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Intolerance of Uncertainty and Meta-worry: Relative importance in discriminating
GAD

Nigar G. Khawaja, Janette McMahon and Esben Strodl

Queensland University of Technology

Authors Note

This research is submitted by Nigar G. Khawaja (N.khawaja@qut.edu.au), Janette McMahon (janettemcmahon@aspirepsych.com.au) and Esben Strodl (e.strodl@qut.edu.au) from the School of Psychology and Counselling, Queensland University of Technology. Janette McMahon is now in private practice.

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Corresponding author: Dr. Nigar Gohar Khawaja,
Senior Lecturer, School of Psychology & Counselling,
Faculty of Health,
Queensland University of Technology,
O Block, B wing, RM 525
Victoria Park Rd., Kelvin Grove, Qld 4059.
PH: 61 7 3138 4540; FAX: 61 7 3138 0486; Email: n.khawaja@qut.edu.au

Intolerance of Uncertainty and Meta-worry: Relative importance in discriminating
GAD

Abstract

This study explored whether intolerance of uncertainty and/or meta-worry discriminate between non-clinical individuals and those diagnosed with generalised anxiety disorder (GAD group). The participants were 107 GAD clients and 91 university students. The students were divided into two groups (high and low GAD symptom groups). A multivariate analysis of covariance (MANCOVA) adjusting for age indicated that intolerance of uncertainty distinguished between the low GAD symptom group and the high GAD symptom group, and between the low GAD symptom group and the GAD group. Meta-worry distinguished all three groups. A discriminant function including intolerance of uncertainty and meta-worry classified 94.4% of the GAD group and 97.9% of the low GAD symptom group. Only 6.8% of the high GAD symptom group was classified correctly, 77.3% of the high GAD symptom group was classified as GAD. Findings indicated that intolerance of uncertainty and meta-worry may assist with the diagnosis and treatment of GAD.

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Introduction

Generalised anxiety disorder (GAD) has recently become the target of extensive investigative research. Researchers have subsequently identified excessive worry as the most salient feature of GAD (Craske, 1999). Given that worry is associated with other disorders, and there is extensive co-morbidity between GAD and other disorders, diagnosis of GAD is difficult (Brown & Barlow, 1992; Kessler, Chiu, Demler, & Walters, 2005). Poor diagnostic reliability led to research designed to determine factors that distinguish GAD from other disorders (Ruscio, 2002). The development of cognitive models of GAD suggested that meta-worry and intolerance of uncertainty are primary causal factors in the development and maintenance of GAD (Dugas, Marchand, & Ladouceur, 2005; Wells, 1995).

To improve diagnostic reliability and distinguish GAD from other disorders, researchers investigated the cognitive factors that contribute to the development and maintenance of GAD (Borkovec, Ray, & Stober, 1998; Dugas, Gagnon, Ladouceur, & Freeston, 1998; Wells, 1999; Wells & Papageorgiou, 1995). Wells (1995) developed a meta-cognitive model of GAD that focused on chronic worry mechanisms. The metacognitive model specified cognitive and behavioural factors that affect the maintenance of chronic worry (Wells & Carter, 1999). The model focuses on cognition about cognition that involves monitoring, controlling, and appraising the processes and products of consciousness. Frequent monitoring and evaluation of thoughts results in maladaptive meta-cognitions (Beck, Emery, & Greenberg, 1985; Wells, 1999). Maladaptive meta-cognitive beliefs influence the development and maintenance of GAD (Wells, 1999).

The model suggests that individuals who develop problematic worrying hold both positive and negative beliefs about worry (Cartwright-Hatton & Wells, 1997; Wells, 1999). In response to a threatening trigger, rigid positive beliefs are activated concerning the benefits of utilising worry as a coping strategy to identify possible solutions to threats. At this stage, the individual engages in type 1 worry, which is worry about external events and physical symptoms. While in the process of type 1 worry, negative beliefs about worry are activated.

