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Abstract

Metacognitive beliefs about worry, intolerance of uncertainty, and fear of emotions are associated with chronic worry and generalized anxiety disorder (GAD). However, much of the existing research is cross-sectional, which cannot determine whether these beliefs are associated with changes in worry severity and GAD symptoms over time. This study examined whether changes in metacognitive beliefs about worry, intolerance of uncertainty, and fear of emotions are associated with changes in worry severity and GAD symptoms. A university sample of high worriers ($N = 372$) completed measures of worry severity, GAD symptoms, negative and positive beliefs about worry, intolerance of uncertainty, and fear of emotions. Participants were assessed at baseline and 4-months. Fear of anxiety was associated with worry severity cross-sectionally, while fear of depression was associated with changes in worry. Intolerance of uncertainty was associated with worry severity and GAD symptoms cross-sectionally, as well as changes in worry and GAD symptoms. However, negative beliefs about worry consistently explained the greatest variance in worry severity and GAD symptoms in all analyses. These findings suggest that negative beliefs about worry are a key dysfunctional belief in chronic worry and GAD, and should be a primary focus of GAD treatment.

Keywords: Anxiety; Metacognitions; Mechanisms of Change; Longitudinal; Worry

Public Significance Statement:

Experiencing chronic and uncontrollable worry, the key feature of generalized anxiety disorder, causes significant stress. Different researchers have proposed different problematic beliefs that may contribute to generalized anxiety disorder. Our findings indicate that believing that your worry is dangerous has a stronger association with generalized anxiety disorder symptoms than other types of problematic beliefs and should be a focus of treatment.

Introduction

Generalized anxiety disorder (GAD) is characterized by chronic and excessive worry, lasting at least six months, with the worry not limited to a single domain or context (American Psychiatric Association, 2022). At any given time, it is estimated that approximately 2% of the population will meet diagnostic criteria for GAD (Grant et al., 2005). If left untreated, GAD tends to be chronic, with individuals experiencing persistent difficulties in ongoing daily functioning (Kessler & Wittchen, 2002). Given the chronic and impairing nature of GAD, it is imperative that the etiology of GAD be understood to improve treatment outcomes. Various mechanisms have been proposed to explain the development and maintenance of GAD, as well as how best to treat it (Behar et al., 2009; McCabe-Bennett et al., 2018). Currently, two mechanisms that have received a great deal of empirical support are negative beliefs about worry (Wells, 1995) and intolerance of uncertainty (Dugas & Koerner, 2005). Fear of emotions has also gained preliminary empirical support (Deleurme et al., 2022; Mennin et al., 2002).

Negative beliefs about worry refer to beliefs that worry is dangerous or uncontrollable (Wells, 2005). Positive beliefs about worry refer to beliefs that worry is beneficial or a useful problem-solving tool (Wells, 2005). These beliefs are metacognitions, which broadly refers to thoughts about one's own mental processes, and both contribute to the development and maintenance of GAD. However, negative beliefs about worry are thought to be more critical to GAD development and maintenance (Wells, 2005). Extensive research has shown that negative beliefs about worry are associated with pathological worry, the central feature of GAD (Cartwright-Hatton & Wells, 1997; Wells & Carter, 1999; Wells & Cartwright-Hatton, 2004). Further, negative beliefs about worry distinguish between individuals experiencing significant GAD symptoms and individuals who are non-clinical chronic worriers (Penney et al., 2013;

Ruscio, 2002; Wells, 2002). Negative beliefs about worry predict dimensional GAD symptom severity scores, as well as whether someone meets criteria for a GAD diagnosis (Koerner et al., 2015). In some studies, positive beliefs about worry have also been found to contribute to worry and GAD symptoms, even when accounting for negative beliefs about worry (Khawaja & Chapman, 2007; Koerner et al., 2015). Further, treatment outcome studies have demonstrated that targeting metacognitive beliefs in therapy, primarily negative beliefs about worry, effectively reduces symptoms of GAD (af Winklerfelt Hammarberg et al., 2023; Haseth et al., 2019; Nordahl et al., 2018; Wells et al., 2010; van der Heiden et al., 2013).

