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Empirical Article

An empirical test of the metacognitive model of generalized anxiety disorder

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The metacognitive model of generalized anxiety disorder (GAD) places worrying, meta-worry ("worry about worry") and corresponding underlying metacognitive beliefs (i.e., beliefs about worry) as central in the maintenance of symptoms. Previous research has demonstrated significant relationships between these factors and symptoms, but no study has tested the statistical fit of this influential model including its hypothesized components and the suggested paths between them. The aim of the current study was therefore to evaluate the fit of the metacognitive model of GAD. A total of 312 participants constituting an analogue GAD sample were included in a cross-sectional study and completed self-report measures of anxiety and depression symptoms and scales relevant to the metacognitive model. Metacognitions, worry, and meta-worry in their hypothesized order provided a good model fit and explained significant and substantial variance in symptoms. These results provide further support for the metacognitive model of GAD and demonstrates separate and unique contributions from worry and meta-worry to generalized anxiety symptoms of which meta-worry was the most influential.

Key words: GAD, anxiety, metacognition, worry, meta-worry, S-REF model.

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INTRODUCTION

Generalized anxiety disorder (GAD) is characterized by persistent anxiety, excessive worry, and physical symptoms combined with substantial distress or impairment in personal, work-related, or other areas of functioning (American Psychiatric Association, 2013). GAD is common, affecting around 7–8% of adults in primary care (Kroenke, Spitzer, Williams, Monahan & Löwe, 2007) and is associated with secondary problems such as depression, substance abuse and physical health problems (Stein & Sareen, 2015).

One way to formulate and treat GAD is founded on the Self-Regulatory Executive Function (S-REF) model developed by Wells and Matthews (1994). This is Wells' (1995) metacognitive model GAD where generalized anxiety is conceptualized as being maintained by two different types of worry which represent state variables. Type 1 worrying refers to worry about, for example health, social interactions, and relationships (that is, non-cognitive events). Type 2 worry (i.e., *meta-worry*) is given more central importance in the model and refers to negative appraisal of worry ("worry about worry"). These two types of worry are further linked to dysfunctional metacognitive beliefs (i.e., beliefs about worry) which represent underlying trait factors in this perspective. The content and frequency of meta-worry is closely linked to negative metacognitive beliefs about the uncontrollability (e.g., "Worrying is uncontrollable") and harm of worrying (e.g., "My worrying could make me go mad"). An example of meta-worry is thinking "I will go mad if I don't stop to worry" when worrying as this is a negative appraisal of the worry process founded on the metacognitive belief that worrying can cause madness. Thus, negative metacognitive beliefs are problematic as they maintain type 1 worrying (for example, if one believes that worrying is uncontrollable, one will not try to interrupt it) and lead to meta-worry. In addition, positive metacognitive beliefs (e.g., "Worrying helps me to get things sorted out in my mind") contribute to anxiety by activating type I worrying as a self-regulatory strategy in response to negative thoughts and external stressors. Thus, the metacognitive model of GAD (Wells, 1995) distinguishes between cognitive style (i.e., worry and meta-worry), and knowledge about cognition (i.e., metacognitive beliefs) which is thought to mutually influence each other in maintaining distress and disorder. The metacognitive model of GAD is described in detail in the metacognitive therapy treatment manual developed by Wells (2009) and a clinical case illustration of the model has been reported by Hjemdal, Hagen, Nordahl and Wells (2013).

Consistent with the metacognitive model, GAD patients endorse positive and negative metacognitive beliefs about worry more strongly than healthy controls (Sun, Zhu & So, 2017), and report more meta-worry than patients with other diagnoses and healthy controls (Wells & Carter, 2001). In addition, prospective studies have reported that negative metacognitive beliefs lead to more worrying (Thielsch, Ehring, Nestler *et al*., 2015) and anxiety symptoms (Ryum, Kennair, Hjemdal, Hagen, Halvorsen & Solem, 2017). However, no study has evaluated the model fit of a theoretically consistent metacognitive model of GAD with its hypothesized components and paths.

In the present study, we therefore aimed to examine the fit of the metacognitive model of GAD using an analogue GAD sample. In line with the metacognitive model (Wells, 1995), we hypothesized that worry and meta-worry would explain variance in symptoms, and that metacognitions would explain variance in the two types of worry when entered in their proposed sequence of activation which is; positive metacognitive beliefs activate worrying, which lead to

symptoms and activation of negative metacognitive beliefs. Negative metacognitive beliefs activate meta-worry which lead to symptoms. We expect that the theoretical metacognitive model of GAD will provide a good fit to the data, and that meta-worry will contribute more to symptoms compared to worry, in line with Wells' (1995) suggestion.