Negative beliefs are often concerned with the uncontrollability of worrying and its dangerous consequences on physical, psychological and social functioning (Wells & King, 2006). The negative beliefs are thought to be linked to the development of pathological worry and GAD. Subsequently, the individual then engages in type 2 worry, defined as worry about worry or meta-worry. Meta-worry increases anxiety and aversive emotional symptoms, which further supports the individual's negative beliefs about worry and meta-worries. The individual then engages in thought control strategies (e.g., suppression) and coping behaviours (e.g., avoidance and distraction), resulting in a decrease in exposure to external and/or internal worry triggers. This is associated with a reduction in aversive physiological and emotional responses, supporting the use of worry as a coping mechanism.

While the meta-cognitive model proposes that both type 1 worry and type 2 worry (meta-worry) are causal factors for pathological worry and GAD, the model suggests that meta-worry is the primary causal factor (Wells, 1999; Wells & Carter, 2001; Wells & King, 2006; Wells & Papageorgiou, 1995). When an individual engages in meta-worry, anxiety increases. This prevents the individual from experiencing a positive emotional

state associated with finding solutions to problems as a result of type 1 worry. Therefore, meta-worry leads to an individual fluctuating between engaging in and avoiding worry, resulting in worry becoming generalised and chronic. The primary causal role of meta-worry has been supported by research indicating that meta-worry predicts pathological worry, independently of type 1 worry and anxiety (Davis & Valentiner, 2000; Nuevo, Montorio, & Borkovec, 2004; Wells, 2005; Wells & Carter, 1999, 2001).

While some research has indicated that meta-worry distinguishes GAD from non-clinical, anxiety disorder, and depressive groups, other researchers have shown a relationship between meta-worry and other psychological disorders (De Bruin, Muris, & Rassin, 2007; De Bruin, Rassin, & Muris, 2006; Irak & Tosun, 2008; McMahon & Khawaja, 2009; Wells, 2005). Wells and Carter (2001) investigated meta-worry in patients with GAD, social phobia, panic disorder, and major depression, and one group with no history of psychological treatment. Patients in the GAD group had significantly higher scores on measures of meta-worry. In contrast, other researchers have found that meta-worry is associated with social phobia, obsessive compulsive symptoms, and depression (De Bruin, Muris, et al., 2007; McMahon & Khawaja, 2009). A recent study by the current authors also found that meta-worry was associated with social phobia and depression (McMahon & Khawaja, 2009). As such, it is still unclear to what degree meta-worry is uniquely characteristic of GAD.

Another cognitive model developed by Dugas et al. (1998) identifies four main cognitive factors which influence the maintenance of pathological worry: intolerance of uncertainty, positive beliefs about worry, negative problem orientation, and cognitive avoidance. Intolerance of uncertainty is the key factor in the model, and results from

negative beliefs about uncertain or ambiguous situations (Ladouceur, Talbot, & Dugas, 1997). Intolerance of uncertainty influences an individual's cognitive, behavioural, and emotional responses when he/she experiences uncertainty. This influence results in stress when encountering uncertainty, and results in avoidance of situations that have uncertain outcomes. Intolerance of uncertainty also impacts the individual's ability to function in uncertain situations (Buhr & Dugas, 2002).

Research comparing the four factors from the model has consistently found that intolerance of uncertainty is the most significant predictor of GAD in both clinical and non-clinical samples (Dugas, et al., 1998; Dugas, et al., 2005; Dugas et al., 2007; Ladouceur et al., 1999). Ladouceur et al. (1999) investigated the relevance of the factors in a sample of individuals with a primary diagnosis of GAD, secondary GAD, other anxiety disorders, and a non-clinical group. All four factors discriminated clinically anxious patients from the non-clinical group. Intolerance of uncertainty and negative problem orientation were the only factors specific to individuals with GAD. Ladouceur et al. (1999) suggested that intolerance of uncertainty can distinguish between the very high levels of worry in individuals with GAD and the high levels of worry associated with other anxiety disorders. Dugas et al. (2007) found that negative problem orientation and intolerance of uncertainty were also strong predictors of the severity of GAD. However, only intolerance of uncertainty predicted worry scores over and above the other factors.