Intolerance of uncertainty refers to the anxiety and distress individuals experience when attempting to deal with uncertain situations (Dugas & Koerner, 2005). Individuals high in intolerance of uncertainty perceive uncertain situations as anxiety provoking and they worry to better cope with the uncertainty. Individuals with GAD believe that worry helps them cope with feared outcomes or will prevent feared events from happening, suggesting that worry is seen as a tool to help cope with the uncertainty of future events (Dugas & Koerner, 2005). When controlling for other dysfunctional beliefs commonly associated with worry, intolerance of uncertainty is strongly associated with pathological worry (Buhr & Dugas, 2006; Dugas et al., 2001; Sexton et al., 2003). Intolerance of uncertainty is also significantly higher in individuals with GAD compared to moderate worriers (Ladouceur et al., 1998). Compared to the general population, and individuals with other anxiety disorders, those with GAD report higher levels of intolerance of uncertainty (Dugas et al., 2005; Ladouceur et al., 1999). Intolerance of uncertainty has also been found to be a unique predictor of meeting criteria for GAD (Koerner et al., 2015; Koerner et al., 2017). Several treatment outcome studies have shown that significant

improvements in worry severity and GAD symptoms occur when targeting and reducing intolerance of uncertainty (Dugas et al., 2003; Dugas et al., 2010; Hebert & Dugas, 2019).

While negative beliefs about worry and intolerance of uncertainty have received the most empirical support, fears of emotions also appear to play a role in GAD (Deleurme et al., 2022; Mennin et al., 2002; Mennin et al., 2005). Fear of emotions has been associated with worry in individuals with heightened GAD symptoms (Salters-Pedneault et al., 2006), and more specifically, fear of anxiety and depression are associated with GAD symptoms and worry (Buhr & Dugas, 2012; Mennin et al., 2005; Salters-Pedneault et al., 2006). Fear of emotions are also positively associated with GAD symptoms when controlling for metacognitions (Deleurme et al., 2022; Stapinski et al., 2010). While treatment outcome studies targeting fear of emotions are limited, therapy targeting emotion regulation has been shown to improve GAD symptoms and worry severity (Mennin et al., 2018). However, compared to the research exploring metacognitions and intolerance of uncertainty in GAD, less research has investigated fear of emotions.

Unfortunately, almost all the existing research comes from either cross-sectional or treatment-outcome data. Cross-sectional studies are unable to determine the temporal relationship between the proposed dysfunctional beliefs and worry severity/GAD symptoms. Treatment-outcome data partially addresses this limitation by allowing researchers to determine whether changes in beliefs precede changes in symptoms. However, it is possible that the factors leading to reduced GAD symptoms and worry during treatment may differ from the factors associated with the development/maintenance of GAD. Further, it is possible that factors influencing GAD and worry severity may differ between individuals seeking GAD treatment and individuals with GAD in the general community. The limitations of both cross-sectional and

treatment-outcome data can be partially mitigated by conducting research using multiple time points in a non-treatment seeking sample. Unfortunately, such research is very limited.

Nassif (1999) found that negative beliefs about worry at baseline predicted worry severity and meeting diagnostic criteria for GAD at a three-month follow-up. Another study found that negative beliefs about worry at baseline predicted GAD symptoms, but not worry severity, at a one-year follow-up (Sun et al., 2019). Longitudinal examination of intolerance of uncertainty has found that changes in intolerance of uncertainty predict changes in worry severity over a five-year period (Dugas et al., 2012). This study also found that changes in the fear of anxiety predicted changes in worry severity, but to a lesser degree than intolerance of uncertainty (Dugas et al., 2012).

While the existing research is valuable, researchers have tended to examine intolerance of uncertainty, negative beliefs about worry, and fear of emotions separately. Although some researchers have compared the dysfunctional beliefs, the results have been equivocal, with some studies finding intolerance of uncertainty to be more strongly associated with worry severity (Khawaja & Chapman, 2007; McEvoy & Mahoney, 2013) and others finding negative beliefs about worry to be more strongly associated with worry severity and GAD symptoms (Penney et al., 2020; Thielsch et al., 2015). As well, some prior studies only examined changes in worry severity, rather than examining both worry and GAD symptoms. This focus limits the generalizability of results because, while closely related, worry severity and GAD symptoms are distinct. The existing longitudinal research provides preliminary evidence for the role of negative beliefs about worry, intolerance of uncertainty, and fear of anxiety in predicting changes in worry severity and GAD symptoms over time. However, further research is needed to examine

the covariation of changes in negative beliefs about worry, intolerance of uncertainty, and fears of emotions with changes in worry severity and GAD symptoms.

Aims of the Study

The present study examined the roles of negative beliefs about worry, positive beliefs about worry, intolerance of uncertainty, fear of anxiety, and fear of depression in worry severity and GAD symptoms. Specifically, we examined which dysfunctional beliefs were most strongly associated with worry severity and GAD symptoms cross-sectionally. Further, we examined if changes in the dysfunctional beliefs were associated with changes in worry severity and GAD symptoms. It was hypothesized that negative beliefs about worry, intolerance of uncertainty, and fear of emotions would account for unique variance in GAD symptoms and worry. However, given previous research showing that negative beliefs about worry are more strongly associated with worry severity and GAD symptoms than positive beliefs about worry, intolerance of uncertainty, and fear of emotions (Deleurme et al., 2022; Ren et al., 2020; Sugiura, 2017; van der Heiden et al., 2012; van der Heiden & Melchior, 2014), it was expected that negative beliefs about worry would have the strongest association with (i.e., account for the most unique variance in) worry severity and GAD symptoms.