METHOD

Participants and procedure

Participants were invited to an online survey about the association between worry, beliefs and anxiety that was distributed through social media. The survey was registered with the Norwegian Centre for Research Data (ref. nr. 570943), and participants had to sign informed consent following an information sheet presented about the study before entering the survey. There were no set inclusion or exclusion criteria for participation in the survey except for voluntary participation and that the participant was minimum 18 years old.

In total, 756 participants responded to the survey. Among them, 312 had a score of 10 or more on the Generalized Anxiety Disorder scale 7 (Spitzer, Kroenke, Williams & Löwe, 2006), indicating a probable diagnosis of GAD and were therefore eligible for the present study.

In our analogue GAD sample (N = 312), 270 (86.5%) of the participants were female and the mean age was 36.50 (SD = 11.81). One-hundred and fourteen (36.5%) reported to have higher education (completed 3 years or more at a university or equivalent). For marital status, 123 (39.4%) reported to be single, 177 (56.7%) reported to be in a relationship/married, eight (2.6%) reported to be separated/divorced, and four (1.3%) reported to be widowed.

Measures

The Generalized Anxiety Disorder 7 (GAD-7; Spitzer *et al*., 2006) assess severity of generalized anxiety symptoms (e.g., "Becoming easily annoyed or irritable") during the past two weeks with seven items on a four-point scale where higher scores indicate more generalized anxiety symptoms. The internal consistency of the scale was acceptable in the present study ($\alpha = 0.64$).

The Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer & Williams, 2001) assess severity of depression symptoms (e.g., "Feeling down, depressed, or hopeless") during the past two weeks with nine items on a four-point scale where higher scores indicate higher depression severity. The internal consistency of the scale was good in the present study ($\alpha = 0.84$).

The Beck Anxiety Inventory (BAI; Beck, Epstein, Brown & Steer, 1988) assess the intensity of physical and cognitive anxiety symptoms during the past week with 21 items on a scale from 0 (low intensity) to 3 (high intensity). The internal consistency of the scale was good in the present study ($\alpha = 0.92$).

The Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger & Borkovec, 1990) assess tendency to worry with 16-items (e.g., "I am always worrying about something") rated on a five-point scale from 1 ("not at all typical of me") to 5 ("very typical of me"). The internal consistency of the scale was good in the present study ($\alpha = 0.87$).

Meta-worry questionnaire (MWQ; Wells, 2005) is a seven-item self-report measure of meta-worry frequency and beliefs. For the present study we used the meta-worry frequency scale as meta-worry as a state variable is predicted to mediate the relationship between negative metacognitive beliefs and anxiety (e.g., "I am going crazy with worrying") in GAD. This scale ranges from 1 ("never") to 4 ("almost always"), and a higher score indicate more frequent meta-worry. The internal consistency of the scale was good in the present study ($\alpha = 0.89$).

The metacognitions questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) assess five dimensions of dysfunctional metacognitive beliefs on a four-point scale for each of the 30 items. In the present study we used two of its subscales: (1) positive beliefs about worry (e.g., "I need to worry in order to remain organized"); and (2) negative beliefs about the uncontrollability and danger of worry (e.g., "I could make myself sick with worrying"), and the internal consistency was good for both scales ($\alpha = 0.84$ for both).

Statistical analyses

IBM SPSS Statistics version 27 and Amos Graphics version 26 were used to conduct the analyses. The basic relationships between the variables were explored with bivariate correlations. Path analysis was conducted to evaluate the fit of the metacognitive model, and fit was evaluated based on commonly recommended fit statistics (Hu & Bentler, 1999): To represent a good statistical fit: (1) the comparative fit index (CFI) should be above 0.95; (2) the Tucker Lewis index (TLI) should be above 0.95; (3) the root mean square error of approximation (RMSEA) should be below or close to 0.06; and (4) the standardized root mean square residual (SRMR) should be less than 0.08. The model was specified using observed variables to represent metacognitive beliefs (i.e., positive and negative metacognitive belief subscales of the MCQ-30), worry (PSWQ total score), and meta-worry (frequency subscale of the MWQ), while a latent "symptoms" variable was constructed using three indicators (total scores of GAD-7, BAI, and PHQ-9). We chose to model symptoms as a latent variable consisting of both anxiety and depression symptoms as both are common in individuals with GAD (e.g., Sunderland, Mewton, Slade & Baillie, 2010).

