Randomized control trial investigating the efficacy of a computer-based intolerance of uncertainty intervention

Mary E. Oglesby [a], Nicholas P. Allan [b], Norman B. Schmidt [a, *]

[a] Florida State University, USA
[b] Ohio University, USA

A B S T R A C T

Intolerance of uncertainty (IU) is an important transdiagnostic variable within various anxiety and mood disorders. Theory suggests that individuals high in IU interpret ambiguous information in a more threatening manner. A parallel line of research has shown that interpretive biases can be modified through cognitive training and previous research aimed at modifying negative interpretations through Cognitive Bias Modification (CBM-I) has yielded promising results. Despite these findings, no research to date has examined the efficacy of an IU-focused CBM-I paradigm. The current study investigated the impact of a brief IU-focused CBM-I on reductions in IU. Participants selected for a high IU interpretation bias (IU-IB) were randomly assigned to an active (IU CBM-I) or control CBM-I condition. Results indicated that our active IU CBM-I was associated with significant changes in IU-IB from pre-to-post intervention as well as with significant reductions in IU at post-intervention and month-one follow-up. Findings also found that the IU CBM-I led to reductions in IU self-report via the hypothesized mechanism. This study is the first to provide evidence that a CBM-I focused on IU is effective in reducing IU-IB and IU across time and suggest that IU CBM-I paradigms may be a novel prevention/intervention treatment for anxiety.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

According to recent epidemiological studies and research from the National Institutes of Mental Health (NIMH), anxiety disorders are among the most commonly occurring class of mental disorders in the United States (Kessler, Ruscio, Shear, & Wittchen, 2009, pp. 21–35; NIMH, 2016). Specifically, research estimates the lifetime prevalence of anxiety disorders to be approximately 28.8% among U.S. adults (Kessler et al., 2009, pp. 21–35; NIMH, 2016). In addition to their prevalence, anxiety disorders are associated with a high societal burden and an array of adverse life events (e.g., reduced education, marital instability, low financial status; Kessler et al., 2009, pp. 21–35). Given the prevalence and societal/individual burden associated with anxiety disorders, identifying malleable factors that contribute to the development and maintenance of these disorders is vital. Specifically, identifying vulnerability factors that may put an individual at risk for the development of an anxiety disorder and then attempting to mitigate this vulnerability within a prevention framework may have tremendous benefit.

One vulnerability factor that meets these criteria is intolerance of uncertainty (IU). IU is traditionally defined as a "dispositional characteristic that reflects a set of negative beliefs about uncertainty and its implications" (Carleton, 2016b; Dugas & Robichaud, 2007). Recent work has expanded this definition of IU, underscoring fear of the unknown as the core element of IU. Fear of the unknown (FOTU) is defined as "an individual's propensity to experience fear caused by a perceived absence of information at any point of processing or consciousness" (Carleton, 2016a). FOTU is hypothesized to be influenced by both individual predispositions (e.g., temperament) and learning. In accordance with this new conceptualization, IU is defined as "an individual's dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty" (Carleton, 2016b).

Within a recent review, Carleton (2016a) provocatively argued FOTU as *the* fundamental fear underlying anxiety and neuroticism. Carleton (2016a) suggested that many other fears (e.g., anxiety sensitivity) can be logically reduced to FOTU and cited research across multiple psychological and biological disciplines (e.g.,

* Corresponding author. Department of Psychology, Florida State University, 1107 W. Call St., Tallahassee, FL 32306, USA.
  E-mail address: schmidt@psy.fsu.edu (N.B. Schmidt).

emotion, development, attachment, neurobiological) demonstrating that unknowns are inherently appraised as aversive and threatening in the absence of knowns associated with safety through learning (Ainsworth & Bell, 1970; Barlow, Ellard, Sauer-Zavala, Bullis, & Carl, 2014; Bowlby, 1960; Carleton, 2016a, 2016b; Gray & McNaughton, 2003; Grupe & Nitschke, 2013; Scherer, 2013). Further, Carleton (2016a) posited that anxiety and fear seem to be dependent on the balance between knowns and unknowns and the learned and predicted consequences of both (see Carleton, 2016b for a full review of this literature).

Consistent with the hypothesized ubiquitous role of IU, the extant literature suggests that IU is an important vulnerability factor associated with a range of psychological disorders (e.g., substance use, depression, and personality disorder symptoms; see Carleton, 2016b for a full review). IU has most notably been associated with various anxiety-related conditions, with an abundance of recent work evidencing robust associations between IU and anxiety pathology (see Carleton, 2016b; Hong & Lee, 2015). Based on the extant literature, we know that IU is associated with elevated anxiety symptoms, but questions still remain as to how IU is involved in the development of anxiety. Cognitive models of anxiety offer potential pathways in which FOTU/IU may lead to elevated anxiety. FOTU is an implicit factor in several cognitive models of anxiety (e.g., Beck & Clark, 1997; Clark & Steer, 1996, pp. 75—96) which suggest a recursive relationship between stimuli from the environment, appraisals of these stimuli, prior learning/experience, and emotional responding. Within this model, unknowns are initially dealt with during early stages of processing (i.e., orienting phase; Clark & Steer, 1996, pp. 75—96). The orienting mode is preconscious and automatic and identifies new information (i.e., unknowns) as neutral, positive, or threatening by comparing the new information to knowns in memory. If the new information is deemed threatening, schemas designed to eliminate threat are activated. These motivational schemas involve rigid rules for eliminating threat and reducing unpredictability (i.e., eliminating unknowns), which in turn reduces aversiveness. Through learning, individuals may develop a tendency to interpret any uncertain information from the environment as negative, thereby activating motivational schemas designed to eliminate threat more often than needed.