As with meta-worry, debate exists as to the specificity of intolerance of uncertainty and GAD. Some research has indicated that intolerance of uncertainty is specific to GAD (Dugas, et al., 2005; Dugas, Schwartz, & Francis, 2004; Ladouceur, et

al., 1999), whilst other researchers have shown that intolerance of uncertainty is significantly related to other disorders (Boelen & Reijntjes, 2009; Holaway, Heimberg, & Coles, 2005; McMahon & Khawaja, 2009; Miranda, Fontes, & Marroquin, 2008; Steketee, Frost, & Cohen, 1998; Tolin, Amramowitz, Brigida, & Foa, 2003). A recent study by the current authors found that intolerance of uncertainty was associated with obsessive compulsive disorder, social phobia, and depression (McMahon & Khawaja, 2009).

While a substantial amount of research investigates intolerance of uncertainty and meta-worry, minimal research has compared meta-worry and intolerance of uncertainty (De Bruin, Rassin, & Muris, 2007; McMahon & Khawaja, 2009). De Bruin, Rassin, and Muris (2007) examined the relationships between meta-worry and intolerance of uncertainty, to worry. The results indicated that meta-worry and intolerance of uncertainty had unique relationships with trait worry.

McMahon and Khawaja (2009) examined the relative contributions of intolerance of uncertainty and meta-worry to pathological worry, and found that meta-worry had the strongest relationship with pathological worry. McMahon and Khawaja (2009) subsequently examined how intolerance of uncertainty and meta-worry related to GAD, obsessive compulsive disorder, social phobia, and depression. While meta-worry was most strongly related to GAD, it was also related to obsessive compulsive disorder, social phobia, and depression. Although intolerance of uncertainty was also most strongly related to GAD, it was also related to obsessive compulsive disorder and social phobia. There was no relationship between intolerance of uncertainty and depression. Further,

when comparing the relative contributions, meta-worry contributed slightly more to GAD than intolerance of uncertainty.

Diagnosis of GAD is problematic due to high co-morbidity between GAD and other psychological disorders (Barlow, Blanchard, Vermilyea, Vermilyea, & DiNardo, 1986; Carter, Wittchen, Pfister, & Kessler, 2001; Ruscio, 2002). Research has shown that meta-worry and intolerance of uncertainty are strongly related to GAD (McMahon & Khawaja, 2009). If both are highly related to GAD, it is possible that intolerance of uncertainty and/or meta-worry may distinguish individuals with GAD. Further, it is possible that the use of measures for both factor may increase the ability to discriminate individuals with GAD. If meta-worry and/or intolerance of uncertainty are able to distinguish individuals with GAD, these factors may prove useful in improving diagnostic reliability and the development of therapeutic interventions that focus on both factors.

The present study examined the relative importance of meta-worry and intolerance of uncertainty. It was expected that meta-worry and intolerance of uncertainty would discriminate individuals with GAD from non-clinical individuals. However, it was unclear which of the two factors would be most important in discriminating GAD. Meta-worry and intolerance of uncertainty were compared in primary GAD and two non-clinical groups: non-clinical individuals scoring low on measures of GAD (low GAD symptom group), and non-clinical individuals scoring high on measures of GAD (high GAD symptom group). It was hypothesised that intolerance of uncertainty and/or meta-worry would discriminate between primary GAD, low GAD symptom, and high GAD

symptom groups. Further, this study determined whether meta-worry or intolerance of uncertainty was the most important factor in discriminating between the three groups.

Method

Participants

Participants were 91 students from a Brisbane metropolitan university and 107 individuals with a principal diagnosis of GAD using the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV) (Brown, DiNardo, & Barlow, 1994). The students were divided into two groups: 47 students were in the low GAD symptom group and 44 students in the high GAD symptom group. These two student groups were distinguished using the Worry and Anxiety Questionnaire (Dugas et al., 2001).