Method

Participants

A non-clinical sample of undergraduates at MacEwan University in Edmonton, Alberta, Canada, participated. Inclusion criteria included scoring above 45 on the Penn State Worry Questionnaire (PSWQ: Meyer et al., 1990). This population was selected because a cut off score of 45 on the PSWQ can be used to identify individuals at risk for the development of GAD within a non-clinical sample (Behar et al., 2003; Fresco et al., 2002). By focusing on individuals

with high levels of worry, the study has enhanced generalizability for those at risk of developing GAD.

A total of 593 participants completed the baseline assessment and 410 participants completed the follow-up (69.14% retention). Of these 410, a final sample of 372 participants' data was sufficiently complete and used for analyses. The sample largely identified as female (84.1%), with 11.3% identifying as male, and 2.4% as non-binary. Further, 59.4% identified as Caucasian, with Southeast Asian (11.3%), mixed race (5.4%), and Indigenous/Aboriginal (2.7%) being the next most selected. The mean age was 20.87 years, and the majority were single (56.7%) or dating (35.8%).

Procedure

The institution's Research Ethics Board (REB Reference Number 101834) approved the study in August 2020. Participants were recruited from a large undergraduate research pool, with everyone in the pool expected to complete the PSWQ. Students scoring 45 or higher on the PSWQ were individually invited via email to complete the baseline assessment. Participants completed the study online and were eligible to receive 2% course credit. Consenting participants completed a demographics form, followed by a series of self-report questionnaires. Participants were also asked if they wished to complete the 4-month follow-up. Those who agreed were emailed 4-months later and offered a $15.00 e-gift card as compensation. Participants provided baseline data between September 2020 and June 2021, and were subsequently invited to provide the 4-month follow-up data between January 2021 and October 2021, with the date of their 4-month follow-up depending on when they completed the baseline.

Measures

GAD Symptoms – Generalized Anxiety Disorder Questionnaire-IV (GADQ-IV)

The GADQ-IV is a self-report diagnostic measure based on the criteria for GAD contained in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994; Newman et al., 2002). The original version contains a 'skip out rule', which was removed in the current study. The GADQ-IV has good test-retest reliability, convergent and divergent validity, and demonstrates a strong one factor structure when scored without the skip out rule (Newman et al., 2002; Rodebaugh et al., 2008). Total scores range from 0 to 13, with higher scores indicating more GAD symptoms and greater impairment. Additionally, with the skip out rule removed, an established cut off score of 5.7 on the GADQ-IV indicates the presence of GAD (Newman et al., 2002).

Worry Severity – Penn State Worry Questionnaire-Modified (PSWQ-M)

The full PSWQ is a 16-item self-report questionnaire designed to measure chronic worry, with higher scores reflecting higher levels of pathological worry (Meyer et al., 1990). While the full version was administered during the study, data from item #12 ("I've been a worrier all of my life") was removed due to its incongruency with this study. Because of this, total scores could range from 15 to 75, rather than the standard 16 to 80. The PSWQ demonstrates strong internal consistency and good criterion, convergent, discriminant, and construct validity (Brown et al., 1992; Meyer et al., 1990).

Intolerance of Uncertainty – Intolerance of Uncertainty Scale-18 (IUS-18)

The IUS-18 is an 18-item self-report measure assessing an individual's tendency to react negatively to uncertain situations (Hong & Lee, 2015). Total scores range from 18 to 90, with higher scores indicating greater intolerance of uncertainty. The IUS-18 has been shown to have strong internal consistency, as well as convergent and discriminant validity (Hong & Lee, 2015).

Negative and Positive Beliefs About Worry – Metacognitions Questionnaire-30 (MCQ-30)

The MCQ-30 is a 30-item self-report questionnaire measuring metacognitive beliefs (Wells & Cartwright-Hatton, 2004). While the MCQ-30 includes five subscales, the present study examined the negative beliefs about worry (MCQ-NBW) and positive beliefs about worry (MCQ-PBW) subscales. Scores on each subscale range from 6-24 with higher scores indicating increased dysfunctional metacognitions. The MCQ-30 demonstrates strong internal consistency and good convergent validity (Typaldou et al., 2010; Wells & Cartwright-Hatton, 2004).

