disorder or dysthymia. Around one-third were married or cohabitating relationships (32%), 61% were never married, and 7% were separated or divorced. One quarter (24%) did not complete high school, 26%

complete high school only, 34% had a university degree, and 16% had a trade qualification.

*2.2 Measures*

*2.2.1 Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV).* The ADIS-IV (Brown et al., 1994) is a structured diagnostic interview for the anxiety, mood, somatoform, and substance use disorders. Diagnoses are made according to the criteria described in the Diagnostic and Statistical Manual (DSM-IV; American Psychiatric Association, 1994). Brown, Di Nardo, Lehman, and Campbell (2001) provide evidence of acceptable inter-rater reliability for the anxiety disorders investigated in the present study ($\kappa$ = .59-.79). Inter-rater reliability ($\kappa$ = .63) for the combined depressive disorders group (major depressive disorder and dysthymia) was also acceptable (Brown et al., 2001). Evidence of construct validity, including discriminant and convergent validity, has been demonstrated (Brown et al., 1998).

In the current study, diagnosticians were clinical psychologists and psychiatrists. Training involved (a) thorough reading of the ADIS-IV protocol, (b) observation of an experienced interviewer conducting an ADIS-IV, and (c) administration of an ADIS-IV while being observed by an experienced interviewer. After the training interviews, diagnosticians compared and reviewed diagnoses. All clinicians had extensive experience in the assessment and treatment of internalizing disorders. Principal diagnosis of an anxiety disorder was determined collaboratively by clinicians and participants by identifying which disorder was the most distressing and life-interfering disorder at the time of interview.

*2.2.2 Eysenck Personality Questionnaire (EPQ).* The 23-item neuroticism subscale (EPQ-N) and 21-item extraversion subscale (EPQ-E) of the EPQ (Eysenck & Eysenck, 1975) were used to assess the higher-order constructs. Internal consistency ($\alpha$ = .82 for both subscales; Loo, 1979) and test–retest reliability (r = .82 and .92 over

1 month for neuroticism and extraversion, respectively; Eysenck & Eysenck, 1975) are good, and data demonstrating construct validity are extensive (e.g., Barrett, Petrides, Eysenck, & Eysenck, 1998; Caruso, Witkiewitz, Belcourt-Dittloff, & Gottlieb, 2001; Steele & Kelly, 1976). A substantial body of evidence suggests that these personality traits are dimensional rather than taxonic (Trull & Durrett, 2005).

*2.2.3 Intolerance of Uncertainty Scale-short form (IUS-12, Carleton et al., 2007).* The IUS-12 is a more recently validated 12-item version of the original 27-item IUS (Freeston et al., 1994; Buhr & Dugas, 2002) and measures negative beliefs about and reactions to uncertainty. The 12-item version has been found to be highly correlated ($r$ = .96) with the full version in undergraduate (Carleton et al., 2007; Khawaja & Yu, 2010) and clinical samples (McEvoy & Mahoney, 2011). Although the IUS-12 comprises of two subscales, Prospective IU (cognitive) and Inhibitory IU (behavioral), the total score was used in this study due to the absence of any *a priori* hypotheses relating to each subscale. Prospective IU measures cognitive anticipation (e.g. "I always want to know that the future has in store for me."), whereas inhibitory IU measures behavioral inhibition (e.g. "When it's time to act, uncertainty paralyses me.") in response to uncertainty. The IUS-12 has been found to be associated with symptoms of multiple anxiety disorders and depression even when controlling for neuroticism (Boelen, Vrinssen, & van Tulder, 2010; Carleton et al., 2010; Mahoney & McEvoy, 2012a, b; McEvoy & Mahoney, 2011, 2012; Norton & Mehta, 2007). IU as measured by the IUS-12 has been shown to be dimensional rather than taxonic (Carleton et al., 2012).

*2.2.4. Metacognitions Questionnaire-30.* The MCQ-30 (Wells & Cartwright-Hatton, 2004) measures five domains of metacognitive beliefs, metacognitive monitoring, and judgments of cognitive confidence. The five subscales are: (1) positive beliefs about worry, (2) negative beliefs about uncontrollability and danger,

(3) cognitive confidence (assessing confidence in attention and memory), (4) negative beliefs concerning the consequences of not controlling thoughts, and (5) cognitive self-consciousness (the tendency to focus attention on thought processes). Wells and Cartwright-Hatton (2004) reported good internal consistency (r = .72–.92) and test–retest reliability (r = .59–.87) across the total score and subscales, as well as providing evidence of the MCQ-30's factor structure and convergent validity. The 4-point response scale is: Do not agree (1), Agree slightly (2), Agree moderately (3), or Agree very much (4). Similar to previous research investigating transdiagnostic relationships between RNT and the MCQ-30 (McEvoy et al., 2010; McEvoy et al., 2013; Watkins et al., 2005), references to 'worry' (n = 13) were replaced by references to non-diagnosis-specific terms (e.g., 'When I start worrying I cannot stop' became 'When I start thinking about my problems I cannot stop') to avoid artificially inflating the relationship between the MCQ and worry. Although 'worry' is not necessarily equivalent to 'thinking about my problems', because worry may be about perceived rather than only actual problems, the MCQ assesses beliefs about negatively valenced thinking (e.g., "I cannot stop") rather than the content of negative thoughts per se. Therefore, we did not expect this modification to substantively alter the assessment of metacognitive beliefs. Similar to van den Heiden et al. (2010) a total score, excluding the items from the positive beliefs subscale, was calculated to form a negative beliefs about thinking score (MCQ-neg).