Of the 47 students with low GAD symptom, 36 were females (76.6%) and 11 were males (23.4%). The age of the students ranged from 17 years to 50 years with a mean age of 31.3 years ($SD= 11.28$). In relation to marital status, 23 were single (48.9%), 12 were married (25.5%), 5 were cohabitating (10.6%), 3 were divorced (6.4%) and 4 were other (8.5%). In relation to education, for 13 participants school was their highest level of education completed (27.7%), 9 had completed TAFE (19.1%), 17 had completed a bachelor degree (36.2%), 6 had completed a postgraduate degree or diploma (12.8%), and 2 had completed a masters degree (4.3%).

Of the 44 students with high GAD symptom, 36 were females (81.8%) and 8 were males (18.2%). The age of the students ranged from 17 years to 53 years with a mean age of 25.14 years ($SD= 10.80$). In relation to marital status, 23 were single (52.3%), 7 were married (15.9%), 6 were cohabitating (13.6%), 4 were divorced (9.1%) and 4 were other (9.1%). In relation to education, 17 had completed school (38.6%), 6 had completed

TAFE (13.6%), 20 had completed a bachelor degree (45.5%) and 1 had completed a postgraduate degree or diploma (2.3%).

The clinical sample consisted of 107 individuals. Out of these participants, 72 were females (67.3%) and 35 were males (32.7%). The age of the GAD participants ranged from 20 years to 65 years with a mean age of 40.09 years ($SD= 11.88$). In relation to marital status, 28 were single (26.2%), 49 were married (45.8%), 6 were cohabitating (5.6%), 8 were divorced (7.5%) and 16 were other (15%). In relation to education, 24 had completed school (22.4%), 19 had completed TAFE (17.8%), 30 had completed a bachelor degree (28%), 11 had completed a postgraduate degree or diploma (10.3%), 4 had completed a masters degree or PhD (3.7%) and 16 were other (15%).

Measures

Anxious Thoughts Inventory (AnTI)

The AnTI (Wells, 1994) measures proneness to worry, and assesses social and health worry (type1) and meta-worry (type 2). The twenty-two items are rated on a four-point Likert scale that ranges from 1 (*almost never*) to 4 (*almost always*). The AnTI demonstrates good internal consistency (subscale $\alpha = .75-.84$) and test-retest reliability (subscale $r = .76 -.84$). The AnTI has good convergent validity, correlating well with measures of worry (Wells, 1994). Wells (1994) reported that the AnTI has good discriminant validity, discriminating between mood disorders, anxiety disorders, and non-clinical controls. For the purpose of this study, meta-worry was measured by the seven item meta-worry subscale of the AnTI (AnTI-MW).

Intolerance of Uncertainty Questionnaire (IUS)

The IUS (Buhr & Dugas, 2002; Freeston, Rheume, Letarte, Dugas, & Ladouceur, 1994) is designed to measure intolerance of uncertainty, with particular emphasis on the premise that uncertainty is unacceptable, reflects negatively on the person, leads to frustration, and disables a person from taking an action. The twenty-seven items are rated on a five-point Likert scale that ranges from 1 (*not at all characteristic of me*) to 5 (*entirely characteristic of me*). Buhr and Dugas (2002) reported that the IUS demonstrated excellent internal consistency ($\alpha = .94$) and good test-retest reliability ($r = .74$). The IUS has good convergent validity, correlating with other measures of worry, anxiety, and depression (Buhr & Dugas, 2002). Buhr and Dugas (2002) reported that the IUS has good discriminant validity, discriminating between generalised anxiety symptoms, somatic anxiety symptoms and individuals with no symptoms. ***Worry and***

Anxiety Questionnaire (WAQ)

The WAQ (Dugas, et al., 2001) measures the diagnostic criteria for GAD, including worry and somatic symptoms. The first question asks for details of six subjects that cause worry, and the other five questions are rated on a five point Likert scale that ranges from 1 (*not at all excessive*) to 5 (*totally excessive*). The WAQ demonstrates good test-retest reliability ($r = .76$). The WAQ has good convergent validity and excellent discriminant validity (Beaudoin et al., 1997; Dugas, et al., 2001). Dugas, Freeston et al. (2001) reported that the WAQ discriminated between high, moderate, and low levels of worry. The WAQ also discriminated GAD patients from non-clinical controls.