Fear of Anxiety and Depression – Affective Control Scale (ACS)

The ACS is a 42-item self-report questionnaire measuring fear of emotions (Williams et al., 1997). The present study focused on the fear of anxiety (ACS-ANX) and fear of depression (ACS-DEP) subscales. ACS-ANX includes 13 items and scores range from 13 to 91. ACS-DEP includes 8 items and scores range from 8 to 56. Higher scores indicate increased fear of anxiety and depression, respectively. The ACS demonstrates good internal validity, as well as convergent and discriminant validity (Berg et al., 1998; Williams et al., 1997).

Statistical Analyses

All analyses were conducted using IBM SPSS Statistics version 28. To justify the use of listwise deletion in the analyses, and ensure the pattern of missing data was completely random, a Little's Missing Completely at Random (MCAR) test was conducted. Bivariate correlations were conducted to assess the correlations between all of the variables. A paired samples *t*-test was also conducted to examine potential differences between participants' baseline and follow-up scores on the measures of worry severity, GAD symptoms, and the dysfunctional beliefs.

Next, multiple regression analyses were conducted to examine cross-sectional predictors of worry and GAD symptoms at baseline and follow-up. First, baseline worry severity scores were entered as the dependent variable and predictor variables included negative beliefs about

worry, positive beliefs about worry, intolerance of uncertainty, fear of anxiety, and fear of depression baseline scores. A second regression analysis was conducted with follow-up worry severity scores as the dependent variable and negative beliefs about worry, positive beliefs about worry, intolerance of uncertainty, fear of anxiety, and fear of depression follow-up scores as predictor variables. Cross-sectional predictors of GAD symptoms at baseline and follow-up were examined using the same regression analyses discussed above, except GAD symptom baseline and follow-up scores were the dependent variables.

To assess whether changes in the dysfunctional beliefs are associated with changes in worry severity and GAD symptoms, change scores were calculated for all measures. Change scores were calculated by subtracting participants' follow-up scores from baseline scores. The use of change scores allows for a more direct test of the underlying theories regarding the influence of metacognitions, intolerance of uncertainty, and fear of emotions on GAD. When previous researchers have examined if baseline scores of dysfunctional beliefs predict follow-up GAD scores, that analysis tests whether scores at time 1 predicts scores at time 2. That analysis does not consider the fluid nature of these variables, even though it is expected that dysfunctional beliefs, GAD symptoms, and worry severity are dynamic and change over time. Instead, it aligns better with the underlying theory to test whether dysfunctional beliefs change alongside changes in GAD symptoms (i.e., whether dysfunctional belief change scores are associated with GAD change scores). In this manner, when a participants' dysfunctional beliefs increase (or decrease) between baseline and follow-up, an increase (or decrease) in GAD symptoms should coincide.

The use of change scores also helps control for baselines scores. However, as extreme baseline scores will likely normalize by follow-up, this regression to the mean would be reflected in raw change scores. This results in a confounding negative correlation between change scores

and baselines scores. When conducting regression analyses using change scores, this can be overcome by including the baseline score of the dependent variable as an independent variable to account for this effect (Gillespie & Streeter, 1994).

Two regressions were conducted with the change scores for worry severity and GAD symptoms as the dependent variables. For both regressions, change scores for negative beliefs about worry, positive beliefs about worry, intolerance of uncertainty, fear of anxiety, and fear of depression were the predictor variables, as well as baseline worry severity and GAD symptom scores for their respective analyses. For the regression analyses, alpha was set to .0083 based on a Bonferroni correction. As six separate regression analyses were conducted, we calculated .05/6, arriving at .0083 (Armstrong, 2014).

Results

The Little's MCAR test was non-significant, χ^2 (2442) = 2475.96, p = .311, so listwise deletion was used in all analyses. Descriptive statistics were conducted to examine Cronbach's alpha coefficients, means, and standard deviations for all scales at baseline and follow-up (see Supplementary Data). Given that participants were pre-screened for high worry, it was not surprising that a substantial percentage of participants screened positive for GAD based on the GADQ-IV cut-off score. At baseline, 92.1% of participants scored above the cut-off of 5.7 (Newman et al., 2002), with 88.3% of participants scoring above the cut-off at the 4-month follow-up. For worry severity, the mean score at baseline and follow-up was only slightly lower than typical scores of individuals diagnosed with GAD (Turk et al., 2001), and the mean scores would have been higher if item #12 had been included. Baseline and follow-up mean scores for negative beliefs about worry, intolerance of uncertainty, fear of anxiety, and fear of depression

were also higher than typical scores in undergraduate student samples (Bottesi et al., 2016; Hong & Lee, 2015; Wells & Cartwright-Hatton, 2004; Williams et al., 1997; Sexton & Dugas, 2008).