*2.2.5 Repetitive Negative Thinking-10 (RNT-10, McEvoy et al., 2010).* The RNT-10 is a 10-item measure of engagement in RNT following distressing target situations derived from the RNT subscale of the Repetitive Thinking Questionnaire (RTQ; McEvoy et al., 2010). The RTQ was derived by factor analysing items from the Penn State Worry Questionnaire (Meyer, Miller, Metzger, & Borkovec, 1990), Ruminative Responses Scale (RRS, Nolen-Hoeksema & Morrow, 1991), and Post-

Event Processing Questionnaire-Revised (McEvoy & Kingsep, 2006) after removing diagnosis-specific confounds from respondent instructions and items. Specifically, similar instructions were provided for completing all items (rather than asking respondents to answer items with respect to specific emotions as in the RRS), items including depression symptoms were removed from the RRS, and the term 'worry' was substituted with non-diagnosis-specific terms in the PSWQ. The RNT-10 subscale correlates very highly with the full 27-item subscale (r = .95-.96), has demonstrated high internal consistency (Cronbach alpha's = .89-.91), and is correlated with symptoms of multiple anxiety disorders and depression in non-clinical (McEvoy et al., 2010) and clinical (Mahoney et al., 2012) samples.

*2.2.6 Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990).* The PSWQ is a widely used 16-item measure of worry with excellent internal consistency (α = .86 -.95) and good temporal stability (r = .92 over 8 to 10 weeks and r =.74 -.93 over 4 weeks; Meyer at al., 1990; Molina & Borkovec, 1994). The measure has demonstrated evidence of construct validity in clinical and community populations (e.g. Brown, Antony, & Barlow, 1992; van Rijsoort, Emmelkamp, & Vervaeke, 1999). Worry as measured by the PSWQ has been shown to be dimensional rather than taxonic (Ruscio, Borkovec, & Ruscio, 2001).

*2.2.7 Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996).* The BDI-II is a 21-item measure of severity of depression symptoms experienced during the previous fortnight. Internal consistency (α = .92) and test re-test reliability (r = .93 over 1 week) are established (Beck et al., 1996), and evidence for construct validity has been demonstrated (e.g. Dozois, Dobson, & Ahnberg, 1998; Osman, Kopper, Barrios, Gutierrez, & Bagge, 2004). Steer, Ball, Ranieri, and Beck (1997) also provide evidence of convergent validity, while Osman, Downs, Barrios, Kopper, Guitierrez, and Chiros (1997) found support for the discriminant validity of the BDI-II.

Depression as measured by the BDI-II has been shown to be dimensional rather than taxonic (Slade, 2007).

*2.3 Procedure*

Patients referred to a specialist anxiety disorders clinic completed a standard battery of questionnaires during their initial assessment, including the EPQ-N, EPQ-E, IUS-12, MCQ-30, RNT-10, PSWQ, and BDI-II. During their initial assessment session patients were administered the ADIS-IV by trained psychiatrists and clinical psychologists with extensive experience in diagnosing and treating emotional disorders. All patients consented for their data to be used for research purposes and the use of the data was approved by the Hospital's Human Research Ethics Committee.

*2.4 Data analytic strategy*

A data analytic strategy similar to van der Heiden et al. (2010) was used to determine mediation effects for the three outcome variables (RNT, worry, depression symptoms). To test the principal mediational hypotheses data were analysed using the PROCESS macro for SPSS (Hayes, 2012). The PROCESS program calculates the total effect of the independent variable (i.e., higher-order factors) on the outcome variables, the direct effect of the independent variables on the outcome variables, the total indirect effect via all mediators (i.e., second-order factors), and individual indirect effects for each mediator along with 95% confidence intervals using at least 1000 bootstrapping re-samples. Bootstrapping accounts for non-normality of the sampling distribution for indirect effects (Preacher & Hayes, 2008). The relationships between the higher order factors neuroticism and extraversion and RNT via negative metacognitions and IU were tested first, followed by the relationships between the higher-order and second-order factors and worry and depression symptoms,

respectively. Models were first run in the whole mixed-diagnosis sample then separately for those with and without GAD.

## 3.0 Results

### *3.1 Data screening*

Prior to data analyses, distributions, skewness and kurtosis were examined for scale total scores. Distributions approximated normality with all scales demonstrating acceptable levels of skewness and kurtosis (< |.69|), with the exception of the EPQ-N which just fell out of the range of -1.0 to 1.0 (skewness = -1.08, kurtosis = 1.25). The removal of two univariate outliers resulted in the skewness (-.66) and kurtosis (-.35) being within the acceptable range for the EPQ-N. All models were run with and without these two outliers but the pattern of results was identical so models using all data are reported. No multivariate outliers were detected and there was no evidence of multicolinearity. Three and five patients had missing data on the MCQ-neg and BDI-II, respectively, so were excluded from analyses using these variables.