Telephone Screen

The telephone screen, including the inclusion and exclusion criteria, was designed. The questions related to GAD were based on the diagnostic criteria of the DSM-IV-TR (American Psychiatric Association, 2000) and were used as the inclusion criteria. Exclusion criteria comprised of questions regarding head injury, memory and learning difficulties, suicide risk, psychosis, previously diagnosed mental health problems, medical conditions, use of medication, and substance dependence. Substance addiction and psychosis were assessed using the Mini-International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998).

Semi-structured Interview

The semi-structured interview was used to assess the clinical sample for co-morbid disorders including: major depressive disorder; dysthymia; mania and hypermania; panic disorder; agoraphobia; social phobia; obsessive compulsive disorder; post-traumatic stress disorder; alcohol abuse; substance abuse; and medical history. The semi-structured interview was based on the Mini International Neuropsychiatric Interview (M.I.N.I.) (Sheehan et al., 1998) and the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV) (Brown, et al., 1994).

The M.I.N.I. is designed to assess the presence of the 19 most common psychiatric disorders. The MINI is a short structured diagnostic interview, developed by psychiatrists and clinicians for Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) (American Psychiatric Association, 1994). It was designed as a short structured interview. The clinician rated version of the M.I.N.I. was used in this study (M.I.N.I.-CR). Sheehan et al. (1998) reported that the M.I.N.I.-CR displays acceptable to good convergent validity with correlations (0.45 – 0.74) with the Structured Clinical

Interview for DSM-III-R (SCID; (Sheehan, et al., 1998; Spitzer, Williams, & Gibbon, 1987).

The ADIS-IV (Brown, et al., 1994) was designed to assist with diagnosis of anxiety disorders. It is based on the DSM-IV (American Psychiatric Association, 1994). The GAD section of the ADIS-IV was used to assess GAD symptoms. This avoided replication as the M.I.N.I. (Sheehan, et al., 1998) was used in the telephone interview. Further it enabled more information to be gathered on the symptoms the individual was experiencing. The ADIS-IV provides information on duration of the disorder, worry themes and percentage of the day spent worrying.

Procedure

The student participants were selected from another study by the current authors (McMahon & Khawaja, 2009). The 253 student participants from the previous study were assessed using the WAQ to determine presence of GAD symptoms (Dugas, et al., 2001). In order to compare low and high scorers amongst students with the individuals with GAD, students scoring one standard deviation below the mean on the WAQ were categorised as the low GAD symptom group ($n = 47$), and students scoring one standard deviation above the mean on the WAQ were categorised as the high GAD symptom group ($n = 44$). The remainder of the participants from the first study ($n = 162$) scored within one standard deviation of the mean on the WAQ and were excluded from the current study.

The GAD participants were part of a previous clinical study on group therapy for GAD at QUT (Strodl, Schweitzer, & Khawaja, 2006; Strodl, Schweitzer, Khawaja, & Young, 2009). These participants were recruited through advertisements in local and

major newspapers, and via radio and television. Individuals interested in participating in the clinical study were requested to call the researchers.

Participants were assessed for GAD by postgraduate clinical psychology students using telephone screening and face to face semistructured interviews, under supervision of the second and third authors who are experienced clinicians. Individuals with GAD were excluded if they had cognitive deficits (intellectual disability, dementia, delirium, significant head injury), current alcohol or substance abuse, and/or psychotic illness. Individuals who met the inclusion criteria and did not meet the exclusion criteria received questionnaires via mail and were randomly assigned to treatment conditions (Strodl et al. 2006, 2009).