Small correlations were observed between positive beliefs about worry and fear of anxiety and fear of depression (see Supplementary Data). However, all other measures had moderate to strong correlations with each other, with moderate to high test-retest correlations (see Supplementary Data). Mean GAD symptom scores decreased slightly, though significantly, from baseline to follow-up, while positive beliefs about worry mean scores increased slightly (see Supplementary Data). No other measures demonstrated significant differences between baseline and follow-up (see Supplementary Data).

Two cross-sectional regression analyses were performed to determine which dysfunctional beliefs were associated with worry severity at baseline and follow-up. In the first regression, the model accounted for 54.6% of variance in worry baseline scores, F (5, 319) = 76.67, $p < .001$ (see Table 1, Panel A). Intolerance of uncertainty, negative beliefs about worry, positive beliefs about worry, and fear of anxiety were uniquely associated with worry scores. As expected, negative beliefs about worry explained the most unique variance in worry severity.

In the second regression analysis, the model accounted for 64.3% of variance in worry severity follow-up scores, F (5, 362) = 130.26, $p < .001$ (see Table 1, Panel B). Intolerance of uncertainty, negative beliefs about worry, positive beliefs about worry, and fear of anxiety were again uniquely associated with worry scores at follow-up. Consistent with results from the first regression, and as hypothesized, negative beliefs about worry explained the most unique variance in worry severity at follow-up.

Two additional cross-sectional regression analyses were performed to determine which dysfunctional beliefs were associated with GAD symptoms at baseline and follow-up. In the first

regression, the model accounted for 59.4% of variance in GAD symptom baseline scores, F (5, 314) = 91.93, $p < .001$ (see Table 2, Panel A). Intolerance of uncertainty, negative beliefs about worry, and fear of depression were found to account for unique variance in GAD symptoms at baseline, with negative beliefs about worry accounting for the most unique variance.

In the regression examining follow-up scores, the model accounted for 58.1% of variance in GAD symptom follow-up scores, F (5, 360) = 99.72, $p < .001$ (see Table 2, Panel B). Only intolerance of uncertainty and negative beliefs about worry were found to account for unique variance in GAD symptoms at follow-up, with negative beliefs about worry again the strongest variable. As expected, the negative beliefs about worry explained the greatest unique variance in GAD symptoms at baseline and follow-up.

Two regression analyses were then conducted to examine whether changes in the dysfunctional beliefs between baseline and follow-up were associated with changes in worry severity and GAD symptoms. In the first regression, the model accounted for 35.7% of variance in worry severity change scores, F (6, 315) = 29.18, $p < .001$ (see Table 3). The change in intolerance of uncertainty, negative beliefs about worry, and fear of depression all accounted for unique variance in change in worry severity scores. Of the dysfunctional beliefs, changes in negative beliefs about worry explained the most variance.

In the second regression analysis, the model accounted for 30.7% of variance in GAD symptom change scores, F (6, 308) = 22.77, $p < .001$ (see Table 4). Change in intolerance of uncertainty and negative beliefs about worry accounted for unique variance in change in GAD symptom scores. Change in negative beliefs about worry again explained the most variance of all the dysfunctional beliefs.

Discussion

The present study examined metacognitions, intolerance of uncertainty, and fear of emotions in pathological worry and GAD symptoms. As hypothesized, the cross-sectional analyses supported the hypothesis that negative beliefs about worry would have the strongest association with worry severity and GAD symptoms. Further, changes in negative beliefs about worry had the strongest association with changes in pathological worry and changes in GAD symptoms. Overall, negative beliefs about worry had the strongest and most consistent association with pathological worry and GAD symptoms, which supports negative beliefs about worry's role in pathological worry and GAD (Cartwright-Hatton & Wells, 1997; Hirsch et al., 2013; Wells, 2005; Wells & Carter, 1999, 2001; Wells & Cartwright-Hatton, 2004). This finding supports the Metacognitive Model of GAD (Wells, 1995, 2005), which posits that negative beliefs about worry play a central role in GAD. Further, this aligns with previous cross-sectional research suggesting that negative beliefs about worry are more strongly associated with worry and GAD symptoms compared to other dysfunctional beliefs (Deleurme et al., 2022; Penney et al., 2013; Ren et al., 2020; Sugiura, 2017), as well as aligning with previous longitudinal findings that negative beliefs about worry play an important role in explaining unique variance in changes in anxiety over time (Ryum et al., 2017).

While negative beliefs about worry explained the most variance, intolerance of uncertainty was also uniquely associated with worry severity and GAD symptoms cross-sectionally, as well as changes in worry severity and GAD symptoms. However, negative beliefs about worry consistently explained greater variance than intolerance of uncertainty. In recent years, emerging evidence has suggested that intolerance of uncertainty is also related to panic disorder with or without agoraphobia, obsessive-compulsive disorder, and social anxiety disorder (Boelen & Reijntjes, 2009; Mahoney & McEvoy, 2012; Norton & Mehta, 2007; Penney et al.,

2020; Wright et al., 2016). Therefore, while these findings offer some support for the Intolerance of Uncertainty Model of GAD (Dugas et al., 2005), which suggests that intolerance of uncertainty plays a key role in GAD, intolerance of uncertainty may be better conceptualized as a transdiagnostic construct across anxiety and related disorders, and may not be as strongly and uniquely related to GAD symptoms as was once thought.