### *3.2 Scale descriptive statistics and internal consistency*

Means, standard deviations and internal reliability estimates (Cronbach's α) for measures used to assess higher-order (neuroticism, extraversion), second-order (intolerance of uncertainty, negative metacognitive beliefs), and outcome (RNT, worry, depression symptoms) variables are reported in Table 1. Independent-samples t-tests were conducted to test for gender differences on all higher-order, second-order, and outcome variables. Compared to men, women scored higher on extraversion (*M*s = 9.04 vs. 6.85, *SD*s = 3.64 vs. 4.02), $t(97) = 2.84$, $p = .005$, $d = .57$ , and intolerance of uncertainty (*M*s = 39.69 vs. 33.26, *SD*s = 10.23 vs. 10.28), $t(97) = 3.12$, $p = .002$, $d = .31$. No other differences were significant (all *p*s > .14). Bivariate correlations demonstrated that age was only significantly correlated with negative metacognitive

beliefs ($r$ = -.23, $p$ < .05, all other $p$s > .05). Cronbach's alphas were high for all measures.

*3.3 Mediational models for the whole sample*

The hypothesized model is illustrated in Figure 1. The relations between the higher-order factors of neuroticism and extraversion, the second-order factors of negative metacognitions and IU, and RNT were examined first. The higher- and second-order factors together explained 54% of the variation in RNT, $F(4, 91) = 26.20$, $p < .001$). After controlling for extraversion, the total effect of neuroticism on RNT was significant (β = 1.02, SE = .23, $t$ = 4.53, $p$ < .0001, 95% CI = .57 – 1.47): the direct effect was not significant (β = .23, SE = .18, $t$ = 1.27, $p$ > .05, 95% CI = -.13-.59) but the total indirect effect was significant (β = .78, SE = .20, bootstrapped 95% CI = .42 – 1.23). Within the indirect effect, the MCQ-neg made a significant contribution (β = .65, SE = .17, bootstrapped 95% CI = .35-1.02) but the IUS-12 did not (β = .14, SE = .13, bootstrapped 95% CI = -.12-.38). The direct link between neuroticism and the IUS-12 was significant (β = 1.48, SE = .26, $t$ = 5.79, $p$ < .0001, 95% CI = .97-1.99). After controlling for neuroticism, the total effect of extraversion on RNT was not significant (β = .05, SE = .29, $t$ = .17, $p$ = .87, 95% CI = -.53-.63). The direct links between extraversion and the IUS-12 (β = -.07, SE = .27, $t$ = -.26, $p$ = .80, 95% CI = -.61-.47) and between extraversion and MCQ-neg (β = -.01, SE = .01, $t$ = -.40, $p$ = .69, 95% CI = -.03-.02) were not significant.

The same procedure was followed to study the relationships between the higher- and second-order factors and worry. The higher- and second-order factors together explained 47% of the variation in worry, $F(4, 91) = 20.53$, $p < .001$). After controlling for extraversion, the total effect of neuroticism on worry was significant (β = 1.61, SE = .19, $t$ = 8.50, $p$ < .0001, 95% CI = 1.24 – 1.99): the direct effect (β = 1.10, SE = .28, $t$ = 3.98, $p$ = .0001, 95% CI = .55-1.64) and the total indirect effect (β

= .51, SE = .19, bootstrapped 95% CI = .17-.93) were significant. Within the indirect effect, and in contrast to the RNT results, the MCQ-neg did not (β = .13, SE = .10, bootstrapped 95% CI = -.06-.36) but the IUS-12 did (β = .38, SE = .16, bootstrapped 95% CI = .10-.73) make a significant contribution to worry. After controlling for neuroticism, the total effect of extraversion on worry was significant (β = -.66, SE = .31, $t$ = -2.13, $p$ < .05, 95% CI = -1.27- -.05). However, the direct effect was only a trend (β = -.48, SE = .26, $t$ = -1.86, $p$ = .07, 95% CI = -.99-.03) and the total indirect effect was not significant (β = -.05, SE = .14, bootstrapped 95% CI = -.31-.23).

The model was run a third time with depressive symptoms as the dependent variable. A total of 28% of the variance in depressive symptoms was explained by all the variables, $F(4, 86) = 8.23$, $p < .001$. After controlling for extraversion, the total effect of neuroticism on depression was significant (β = 1.35, SE = .24, $t$ = 5.56, p < .0001, 95% CI = .87-1.83): the direct effect (β = .93, SE = .30, $t$ = 3.10, $p$ < .01, 95% CI = .33-1.52) and the total indirect effect (β = .42, SE = .18, bootstrapped 95% CI = .14-.88) were significant. Within the indirect effect, the IUS-12 made a significant contribution (β = .26, SE = .15, bootstrapped 95% CI = .01-.61) but the MCQ-neg just fell short of being significant (β = .16, SE = .12, bootstrapped 95% CI = -.004-.61). After controlling for neuroticism, the link between extraversion and depression just fell short of statistical significance (β = -.55, SE = .28, $t$ = -1.97, $p$ = .052, 95% CI = -1.11-.01).