Results

Data Screening and Preliminary Analyses

Data were screened to assess compliance with the assumptions of the analysis. There was a small portion of random missing data for all variables. Missing data were replaced with the mean of the variable (Tabachnick & Fidell, 2001). Due to a technical error, the IUS questionnaire given to the 56 of the 107 GAD participants had item 27 missing, therefore the missing data for this item was replaced with the mean. The total scores for the meta-worry subscale of the AnTI (MW) and IUS were mean adjusted and the mean was used in the analysis (Tabachnick & Fidell, 2001). The distributions met the assumptions of normality and multicollinearity. Internal consistencies were examined by calculating Cronbach's alphas. The alpha coefficients of the IUS (.97) and AnTI-MW (.92) were satisfactory. The Pearson correlation between the AnTI-MW and IUS was .79 ($p < .01$).

Means and Standard Deviations

Means and standard deviations for the scales are reported in Table 1.

Insert table 1 here

Group Differences on Meta-worry and Intolerance of Uncertainty

Given that there was a significant difference between the three groups in age, $F(2, 194) = 28.90, p < .001$, a multivariate analysis of covariance (MANCOVA) was conducted to determine group differences on meta-worry and intolerance of uncertainty after adjusting for age as a covariate. The groups were the low GAD symptom group (students with low scores on a measure of GAD), the high GAD symptom group (students with high scores on a measure of GAD) and the GAD group (individuals diagnosed with GAD). Box's Test evaluates the variance and covariance among dependent variables (Hair, Anderson, Tatham, & Black, 1998). Box's test was significant indicating that there was homogeneity within the sample. To address this, as suggested by Hair et al. (1998), transformations were performed on the variables. This had no effect on the result of Box's Test, therefore as suggested by Hair et al. (1998) a significance level of $p < .001$ is used in any further analysis. Significant differences were found between the groups on combinations of measures of intolerance of uncertainty and meta-worry, Wilks' Lambda = .377, $F(4, 388) = 60.58, p < .001$. The multivariate $\eta^2 = .39$ indicating that 39% of multivariate variance in a linear combination of intolerance of uncertainty and meta-worry is associated with the group factor.

Analysis of covariances (ANCOVA) on intolerance of uncertainty and meta-worry with age as a covariate were conducted as follow-up tests to the MANCOVA. The ANCOVA on intolerance of uncertainty scores was significant $F(2, 193) = 99.19, p < .001$,

indicating that there is a significant difference between groups in intolerance of uncertainty scores. The ANCOVA on meta-worry scores was significant $F(2,193) = 137.36$ $p < .001$, indicating that there is a significant difference between groups in meta-worry scores.

Follow-up analyses were conducted to evaluate the pairwise differences between the means for each group. There were significant differences in the intolerance of uncertainty score means between the low GAD scorers and the high GAD scorers, as well as the low GAD scorers and the GAD group. There were no significant differences in intolerance of uncertainty scores between the high GAD scorers and the GAD group. There were significant differences in the meta-worry score means between the low GAD scorers, the high GAD scorers and the GAD group.

Classification of Groups Based on Intolerance of Uncertainty and Meta-worry Scores

Discriminant function analysis was used to determine the relative contribution of intolerance of uncertainty and meta-worry to group membership after adjusting for age as a covariate. Box's test was significant indicating that there was homogeneity within the sample. As suggested by Hair et al. (1998) separate variance estimates were used in the classification. The overall Wilks' Lambda was significant ($.38, \chi^2(4, N=198) = 189.60$), indicating that overall intolerance of uncertainty and meta-worry differentiated between the groups. The residual Wilks' Lambda was not significant, therefore only the first discriminant function was interpreted. The within groups correlations between intolerance of uncertainty scores, meta-worry scores and the discriminant function, and the standardised weights are presented in Table 2.

Insert table 2 here

As shown by the Table 2, the coefficients indicated that, meta-worry scores demonstrated the strongest relationship with the discriminant function. The means on the discriminant function were consistent with the interpretation. The GAD group ($M=.86$) had the highest mean scores on the discriminant function. The high GAD scorers had lower mean scores ($M=.31$) and low GAD scorers had the lowest mean scores ($M=-2.24$).