An understanding of Wells' (2019) Metacognitive Control System Model offers another possibility for why intolerance of uncertainty did not associate with worry and GAD severity as strongly as negative beliefs about worry. To greatly simplify a complex model, Wells (2019) argues that in the mind there is a cognitive system, which includes the experience of in-the-moment worrying and ruminating during times of stress, as well as a metacognitive control system, which includes the beliefs people have about their thinking. Wells (2019) argues that the metacognitive control system exerts significant influence on the cognitive system, and that underlying metacognitive beliefs are a primary factor that lead to psychological disorders. Negative beliefs about worry are a principal metacognitive vulnerability within this model, so it is not surprising that negative beliefs about worry would have the strongest association with pathological worry and GAD. Further, intolerance of uncertainty, as measured by the IUS-18 and previous versions of the questionnaire, appears to include elements of both the metacognitive system (e.g., item #2, "My mind can't be relaxed if I don't know what will happen tomorrow") and the cognitive system (e.g., item #4, "Unforeseen events upset me greatly"). It would be interesting to determine if the associations between intolerance of uncertainty and GAD were strengthened if the IUS focused on metacognitions. Future researchers may wish to investigate how negative beliefs about worry and intolerance of uncertainty are related to each other, and

how intolerance of uncertainty fits within a metacognitive approach. Comprehensive GAD theories should incorporate both intolerance of uncertainty and negative beliefs about worry.

Interesting findings were also observed with the other dysfunctional beliefs. Positive beliefs about worry were associated with worry severity cross-sectionally, but not with changes in worry severity. Further, positive beliefs about worry were not associated with GAD symptoms in any analysis. These findings indicate that positive beliefs about worry may be associated with chronic worry, but do not significantly contribute to changes in worry. This supports the Metacognitive Model's proposition that positive beliefs about worry could be related to the early development of pathological worry, but are often not a significant factor in true GAD (Wells, 2005; Wells & Carter, 1999).

The results also indicate that fear of emotions may be involved in pathological worry. Fear of anxiety had a consistent cross-sectional association with worry severity, while fear of depression was associated with changes in worry severity. This aligns with previous findings that fears about anxiety and depression are associated with worry (Buhr & Dugas, 2012; Mennin et al., 2005). Yet, the findings also support previous studies that found that while fears of emotions are associated with pathological worry, negative beliefs about worry explain greater variance (Deleurme et al., 2022; Sugiura, 2017). Researchers wishing to further explore how fear of emotions contribute to pathological worry are strongly encouraged to include negative beliefs about worry and intolerance of uncertainty in their research, so they are not ignoring significant third variable confounds.

Regarding GAD symptoms, it was found that fear of depression was associated with GAD cross-sectionally, but changes in fears of anxiety and depression were not associated with changes in GAD symptoms. While fears of emotions may be involved in pathological worry,

they may not be key to the development and maintenance of GAD symptoms, at least compared to negative beliefs about worry and intolerance of uncertainty. These findings suggest that while the Emotion Dysregulation Model of GAD (Mennin et al., 2002), which places the role of emotions at the core of GAD, may contribute to our understanding of chronic worry, other dysfunctional beliefs, such as negative beliefs about worry and intolerance of uncertainty, play a larger role in the development and maintenance of pathological worry and GAD.

The finding that negative beliefs about worry have the strongest association with GAD provides support for the Metacognitive Model (Wells, 1995, 2005, 2019) and suggests that negative beliefs about worry should be a primary focus of GAD treatment. This aligns with the current literature suggesting that Metacognitive Therapy is an effective treatment for GAD and leads to significant improvements in worry severity and GAD symptoms (Haseth et al., 2019; Nordahl et al., 2018; Wells et al., 2010; van der Heiden et al., 2013). The findings also align with previous research demonstrating that Metacognitive Therapy may lead to superior outcomes for clients with GAD compared to Intolerance of Uncertainty Therapy (af Winklerfelt Hammarberg et al., 2023; van der Heiden et al., 2012; van der Heiden & Melchior, 2014). However, given that changes in intolerance of uncertainty were found to be associated with changes in GAD symptoms, targeting intolerance of uncertainty in therapy can also lead to positive treatment outcomes. This has been shown in previous treatment-outcome studies that specifically target intolerance of uncertainty (Dugas et al., 2010; Hebert & Dugas, 2019). The findings also suggest that targeting fears of anxiety and fears of depression could improve chronic worry, though this may not be as effective as targeting negative beliefs about worry.