*3.4 Mediation models for patients with and without GAD*

Similar models were re-run separately for patients with (n = 46, Figure 3) and without (n = 53, Figure 4) a diagnosis of GAD. Principal diagnoses for those with GAD included social phobia (46%), GAD (39%), panic disorder with or without agoraphobia (13%), and specific phobias (2%). Principal diagnoses for those without GAD included social phobia (57%), panic disorder with or without agoraphobia

(32%), OCD (7%), and PTSD (4%). Given the previous results extraversion was excluded from the models. For the subgroup with GAD the higher- and second-order variables explained 63% of the variance in RNT, $F(3, 39) = 22.29$, $p < .001$. The total effect of neuroticism on RNT was significant (β = .78, SE = .31, $t = 2.49$, $p = .02$, 95% CI = .15 – 1.41): the direct effect was not significant (β = -.07, SE = .32, $t = -.23$, $p > .05$, CI = -.71 – .57) but the total indirect effect was significant (β = .85, SE = .37, bootstrapped 95% CI = .27 – 1.81). Within the indirect effect, both the MCQ-neg (β = .68, SE = .35, bootstrapped 95% CI = .21-1.77) and the IUS-12 (β = .17, SE = .15, bootstrapped 95% CI = .01-.64) made significant contributions.

Higher- and second-order variables explained 60% of the variance in worry, $F(3, 39) = 19.18$, $p < .001$. The link between neuroticism and worry was significant (β = 1.66, SE = .24, $t = 6.93$, p < .0001, 95% CI = 1.18 – 2.14): the direct effect (β = 1.26, SE = .30, $t = 4.29$, $p = .0001$, CI = .66 – 1.85) and the total indirect effect (β = .40, SE = .19, bootstrapped 95% CI = .13 – .90) were significant. Within the indirect effect, the MCQ-neg just fell short of statistical significance (β = .17, SE = .13, bootstrapped 95% CI = -.01-.56), but the IUS-12 was significant (β = .23, SE = .14, bootstrapped 95% CI = .04-.62), make a significant contribution. Higher- and second-order variables explained 32% of the variance in depression symptoms, $F(3, 37) = 5.70$, $p < .01$. However, the total effect of neuroticism on depressive symptoms was not significant (β = 1.56, SE = .82, $t = 1.90$, $p > .05$, 95% CI = -.10-3.21).

For those without a GAD diagnosis, the higher and second-order variables explained 44% of the variance in RNT, $F(3, 49) = 12.77$, $p < .001$. The total effect of neuroticism on RNT was significant (β = 1.08, SE = .27, $t = 3.94$, $p < .001$, 95% CI = .53 – 1.63): the direct effect was not significant (β = .50, SE = .34, $t = 1.48$, $p > .05$, CI = -.18 – 1.19) but the total indirect effect was significant (β = .58, SE = .30, bootstrapped 95% CI = .04 – 1.28). Within the indirect effect, the MCQ-neg made a

significant contribution (β = .61, SE = .21, bootstrapped 95% CI = .25-1.12) but the IUS-12 did not (β = -.03, SE = .23, bootstrapped 95% CI = -.52-.37). The direct effect of neuroticism on the IUS-12 was significant (β = 1.88, SE = .24, $t$ = 7.89, $p$ < .0001, 95% CI = 1.40-2.36).

Higher- and second-order variables explained 36% of the variance in worry, $F(3, 49) = 9.29$, $p < .001$. The total effect of neuroticism on worry was significant (β = 1.49, SE = .29, $t$ = 5.22, $p$ < .0001, 95% CI = .92 – 2.06): however, the direct effect (β = .88, SE = .55, $t$ = 1.59, $p$ > .05, CI = -.23 – 1.99) and the total indirect effect (β = .61, SE = .39, bootstrapped 95% CI = -.25 – 1.38) were not significant. Higher- and second-order variables explained 24% of the variance in depression symptoms, $F(3, 46) = 4.82$, $p < .01$. The total effect of neuroticism on depressive symptoms was significant (β = 1.21, SE = .27, $t$ = 4.37, $p$ < .0001, 95% CI = .65-1.77). However, the direct effect of neuroticism on depression (β = 1.21, SE = .28, $t$ = 1.93, $p$ = .06, 95% CI = -.03-1.60) and the total indirect effect (β = .43, SE = .33, bootstrapped 95% CI = -.09-1.19) were not significant.[1]

## 4.0 Discussion

This study tested a hierarchical model with neuroticism and extraversion as higher-order factors, negative metacognitions and IU as second-order factors, and RNT, worry and depression as outcome variables. The first hypothesis that the relationships between neuroticism and worry, and between neuroticism and RNT, would be fully mediated by negative metacognitions and IU was partially supported. Negative metacognitions fully mediated the relationship between neuroticism and RNT in all samples, but did not significantly mediate the relationship between neuroticism and worry in any sample. For those with GAD, IU partially mediated the relationship between neuroticism and worry and negative metacognitions just fell short of partially mediating this relationship. IU and negative metacognitions fully

mediated the relationship between neuroticism and RNT. IU did not mediate the relationship between neuroticism and RNT or worry for those without GAD.