RESULTS

Correlational analyses

Descriptive statistics and bivariate correlations between the variables are presented in Table 1. Anxiety symptoms (from the GAD-7 and BAI) and depression symptoms were significantly and positively intercorrelated with moderate strength. Furthermore, symptom domains showed a significant and moderate positive correlation with worry, meta-worry, and negative metacognitive beliefs, and no significant correlation with positive metacognitive beliefs. Of note was that negative

Table 1. *Descriptive statistics and bivariate inter-correlations*

	Mean (*SD*)	2.	3.	4.	5.	6.	7.
1. GAD-7	14.74 (3.33)	0.588*	0.528*	0.396*	0.471*	0.080	0.423*
2. PHQ-9	17.04 (5.69)		0.540*	0.344*	0.422*	0.077	0.401*
3. BAI	28.05 (12.60)			0.326*	0.541*	0.042	0.439*
4. Worry	64.08 (10.32)				0.611*	0.179*	0.732*
5. Meta-worry	17.52 (5.20)					0.089	0.756*
6. PMB	10.58 (3.97)						0.161*
7. NMB	17.18 (4.33)						

Note: *$p < 0.01$, SD = standard deviation, GAD-7 = generalized anxiety symptoms, PHQ-9 = depression symptoms, BAI = physical and cognitive anxiety symptoms, PMB = positive metacognitive beliefs, NMB = negative metacognitive beliefs.

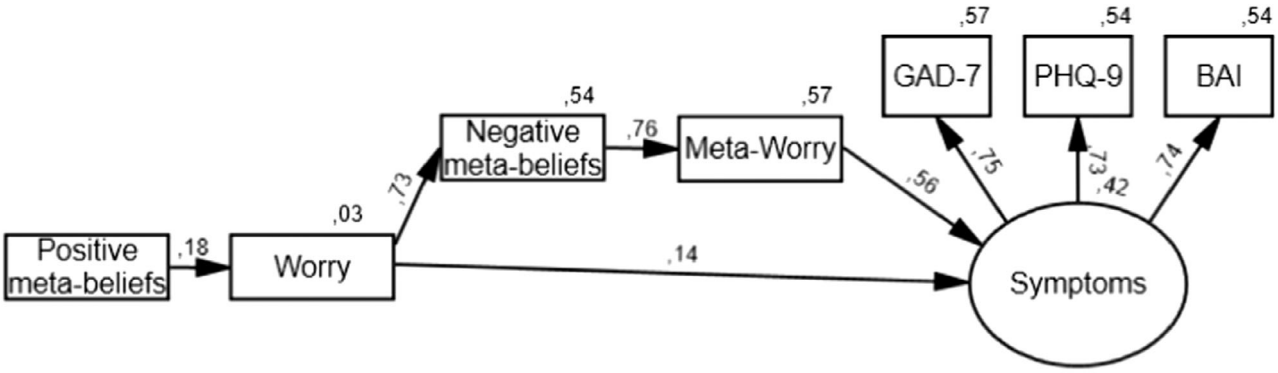

Fig. 1. Standardized beta coefficients of the path analysis of positive metacognitive beliefs, worry, negative metacognitive beliefs, meta-worry, and symptoms (generalized anxiety, depression, and physical and cognitive anxiety symptoms).

metacognitive beliefs were significantly and strongly correlated to both worry and meta-worry.

Path analyses

We tested several models with path analyses to evaluate the metacognitive model of GAD. The first model (Fig. 1) was specified in line with metacognitive theory and the model fit was good $\chi^2(13) = 28.589$, $p = 0.007$, CFI = 0.98, TLI = 0.97, RMSEA = 0.06, SRMR = 0.03. All paths were significant and 42% of the variance in symptoms was explained. In a similar model but where symptoms were specified as an observed variable consisting of the GAD-7 total score, the model fit was also very good: $\chi^2(5) = 7.754$, $p = 0.170$, CFI = 1.00, TLI = 0.99, RMSEA = 0.04, SRMR = 0.02. All paths were significant and 23% of the variance in anxiety was explained.

As negative metacognitive beliefs showed significant and strong correlations with worry and meta-worry, a second version of the model presented in Fig. 1 where negative metacognitive beliefs were excluded was tested to avoid artificial good model fit due to collinearity. In this model, worry was directly connected to meta-worry, but all other paths remained the same. The fit of the second model was also good $\chi^2(8) = 18.339$, $p = 0.019$, CFI = 0.98, TLI = 0.97, RMSEA = 0.06, SRMR = 0.02. All paths were significant, and the model explained 43% of the variance in symptoms.

With the aim to evaluate the robustness of our findings, we specified a model including the same variables and number of paths but that were inconsistent with the metacognitive model of GAD. In this model, meta-worry led to negative metacognitive beliefs, which led to positive metacognitive beliefs. Positive metacognitive beliefs led to symptoms and activated worrying which also led to symptoms. For this alternative model, the model fit was poor: $\chi^2(13) = 321.736$, $p < 0.001$, CFI = 0.66, TLI = 0.46, RMSEA = 0.28, SRMR = 0.27. This finding in comparison with the model fit of the model consistent with the metacognitive model of GAD indicates that the suggested ordering of the relevant variables is of importance and thus bring further support for the validity of the metacognitive model of GAD.

DISCUSSION

The aim of the current study was to evaluate the fit of a theoretically consistent metacognitive model of GAD in an analogue GAD sample and is to the authors' knowledge the first of its kind.