Study Limitations

The use of a non-clinical sample and a four-month follow-up length limit the generalizability. While the sample reported mean scores similar to GAD samples, formal diagnostic interviews were not conducted. Future research may wish to extend these findings to a clinical population and use a larger follow-up window to observe how worry severity and GAD symptoms change over longer periods. The four-month follow-up length also means practice effects could have influenced the results, as the same measures were used during both measurement points. With only two measurement points, this study was also unable to test whether changes in the dysfunctional beliefs preceded changes in worry and GAD symptoms, as is assumed in cognitive-behavioural and metacognitive models of GAD. To determine whether changes to the dysfunctional beliefs directly cause changes in worry and GAD, future researchers should include multiple measurement points. Further, a large gender imbalance was observed in this study, with most participants identifying as female, limiting the generalizability to individuals with other gender identities. This study was also conducted during the COVID-19 pandemic which could have artificially inflated participant's worry. Given the social climate during data collection, it is possible self-reports like the PSWQ-M may have overestimated typical worry severity.

Conclusion

Overall, negative beliefs about worry consistently explained the greatest variance in pathological worry and GAD symptoms, suggesting that negative beliefs about worry play a key role in pathological worry and GAD symptoms. Intolerance of certainty was also consistently associated with worry severity and GAD symptoms, but to a lesser degree than negative beliefs about worry. Overall, negative beliefs about worry emerged as the most consistent dysfunctional

belief across analyses and explained the greatest amount of variance in pathological worry and GAD symptoms, supporting the Metacognitive Model of GAD (Wells, 1995, 2005).

While the current study supports the role of metacognitive beliefs in GAD, particularly negative beliefs about worry being uncontrollable and dangerous, metacognitive beliefs play a role in a range of emotional disorders (Wells, 2019). Metacognitive beliefs appear to exert significant influence on an individual's cognitive processes, predisposing them to the development of psychological disorders, including GAD (Wells, 2019). Future research should continue to explore the role of metacognitions, and the utility of metacognitive therapy, across a range of disorders.

Declarations

Disclosure of Interest & Data Availability

The authors report there are no competing interests to declare. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Table 1.

Regression analyses for cross-sectional predictors of worry at baseline (Panel A) and follow-up (Panel B).

Variable	*R*	R^2 Change	*β*	*t*	*pr*
Panel A					
DV: PSWQ-M					
Step 1	.739	.546**			
IUS-18			.208	3.92**	.22
MCQ-NBW			.350	6.68**	.35
MCQ-PBW			.107	2.72*	.15
ACS-ANX			.255	4.75**	.26
ACS-DEP			.018	0.39	.02
Panel B					
DV: PSWQ-M					
Step 1	.802	.643**			
IUS-18			.193	4.49**	.23
MCQ-NBW			.468	10.07**	.47
MCQ-PBW			.145	4.40**	.23
ACS-ANX			.208	4.18**	.21
ACS-DEP			-.020	-0.50	-.03

Note. *β* = Standardized regression coefficient; *pr* = Partial correlation; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs about Worry; MCQ-PBW = Positive Beliefs about Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

* $p < .0083$. ** $p < .001$.

Table 2.

Regression analyses for cross-sectional predictors of GAD at baseline (Panel A) and follow-up (Panel B).

Variable	*R*	R^2 Change	*β*	*t*	*pr*
Panel A					
DV: GADQ-IV					
Step 1	.771	.594**			
IUS-18			.181	3.59**	.20
MCQ-NBW			.439	8.85**	.45
MCQ-PBW			.027	0.71	.04
ACS-ANX			.113	2.22	.12
ACS-DEP			.197	4.59**	.25
Panel B					
DV: GADQ-IV					
Step 1	.762	.581**			
IUS-18			.187	4.00**	.21
MCQ-NBW			.472	9.38**	.44
MCQ-PBW			.011	0.32	.02
ACS-ANX			.116	2.15	.11
ACS-DEP			.112	2.59	.14

Note. *β* = Standardized regression coefficient; *pr* = Partial correlation; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs about Worry; MCQ-PBW = Positive Beliefs about Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

* $p < .0083$. ** $p < .001$.

Table 3.

Regression analysis for changes in beliefs predicting changes in worry.

Variable	*R*	R^2 Change	*β*	*t*	*pr*
DV: PSWQ-M_{change}					
Step 1	.598	.357**			
PSWQ-$M_{baseline}$			-.263	-5.77**	-.31
IUS-18_{change}			.130	2.65*	.15
MCQ-NBW_{change}			.287	5.48**	.30
MCQ-PBW_{change}			.092	2.00	.11
ACS-ANX_{change}			.116	2.11	.12
ACS-DEP_{change}			.186	3.56**	.20

Note. *β* = Standardized regression coefficient; *pr* = Partial correlation; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs about Worry; MCQ-PBW = Positive Beliefs about Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

* $p < .0083$. ** $p < .001$.