The second hypothesis, that IU would partially mediate the relationship between IU and depression, was supported for the whole sample but not for the subsamples with and without GAD. Neuroticism also demonstrated a direct relationship to depression symptoms within the whole sample. These pathways to depression symptoms failed to reach statistical significance for the two subsamples, which may be a consequence of a loss of power. The third hypothesis, that extraversion would be directly related to depression symptoms, was not supported. There was no evidence that extraversion provided predictive utility for any of the outcome variables, although some effects just fell short of statistical significance (e.g., link between extraversion and depression in the whole sample) and may have been significant with a larger sample.

The finding that metacognitions failed to mediate the relationship between neuroticism and worry was unexpected. One explanation for this finding is the modifications we made to the measure of metacognitive beliefs. Most previous studies have used the original MCQ (e.g., van der Heiden et al., 2010), which includes the term ‘worry’ in many items and therefore may inflate the strength of the relationship between metacognitions and worry in particular. We used the short version of the MCQ (MCQ-30) and, similar to an approach used in previous research (Watkins et al., 2005), we used a modified version that substituted the term ‘worry’ with alternative, non-diagnosis-specific terms. These modifications may have attenuated the strength of association between the modified MCQ-30 and the PSWQ. Some previous studies investigating these relationships have also examined metacognitions in isolation whereas we simultaneously considered the alternative second-order mediator of IU. IU may be a more powerful mediator for worry than negative

metacognitions, such that when both are included in the model negative metacognitions fail to add explanatory power.[2]

The role of IU differed between those with and without GAD. Replicating van der Heiden et al.'s (2010) findings, IU was a partial mediator between neuroticism and worry and RNT for those with GAD but, extending previous findings, IU did not mediate the relationship between IU and any outcome variable for those without GAD. These findings provide some evidence of diagnostic specificity and are also consistent with previous findings demonstrating that IU is most strongly related to worry, although still significantly associated with symptoms of other emotional disorders (Boelen & Reijntjes, 2009; McEvoy & Mahoney, 2012). Our subsample analyses may have been underpowered to detect some of these weaker relationships. It is important to note that our study cannot rule out that IU contributes to symptoms of other disorders directly or indirectly via other second-order factors, given that we focused on the transdiagnostic process of RNT rather than symptoms of other disorders. Indeed there is evidence that trait and diagnosis-specific IU are directly associated with symptoms of various emotional disorders (Boelen et al., 2010; Mahoney & McEvoy, 2012a, b).

An alternative explanation for the robust relationship between metacognitive beliefs and RNT, compared to the relationship between metacognitive beliefs and worry, is that metacognitive beliefs and RNT are less time-dependent than worry. There is evidence that worry is more future-oriented than other forms of RNT (Papageorgiou & Wells, 1999; Watkins et al., 2005), so the relationship with worry may be stronger if metacognitive beliefs are assessed with specific reference to future-oriented RNT. IU is arguably a predominantly future-oriented construct. In fact, one of the two IUS-12 subscales is labelled 'prospective IU' and measures cognitive consequences of future uncertainty (e.g., "One should always look ahead to avoid

surprises", "I always want to know what the future has in store for me"). Thus, IU may be more strongly associated with future-oriented RNT (i.e., worry), as we found with the whole sample. Accordingly, the similar strength of the indirect relationships between IU and worry and IU and RNT in the subsample with GAD may be accounted for by individuals with GAD predominantly engaging in future-oriented RNT. In contrast, metacognitive beliefs may be more strongly associated with a general tendency to engage in RNT, especially given that we used a modified version of the MCQ that substituted the term 'worry'.

There are several implications of these findings. First, consistent with the S-REF model (Wells & Mathews, 1996) negative metacognitions were a robust, transdiagnostic mediator of RNT. Interventions aimed at challenging and modifying negative metacognitions may therefore impact on engagement in RNT regardless of the emotional disorder being treated. Second, consistent with the IU model, for those with GAD IU mediated worry and RNT to a similar degree. This finding suggests that IU is not specific to worry per se but instead is common to RNT in general for those with GAD. Distinguishing between diagnosis-specific forms of RNT may therefore be relatively unimportant when identifying mediators of RNT and determining treatment targets. Researchers specifically interested in worry within GAD would clearly be well served by the extensively validated PSWQ. However, as transdiagnostic models and treatments are developed, evaluated, and refined, it seems important to use transdiagnostic measures without diagnosis-specific confounds so that specificity can be directly tested rather than assumed. For similar reasons it is important to evaluate models within mixed-diagnosis samples. Rather than attributing a particular type of RNT to a particular disorder it may be more fruitful to identify mediators and moderators of future- versus past-focused RNT, as it is plausible that different mechanisms operate at these different time points. For instance, the controllability

(i.e., ability to effect change over the stressor) and uncertainty (i.e., whether it will vs. has occurred) of a stressor differ before and after the stressor (more control and uncertainty before, less control and uncertainty after), and thus these factors may have different influences over engagement in RNT depending upon temporal orientation to the stressor regardless of an individual's diagnostic profile (Nolen-Hoeksema et al., 2008).