When predicting group membership 75.8% of cases were classified correctly. The discriminant function correctly classified 46 (97.9%) of low GAD scorers, 3 (6.8%) of high GAD scorers and 101 (94.4%) of the GAD group. Classification results are presented in Table 3.

Insert Table 3 here.

In order to take into account chance agreement a kappa coefficient was computed, the value was .56 which is a moderate value.

Discussion

This study investigated the role intolerance of uncertainty and meta-worry played in differentiating and discriminating the individuals diagnosed with GAD from two non-clinical groups: scoring high and low scores on measures of GAD. Only meta-worry was able to distinguish between the three groups. While a discriminant function including intolerance of uncertainty and meta-worry was useful in classifying the individuals with GAD and the low GAD symptom group, a large proportion of the high GAD symptom group were incorrectly classified with those diagnosed with GAD.

Intolerance of uncertainty levels differed significantly between the GAD group and the low GAD symptom group and also distinguished between the high GAD

symptom and the low GAD symptom group. This is in accordance with previous research that indicates that intolerance of uncertainty distinguishes individuals with GAD from non-clinical individuals (Dugas, et al., 1998; Ladouceur, et al., 1999). There were no significant differences between the GAD group and the high GAD symptom group.

Previous research has shown that intolerance of uncertainty distinguished high levels of worry in individuals with GAD from high worry levels associated with other disorders (Dugas, et al., 2007). The present study differed from previous research as it utilised a measure of the diagnostic criteria for GAD (not worry) to define the groups. It is possible that members of the high GAD symptom group may meet the diagnostic criteria for GAD and therefore intolerance of uncertainty did not distinguish between the two groups.

It is interesting to note that although 94.4% of the GAD group and 97.9% of the low GAD symptom group were classified correctly, only 6.8% of the high GAD symptom group were correctly classified. As stated previously this may be due to members of the high GAD symptom group meeting the criteria for GAD, the fact that 77.3% of the high GAD symptom group were classified as the GAD group would indicate that this is possibly the case.

Previous research has indicated that meta-worry accounts for more unique variance in GAD than intolerance of uncertainty (McMahon & Khawaja, 2009). In the present study meta-worry distinguished between all three groups. This suggests that meta-worry may be a more sensitive measure of GAD than intolerance of uncertainty. It seems that replication of this study in clinical and non-clinical samples is necessary to confirm these findings before any firm conclusions can be drawn.

The study investigated intolerance of uncertainty and meta-worry further by investigating if the two variables could be utilised to classify the GAD individuals, the low GAD symptom and high GAD symptom groups into their respective groups. A discriminant function derived from intolerance of uncertainty and meta-worry was able to discriminate between the three groups. Meta-worry had the strongest relationship with the discriminant function.

Previous research on the model proposed by Dugas et al. (1998) using discriminant analysis indicated that intolerance of uncertainty was the key variable in discriminating between GAD patients and non-clinical participants (Dugas, et al., 1998). Further research on the metacognitive model by Wells (1995) using discriminant analysis found that meta-worry discriminated GAD patients from social phobia, panic disorder, depressed patients and non-clinical participants. The results of the present study are in accordance with previous research (Dugas, et al., 1998), intolerance of uncertainty was able to discriminate between the GAD group and the non-clinical low GAD scorer group. However, in the present study, intolerance of uncertainty did not distinguish the GAD group from the high scorer group. As suggested previously, it may have been the case that some of the participants in the high GAD scorer group may have met the criteria for GAD and therefore intolerance of uncertainty did not distinguish these groups.

The fact that meta-worry did discriminate between all the groups, seems to suggest that meta-worry levels are a more sensitive measure of GAD. Further, it may be the case that meta-worry was able to discriminate between the GAD group and the high GAD scorer group due to differing severity levels between the groups. Therefore meta-worry may be associated with the severity of GAD. Future research comparing the

differences in intolerance of uncertainty and meta-worry and severity of GAD would be necessary to confirm these findings. Research on interventions involving intolerance of uncertainty and meta-worry would be useful in assessing the benefits of this approach for individuals with GAD.