This tendency to interpret ambiguous information from the environment as negative is often referred to as an interpretation bias (IB). Previous work has suggested that anxious individuals tend to interpret ambiguous information more negatively and threatening, suggesting the presence of a negative IB among individuals with anxiety (Amir, Beard, & Bower, 2005; Eysenck, Mogg, May, Richards, & Mathews, 1991). In line with these findings, the extant literature has consistently found support for the presence of a negative interpretation bias among individuals elevated in anxiety symptoms (see Hallion & Ruscio, 2011 for a review). Further, a substantial body of work, along with cognitive theories of anxiety (e.g., Beck & Clark, 1997), suggests that negative IBs play a causal role in the development of anxiety (see MacLeod & Mathews, 2012 for a review).

More recent work has found that individuals elevated in IU display a negative IB for uncertain information (Oglesby, Raines, Short, Capron, & Schmidt, 2016). In their study, Oglesby, Raines, et al. (2016) found individuals elevated in IU to rate ambiguous information more negatively in comparison to individuals low in IU. Specifically, participants were presented with ambiguous prime words (e.g., "Doctor called") and were asked to rate whether or not threatening (e.g., "I have a terrible disease") or neutral (e.g., "Appointment reminder") interpretations of the prime words were related or not. Results indicated that individuals high in IU (versus low in IU) were more likely to rate ambiguous prime words and

threatening/negative interpretations as related. Moreover, results from this study found that IU was not related to neutral interpretations of ambiguous information, therefore providing specificity for the relationship between elevated IU and negative interpretation of ambiguous information. These findings suggest that IU may be an important factor underlying the development of negative IBs for ambiguous information. In turn, negative IBs have been hypothesized to play a casual role in the development of anxiety symptoms (Beck & Clark, 1997; Mathews & MacLeod, 1994). Therefore, IU may be an important factor to target in prevention paradigms.

In line with this idea, a constellation of methods known as cognitive bias modification (CBM) have been developed to directly manipulate these cognitive biases. CBM for interpretation bias (CBM-I) is aimed at training individuals to interpret emotionally ambiguous information as negative or positive, therefore inducing a negative or positive bias. Within these paradigms, individuals are presented with ambiguous information and negative or neutral interpretations of this information via computer. Individuals are then asked to make a decision as to whether the ambiguous information and negative or neutral interpretations are related. Interpretation bias modification is geared to facilitate neutral/nonthreatening interpretations by providing feedback to the participants. Specifically, individuals are told they are incorrect if they endorse a threatening interpretation of ambiguous information; individuals are told they are correct if they endorse neutral/positive interpretations of the ambiguous information. A small number of studies have investigated the use of CBM-I paradigms within anxious and/or at-risk populations. Specifically, previous work has found CBM-I protocols to be effective in reducing symptoms of social anxiety and anxiety sensitivity (Beard & Amir, 2008; Capron & Schmidt, 2016; MacDonald, Koerner, & Antony, 2013; Steinman & Teachman, 2010). Within these paradigms, individuals in the active condition are trained to interpret construct relevant (e.g., anxiety sensitivity) ambiguous information (e.g., "Heart racing") in a neutral (e.g., "Exercise") or threatening (e.g., "I am having a heart attack") fashion.

It is theoretically plausible that FOTU and IU could be successfully targeted using CBM-I. No study to date has investigated whether an IU focused CBM-I would lead to reductions in IU. The primary aim of the current study was to determine the effectiveness of a novel, IU-focused CBM-I intervention. Given previous research finding baseline bias levels to interact with treatment effectiveness (Amir, Taylor, & Donohue, 2011; Klein et al., 2015; Salemink, van den Hout, & Kindt, 2009), we examined the efficacy of our intervention among individuals with an elevated IU-IB. This method was utilized at the suggestion of previous research and was employed to ensure that the final sample was appropriate for the IU-IB intervention. Specifically, we examined whether our IU CBM-I would successfully reduce IU across time among individuals who displayed an elevated IU-IB. We hypothesized that individuals in the active IU CBM-I condition (compared to the control condition) would display significant reductions in IU from pre-intervention to one month follow-up. Further, we predicted that change in interpretation bias would mediate the relationship between treatment condition (active versus control) and change in IU from pre-intervention to one month follow-up.

2. Methods

2.1. Participants

A total of 79 individuals completed the baseline appointment. Sample size was determined using G*Power and a medium to large effect size based on pilot data. Participants included undergraduate