Third, the finding that for those with GAD transdiagnostic mediators were associated with RNT in general can inform nosology and treatment applications. If theories of GAD, and worry in particular, are consistently found to extend to RNT more generally then the utility of worry per se as a diagnosis-specific feature of GAD may be called into question. Engagement in worry may be insufficient to differentiate GAD from other disorders that are similarly characterized by RNT. The content (e.g., themes of threat vs. hopelessness), temporal orientation (future- vs. past-oriented), and breadth (e.g., health, finances, family, daily activities) of RNT may better inform differential diagnosis than worry per se (e.g., Papageorgiou & Wells, 1999; Watkins et al., 2005). Development of multidimensional measures that directly assess theory- and evidence-based transdiagnostic and diagnosis-specific qualities of RNT, without using diagnosis-specific terminology, may be particularly beneficial for furthering our understanding of the causes and sequelae of RNT (see Ehring et al., 2011, for an example of a multidimensional transdiagnostic measure of RNT). Our findings also suggest that whereas modifying metacognitive beliefs may be useful for reducing RNT regardless of diagnosis, targeting IU is most likely to impact RNT (and worry) for those with GAD. Future research with larger mixed-diagnosis samples, or large clinical samples with principal and comorbid disorders other than GAD, could more definitively evaluate the role of IU in driving RNT and symptoms transdiagnostically

and, in turn, the impact of targeting these mechanisms in individuals meeting criteria for various emotional disorders.

Our findings are tempered by limitations. First, this study was cross-sectional so no causal conclusions can be made (Maxwell & Cole, 2007). However, our findings provide some empirical justification for future research using prospective and experimental designs that can make causal inferences. Second, our subsamples with and without GAD were relatively small so only medium to large effects were likely to have been detected. Smaller effects may meaningfully contribute to the outcomes studied here and should be investigated further with large, mixed-diagnosis samples. Third, this study served as a replication and extension of van der Heiden et al.'s (2010) findings and, as noted by these researchers, the study was limited by its reliance on self-report (rather than multi-method approaches), and exclusion of alternative mediators that may explain additional variance in the outcome variables. The need to identify additional mediators appears to be particularly important to worry, with neuroticism demonstrating a direct effect to worry for the whole sample and for those with a GAD diagnosis.

This study found evidence of transdiagnostic and diagnosis-specific mediation effects within a hierarchical model of vulnerability to worry and RNT in general. Negative metacognitions were a robust mediator between neuroticism and RNT for those with and without a diagnosis of GAD. IU was a partial mediator of worry (for the whole sample and those with GAD) and of RNT (for those with GAD), but not for those without GAD. Targeting negative metacognitions may be important to reduce engagement in RNT regardless of diagnosis, whereas IU appears to be particularly important for RNT among those with a GAD diagnosis.

## Footnotes

[1] All models were re-run controlling for age and gender but the pattern of results was identical.

[2] When IU was excluded from the model, neuroticism had a significant direct and indirect effect on worry via negative metacognitive beliefs for the whole sample (direct effect: $b$ = 1.40, SE = .23, $t$ = 6.09, $p$ < .0001; indirect effect: $b$ = .21, SE = .11, bootstrapped 95% CI = .01-.47) and for the subsample with GAD (direct effect: $b$ = 1.40, SE = .29, $t$ = 4.88, $p$ < .0001; indirect effect: $b$ = .26, SE = .16, bootstrapped 95% CI = .04-.72), but only the direct effect was significant for those without a diagnosis of GAD (direct effect: $b$ = 1.34, SE = .36, $t$ = 3.75, $p$ < .001; indirect effect: $b$ = .15, SE = .21, bootstrapped 95% CI = -.21-.64).

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Table 1. Means, standard deviations, Cronbach's alphas and Pearson bivariate correlation coefficients between higher order, second-order, and outcome variables

| | Mean (SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 1. EPQ-N | 18.11 (3.92) | .79 | | | | | | |
| 2. EPQ-E | 8.00 (3.96) | -.18 | .73 | | | | | |
| 3. IUS-12 | 36.64 (10.70) | .53*** | -.11 | .92 | | | | |
| 4. MCQ-neg | 2.00 (.48) | .40*** | -.10 | .43*** | .92 | | | |
| 5. RNT-10 | 33.59 (10.15) | .38*** | .02 | .40*** | .71*** | .90 | | |
| 6. PSWQ | 64.04 (10.25) | .59*** | -.26* | .53*** | .41*** | .42*** | .83 | |
| 7. BDI-II | 23.62 (11.41) | .49*** | -.21* | .40*** | .34** | .30** | .47*** | .91 |

*Note.* Cronbach's alphas are on the diagonal. EPQ-N, neuroticism subscale of the Eysenck Personality Inventory, EPQ-E, extraversion subscale of the EPQ, IUS-12, Intolerance of Uncertainty Scale-12, MCQ-neg, negative metacognitive beliefs from the MCQ-30 subscale, RNT-10 – Repetitive Negative Thinking – 10, PSWQ, Penn State Worry Questionnaire, BDI-II = Beck Depression Inventory.

