

Intolerance of Uncertainty in Emotional Disorders: What Uncertainties Remain?

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Accepted Version

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### Abstract

The current paper presents a future research agenda for intolerance of uncertainty (IU), which is a transdiagnostic risk and maintaining factor for emotional disorders. In light of the accumulating interest and promising research on IU, it is timely to emphasize the theoretical and therapeutic significance of IU, as well as to highlight what remains unknown about IU across areas such as development, assessment, behavior, and relationships to emotional disorders. The present paper was designed to provide a synthesis of what is known and unknown about IU, and, in doing so, proposes broad and novel directions for future research to address the remaining uncertainties in the literature.

*Keywords:* intolerance of uncertainty, review, emotional disorders, transdiagnostic, disorder-specific, research agenda

## **1. Intolerance of Uncertainty in Emotional Disorders: What Uncertainties Remain?**

The current paper briefly reviews what is known about intolerance of uncertainty (IU) before highlighting what remains unknown. Due to rapidly increasing interest and research focus on IU, culminating in the current special issue, a review is both timely and necessary to set a future research agenda. This paper will review IU with respect to conceptual foundations and definitional issues, development, assessment, behavioral consequences, associations to threat and risk, other cognitive vulnerability factors, emotional disorders, as well as clinical applications. Within each of these domains, what is currently known will first be briefly reviewed followed by what remains unknown. The major contribution of the current paper is the description of future research avenues to address the known unknowns.

## **2. Conceptual Foundations of Intolerance of Uncertainty**

### **2.1 What is known?**

Models of psychopathology posit that uncertainty is a central feature in anxiety-related experience (Carleton, 2016) and the incapacity to endure unknowns appears to be a robust vulnerability factor associated with a range of psychological disorders (Grupe & Nitschke, 2013; Hong & Cheung, 2015). IU was originally defined as a broad construct that reflects “cognitive, emotional, and behavioral reactions to uncertainty in everyday life situations” (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994, p. 792). Freeston and colleagues (1994) speculated that people with IU may engage in worry to increase their sense of certainty and control when faced with ambiguity. The definition of IU evolved as research on IU shifted from an initial focus on generalized anxiety disorder (GAD) to other disorders. A revised and broader definition described IU as a predisposition to negatively perceive and respond to uncertain information and situations irrespective of its probability and outcomes (Ladouceur, Blais,

Freeston, & Dugas, 1998; Ladouceur, Gosselin, & Dugas, 2000). IU has also been conceptualized as a cognitive filter and as the excessive tendency to perceive and interpret negative events as unacceptable (Buhr & Dugas, 2002; Dugas, Gosselin, & Ladouceur, 2001). Individuals with high IU have the tendency to appraise ambiguity as threatening and experience heightened physiological arousal (Greco & Roger, 2001, 2003; Hock & Krohne, 2004). Furthermore, difficulties tolerating uncertainty may represent the tendency to believe that uncertainty in itself is distressing, unfair, and should be avoided (Dugas, Marchand, & Ladouceur, 2005; Dugas, Schwartz, & Francis, 2004). Current consensus describes IU as a “dispositional characteristic that reflects a set of negative beliefs about uncertainty and its implications” (Dugas & Robichaud, 2007), and represents an underlying fear of the unknown (Carleton, this issue). Carleton (2016, p. 31) recently proposed that IU represents a broad “incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information”.

Recent measurement research sheds light on the conceptual nature of IU, postulating that that IU comprises two dimensions; prospective IU (e.g., “*I always want to know what the future has in store for me*”) and inhibitory IU (e.g., “*When its time to act, uncertainty paralyzes me*”); Carleton, 2012; Carleton, Sharpe, & Asmundson, 2007; Hong & Cheung, 2015; McEvoy & Mahoney, 2011), sometimes referred to as desire for predictability and uncertainty paralysis, respectively (Berenbaum, Bredemeier, & Thompson, 2008; Birrell, Meares, Wilkinson, & Freeston, 2011). Both prospective and inhibitory IU are conceptualized as responses to uncertainty such that prospective IU represents cognitive appraisals of threat related to future uncertainty while inhibitory IU represents behavioral inhibition related to uncertainty (Carleton, 2012; Carleton, Norton, & Asmundson, 2007; Einstein, 2014).