The present study had several limitations. Firstly, the university student sample and individuals with GAD were predominantly women. Utilising relatively gender balanced samples could allow an examination of gender effects. This may provide further information allowing the results to be generalised to both men and women. Secondly, the student group had a mean age of 28.32 years and the GAD group had a mean age of 40.70 years. GAD is more prevalent in those aged over 35 years and researchers have shown that early onset GAD is associated higher levels of severity (Campbell, Brown, & Grisham, 2003; Wittchen & Hoyer, 2001). Further research is warranted to examine the differences in intolerance of uncertainty and meta-worry on the basis of age.

Additionally, it would be interesting to investigate the relationship between intolerance of uncertainty, meta-worry, age and severity. Thirdly, there were group differences on the basis of marital status. The marital status of the student was predominantly single and those who were categorized as GAD were generally married. It may be interesting for future researchers to compare groups based on marital status, since single individuals and married individuals are likely to experience different lifestyle demands and therefore the content and severity of worry and the severity of GAD may differ between these groups.

The results of this study suggest that a combination of intolerance of uncertainty and meta-worry can discriminate between GAD groups and non-clinical groups. Previous research has indicated that intolerance of uncertainty and meta-worry are also associated

with social phobia and OCD, only meta-worry was found to be associated with depression (McMahon & Khawaja, 2009). There is difficulty delineating GAD from other disorders due to substantial co-morbidity between GAD and other disorders (Ruscio, 2002). It is possible that utilising intolerance of uncertainty and meta-worry to distinguish between disorders may improve the reliability of diagnosis. Future research investigating the discriminant validity of intolerance of uncertainty and meta-worry in distinguishing between GAD and other disorders, may provide further information that may assist in delineating the boundaries between GAD and other disorders.

In summary, despite some limitations, the present study adds to existing literature on intolerance of uncertainty, meta-worry and GAD. In combination meta-worry and intolerance of uncertainty are able to discriminate between non-clinical and GAD groups. Meta-worry not only distinguished individuals measuring low on measures of GAD from the GAD group, but also distinguished individuals scoring high on measures of GAD from the GAD group. This suggests that it is possible that measures of meta-worry may be sensitive to severity of GAD. If the findings of the present study are confirmed by future research, intolerance of uncertainty and meta-worry may prove useful in assisting with the diagnosis of GAD. Also, interventions focusing on both intolerance of uncertainty and meta-worry may be beneficial for individuals with GAD. If future research identifies an association between meta-worry and GAD severity, this could have treatment implications for individuals with severe GAD.

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Table 1

Means and standard deviations for AnTI-MW and IUS.

	Group		High GAD scorers		GAD	
	Low GAD scorers		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
	<i>M</i>	<i>SD</i>				
AnTI-MW	8.43	8.42	17.70	4.63	20.08	4.20
IUS	40.09	11.03	80.86	21.43	86.59	20.23

Note – $n = 198$. IUS = Intolerance of Uncertainty Questionnaire. AnTI-MW = Anxious Thoughts Inventory Meta-worry Subscale.

Table 2

Canonical coefficients and correlations of predictor variables for the discriminant function.

	Correlation coefficients	Canonical coefficients
IUS	.81	.43
AnTI- MW	.93	.70

Note: IUS = Intolerance of Uncertainty Questionnaire. AnTI-MW = Anxious Thoughts Inventory Meta-worry Subscale.

Table 3

Classification results from the discriminant function.

Actual Group	Predicted Group		
	Low GAD scorers	High GAD scorers	GAD
Low GAD scorers	46 (97.9%)	0 (0.0%)	1 (2.1%)
High GAD scorers	7 (15.9%)	3 (6.8%)	34 (77.3%)
GAD	5 (4.7%)	1 (0.9%)	101 (94.4%)

Note – $n = 198$.