* $p < .05$ ** $p < .01$ *** $p < .001$

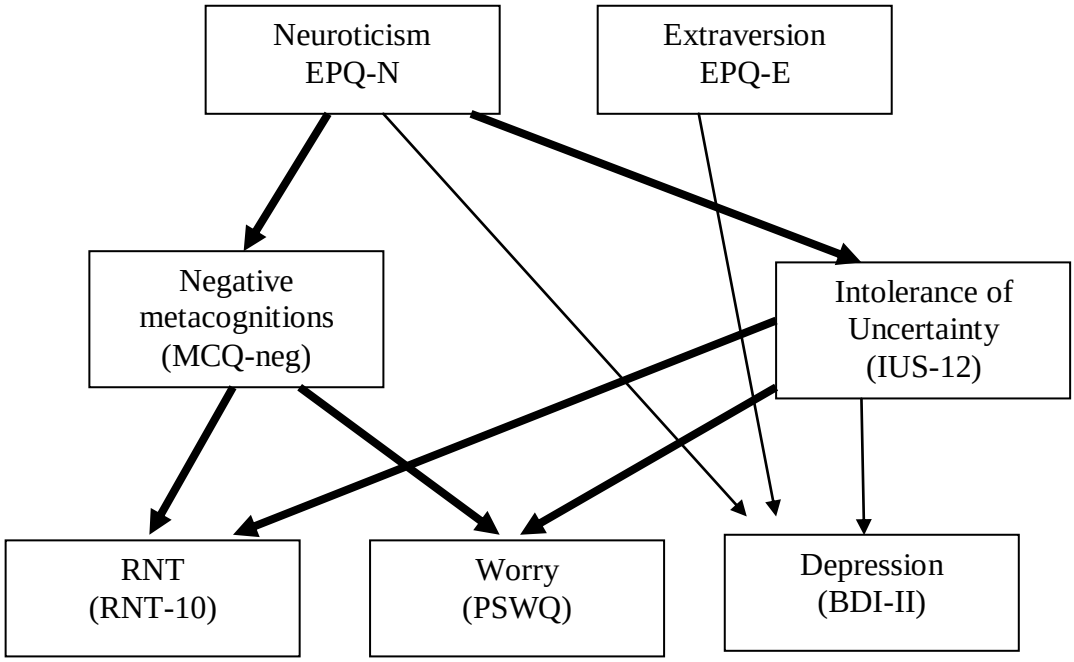


*Figure 1*. Hypothesized model of RNT and worry (bold lines) and comorbid depression symptoms (regular lines) based on results from van der Heiden et al. (2010).

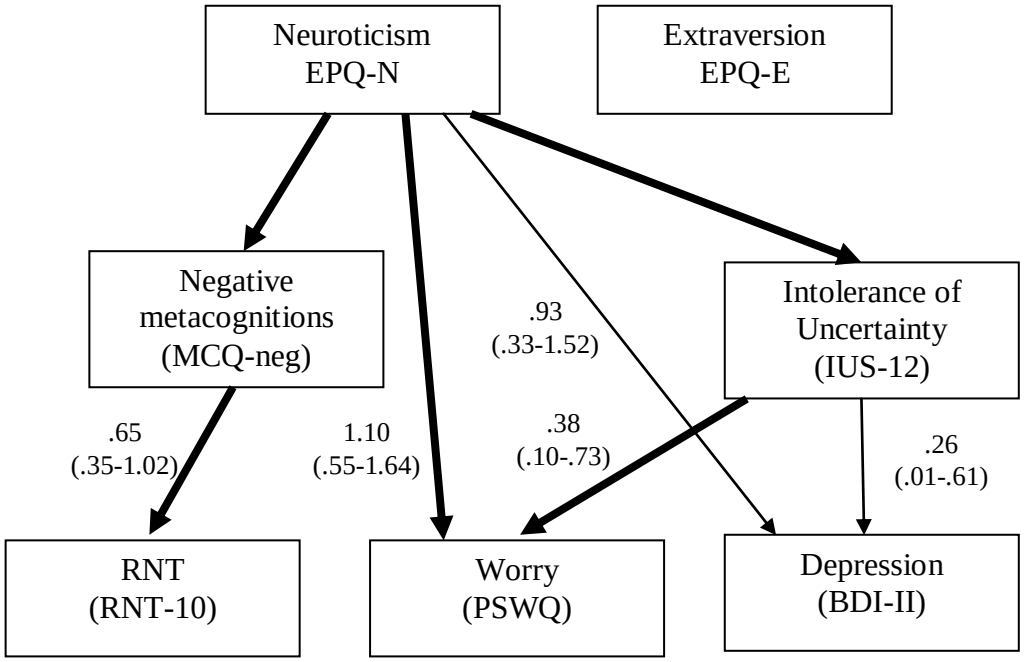


*Figure 2.* Model for the whole sample with significant direct and indirect pathways for RNT and worry (bold lines) and depression symptoms (regular lines). Standardized path coefficients with 95% confidence intervals are shown.