Table 4.

Regression analysis for changes in beliefs predicting changes in GAD.

Variable	*R*	R^2 Change	*β*	*t*	*pr*
DV: GADQ-IV$_{change}$					
Step 1	.554	.307**			
GADQ-IV$_{baseline}$			-.226	-4.71**	-.26
IUS-18$_{change}$			.180	3.45**	.19
MCQ-NBW$_{change}$			.268	4.87**	.27
MCQ-PBW$_{change}$			.092	1.89	.11
ACS-ANX$_{change}$			.063	1.09	.06
ACS-DEP$_{change}$			.126	2.30	.13

Note. *β* = Standardized regression coefficient; *pr* = Partial correlation; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs about Worry; MCQ-PBW = Positive Beliefs about Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

* $p < .0083$. ** $p < .001$.

Supplemental Data

Table S1.

Psychometric properties of the measures at baseline.

Measures	Mean	*SD*	Observed Range	Cronbach's Alpha
GADQ-IV	9.37	2.38	0.58-13	.72
PSWQ-M	59.83	9.96	29-75	.89
IUS-18	55.27	12.76	20-87	.91
MCQ-NBW	16.26	4.51	6-24	.85
MCQ-PBW	12.51	4.37	6-24	.87
ACS-ANX	58.50	12.90	19-88	.89
ACS-DEP	34.92	10.56	8-56	.90

Note. Observed Range = Range of Participants' Scores; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs About Worry; MCQ-PBW = Positive Beliefs About Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

Table S2.

Psychometric properties of the measures at follow-up.

Measure	Mean	*SD*	Observed Range	Cronbach's Alpha
GADQ-IV	9.14	2.54	1.58-13	.74
PSWQ-M	59.26	10.55	28-75	.90
IUS-18	54.68	12.82	18-86	.91
MCQ-NBW	15.97	4.68	6-24	.87
MCQ-PBW	13.07	4.86	6-24	.92
ACS-ANX	58.42	12.98	20-88	.89
ACS-DEP	34.50	10.94	8-56	.91

Note. Observed Range = Range of Participants' Scores; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs About Worry; MCQ-PBW = Positive Beliefs About Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

Table S3.

Bivariate correlations for all measures at baseline and follow-up.

	1	2	3	4	5	6	7
1. GADQ-IV	.70***						
2. PSWQ-M	.67*** (.69***)	.75***					
3. IUS-18	.60*** (.59***)	.60*** (.63***)	.76***				
4. MCQ-NBW	.70*** (.72***)	.65*** (.74***)	.61*** (.61***)	.73***			
5. MCQ-PBW	.16** (.16**)	.24*** (.30***)	.28*** (.28***)	.15** (.17**)	.62***		
6. ACS-ANX	.60*** (.62***)	.62*** (.65***)	.60*** (.60***)	.61*** (.69***)	.08 (.12*)	.77***	
7. ACS-DEP	.51*** (.49***)	.38*** (.43***)	.43*** (.43***)	.41*** (.48***)	.04 (.06)	.52*** (.61***)	.77***

Note. Correlations along the diagonal indicate the test-retest correlation of each measure between baseline and follow-up, while correlations inside parentheses indicate the correlations at follow-up; GADQ-IV = Generalized Anxiety Disorder 7-Item Scale; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-NBW = Negative Beliefs About Worry; MCQ-PBW = Positive Beliefs About Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.

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

Table S4.

Paired sample t-tests for measures at baseline and follow-up.

Variable	M1	M2	M2 - M1	*t*	*p*
GADQ-IV	9.38	9.14	-0.25	-2.45	.015
PSWQ-M	59.81	59.20	-0.60	-1.61	.109
IUS-18	55.27	54.51	-0.76	-1.61	.108
MCQ-NBW	16.26	15.96	-0.29	-1.66	.097
MCQ-PBW	12.51	13.03	0.52	2.47	.014
ACS-ANX	58.53	58.40	-0.13	-0.28	.778
ACS-DEP	34.94	34.56	-0.37	-0.99	.323

Note. M1 = Mean scores at baseline; M2 = Mean scores at follow-up; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; PSWQ-M = Penn State Worry Questionnaire – Modified; IUS-18 = Intolerance of Uncertainty Scale-18; MCQ-PBW = Positive Beliefs about Worry; MCQ-NBW = Negative Beliefs about Worry; ACS-ANX = Fear of Anxiety; ACS-DEP = Fear of Depression.