Basic correlations indicated positive and significant associations of moderate strength between symptom domains. Worry, meta-worry, and negative metacognitive beliefs were significantly and positively correlated with each other. Positive metacognitive beliefs positively and significantly correlated with worry but were not significantly correlated with the other variables. In evaluating the hypothesized model using path analysis, we found that positive metacognitive beliefs significantly contributed to worry, that worry significantly contributed to symptoms and negative metacognitive beliefs, and that negative metacognitive beliefs significantly contributed to meta-worry which further contributed significantly to symptoms. It should be noted that positive metacognitive beliefs accounted for only a small amount of variance in worry. Nonetheless, the model fit was good, and 42% of the variance in the latent symptom variable, consisting of two observed variables of anxiety symptoms and one observed variable of depression symptoms, were accounted for. In a secondary model evaluation, we found a good model fit when specifying symptoms as an observed variable indicated by the GAD-7 total score. In this model, all paths were significant but the variance explained was reduced to 23% which might be explained by the fact that the GAD-7 was used to select eligible participants for the current study which likely resulted in restricted variance on the scale in this sample. We further observed unique contributions to symptoms from worry and meta-worry in both the models, and that meta-worry contributed more to symptoms than worry. These observations are all in line with the metacognitive model of GAD (Wells, 1995) and were maintained in a second model that excluded negative metacognitive beliefs to account for the expected statistical overlap between negative metacognitive beliefs and worry domains.

With an aim to further evaluate the validity of the metacognitive model of GAD, an alternative model not consistent with metacognitive theory but that included the same variables and number of paths as the primary model was evaluated. In contrast to the theory consistent model, the alternative model had a poor fit to the data, a finding that brought some further support for the validity of the theoretically consistent model.

Consistent with metacognitive theory, these findings indicate that worry and meta-worry are central factors that maintain

symptoms in individuals with elevated generalized anxiety, and that positive and negative metacognitive beliefs contribute to them. We observed statistical overlap between negative metacognitive beliefs and worry/meta-worry, but this finding is not surprising given that the two forms of worry are considered state-variables and the more proximal cause of symptoms but influenced by underlying trait-variables (i.e., metacognitions). The clinical implications are that treatment should aim to reduce meta-worry and worry, and that modifying metacognitions could be one way to impact on these factors. Furthermore, meta-worry seems to be more closely related to symptoms compared to worry and may therefore be the more important target for treatment.

In line with metacognitive theory and these findings, there are several studies showing that metacognitive therapy (Wells, 2009) specifically designed to reduce meta-worry and worry through metacognitive change is a highly effective treatment of GAD and its associated symptoms such as depression symptoms (Normann & Morina, 2018). According to one study, metacognitive therapy is more effective for GAD than cognitive-behavioral therapy which is currently considered the gold-standard treatment (Nordahl, Borkovec, Hagen *et al*., 2018) even at nine-year follow up (Solem, Wells, Kennair, Nordahl & Hjemdal, 2021). Metacognitive therapy's superior effect for GAD pathology may be a result of its primary emphasis on meta-worry and corresponding negative metacognitive beliefs in this disorder which is also considered a transdiagnostic mechanism of distress (Wells, 2009).

This study has several limitations that must be acknowledged. Due to the cross-sectional nature of our study, it is important to acknowledge that several models using the same variables and number of paths could provide equally good statistical fit. We did however evaluate the model fit of an alternative model inconsistent with metacognitive theory and obtained a poor model fit, a finding that bring support for the validity of the theory-consistent model. Nonetheless, it is a limitation that we did not include a model comparison with competing variables. However, the model evaluated here is pre-specified by metacognitive theory and it could therefore be that the model fit will be poor. Furthermore, causal inferences cannot be made due to the design of the study, and we used an analogue sample based on the GAD-7 rather than a diagnosed sample. Our study and hypotheses were not preregistered or submitted to a registry before conducting the data collection. A substantial part of our participants were female. Thus, these findings may not generalize to other populations including patients with GAD. Further research should use samples consisting of diagnosed patients and a longitudinal design in testing the model. However, we were able to test the goodness of fit of a theoretically consistent metacognitive model of GAD in a sample of individuals with elevated generalized anxiety symptoms using cross-sectional data and found support for a good statistical fit and the suggested relationships, and in addition that a substantial part of the variance in symptoms (anxiety and depression) was accounted for.

In conclusion, our study brings further support to the metacognitive model of GAD and show that worry and meta-worry both contribute to symptoms in individuals with elevated anxiety of which meta-worry was the most influential. Furthermore, both types of worry were related to preceding metacognitions. Targeting worry, meta-worry, and underlying metacognitions will likely influence anxiety and depression symptoms in individuals with GAD, consistent with metacognitive theory and evidence from treatment studies.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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