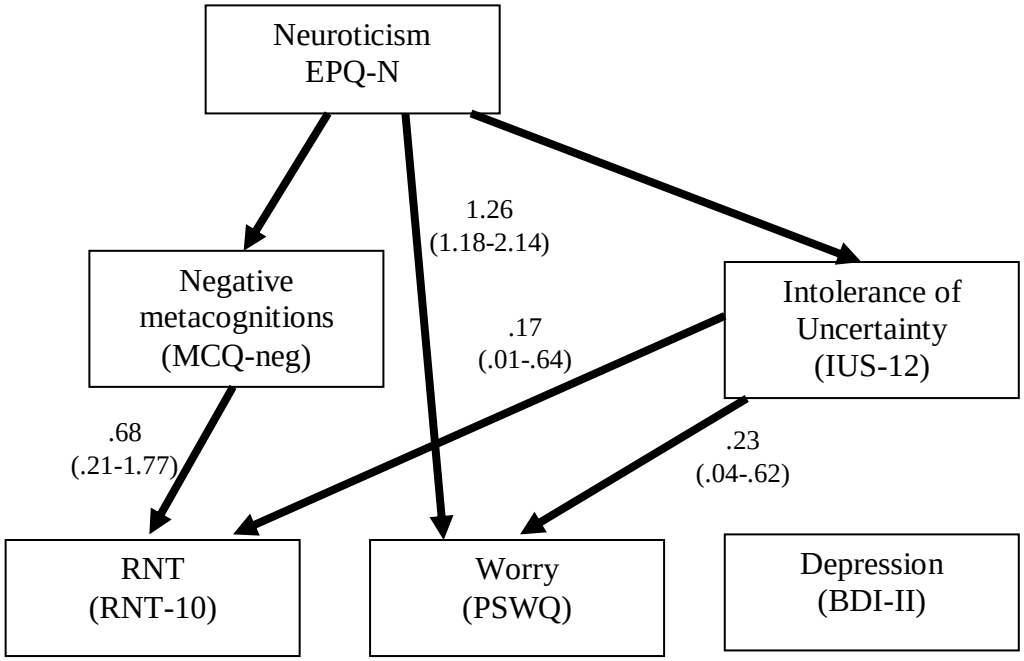


*Figure 3.* Model for the sample with GAD. Extraversion was excluded from the model. Standardized path coefficients with 95% confidence intervals are shown.

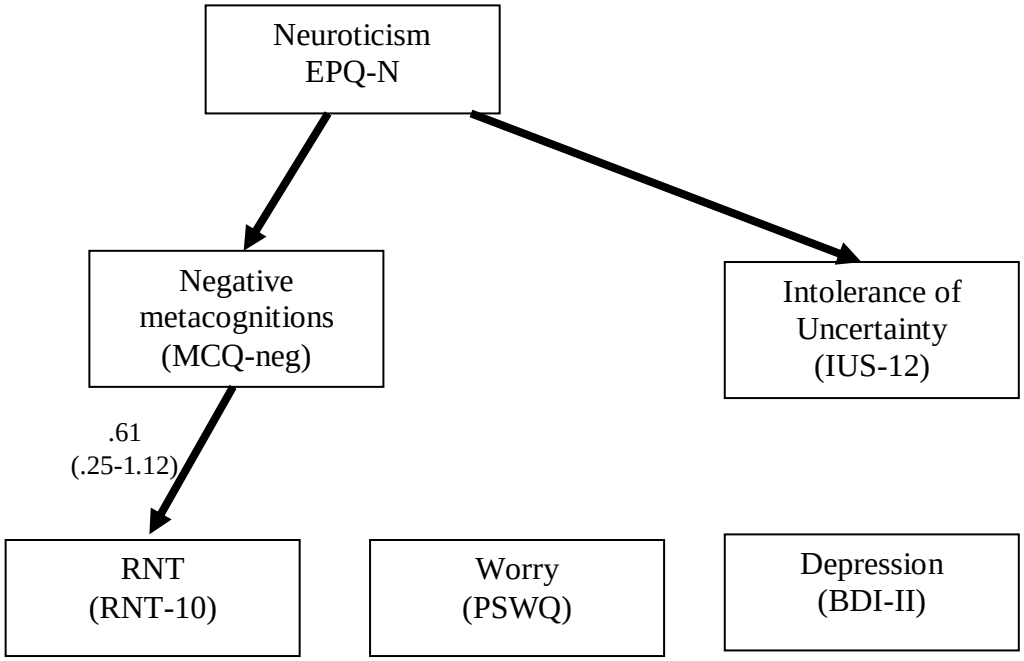


*Figure 4*. Model for the sample without GAD. Extraversion was excluded from the model. Standardized path coefficients with 95% confidence intervals are shown.