IU has predominantly been conceptualized as a dispositional trait (Mahoney & McEvoy, 2012c); however, recent research suggests distinctions can be made between trait IU and disorder-specific IU (Thibodeau et al., 2015), sometimes referred to as situation-specific IU (Mahoney & McEvoy, 2012a, 2012c). Mahoney and McEvoy (2012c) were the first to conceptualize dimensions of the IU construct as disorder-specific based on early speculations that general experiences of uncertainty may differ across disorders and thus situations (Carleton, Gosselin, & Asmundson, 2010; Tolin, Abramowitz, Brigidi, & Foa, 2003). For example, uncertainty about catastrophic consequences of physical symptoms in panic disorder may differ from uncertainty about social evaluative cues in social anxiety disorder. Thus, the nature of uncertainty may differ between emotional disorders and IU may manifest differently based on contextual factors (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013; Carleton, 2016; Mahoney & McEvoy, 2012c). State IU can be considered as any instance of heightened negative affect in response to an uncertain stimulus, which may or may not co-occur with high trait IU or occur within the context of emotional disorders.

Mahoney and McEvoy (2012c) found that clinical participants reported higher disorder-specific IU relative to trait IU. Further, disorder-specific IU displayed a significant, but modest, association with depression and panic disorder symptoms beyond trait IU, but not for social anxiety, worry, or obsessive-compulsive disorder symptoms. Additionally, Mahoney and McEvoy (2012a) reported no significant differences between trait and disorder-specific IU amongst individuals with GAD, social anxiety disorder, and panic disorder. Thus, in line with normative descriptive research (e.g., Carleton et al., 2012), trait IU appeared comparable across disorders, supporting IU as a transdiagnostic construct.

Jensen and Heimberg (2015) extended this research by comparing diagnostically-congruent and -incongruent situations using a non-anxious control and two anxious groups. The socially anxious and obsessive-compulsive groups reported higher disorder-specific IU relative to trait or disorder-incongruent IU. Further, the socially anxious and control groups reported similar IU levels with regard to contamination concerns, while the obsessive-compulsive and control groups reported similar IU levels with regard to social interactions (Jensen & Heimberg, 2015). Thus, in line with recent theory (Carleton, 2016), context remains a critical component for considering uncertainty threatening, even for persons reporting high trait IU and anxiety symptoms.

Thibodeau and colleages (2015) also found disorder-specific IU was associated with unique variance in concordent symptom measures (e.g., disorder-specific IU in social situations predicted symptoms for social anxiety; disorder-specific IU in bodily sensations predicted symptoms for panic disorder). Relative to disorder-specific IU, trait IU explained more unique variance in GAD and obsessive-compulsive disorder, but less unique variance in social anxiety and panic disorder symptoms. Disorder-specific and trait IU accounted for similar proportions of unique variance in symptoms of health anxiety, depression, posttraumatic stress disorder, and specific phobia. Taken together, research suggests the generalizability of IU varies, with some disorders appearing more strongly associated with disorder-specific IU than trait IU (Mahoney & McEvoy, 2012a; Thibodeau et al., 2015). Moreover, expressions of disorder-specific and trait IU may be dependent on context, with intolerance increasing during exposure to disorder-congruent situations (Jensen & Heimberg, 2015; Mahoney & McEvoy, 2012a).

## 2.2 What is unknown?

Converging evidence highlights the possibility that IU comprises both prospective IU (desire for predictability) and inhibitory IU (uncertainty paralysis); nevertheless, future research should examine the theoretical nature of prospective and inhibitory IU, and the relationships between these two dimensions and other aspects of psychopathology, including affective, behavioral, cognitive, and interpersonal factors. For example, investigating whether prospective IU is more strongly related to approach behaviors designed to stave off future uncertainty and whether inhibitory IU is more strongly associated with avoidance behaviors to minimize exposure to uncertainty (Birrell et al., 2011).

The historical focus on trait IU has left the role of disorder-specific IU in emotional disorders less clear. Further research is needed to elucidate the nature of IU across disorders, each of which may involve varying degrees of trait and disorder-specific IU (Thibodeau et al., 2015). There is also a need to clarify the predictive nature of disorder-specific IU in emotional disorders. Disorder-specific and trait IU need to be delineated and integrated into theoretical models to provide a framework for this endeavor. Distinguishing between disorder-specific IU, trait IU, and symptoms may have important treatment implications, such as guiding targets for exposure or psychoeducation. Alternatively, for some or most disorders targeting trait IU may sufficiently generalize to disorder-specific IU, or vice versa, offering several potential avenues for reducing IU-related vulnerability for primary and comorbid emotional problems. Answers to these questions are currently unknown.

### 3. Development of Intolerance of Uncertainty

#### 3.1 What is known?

Associations between IU, other cognitive vulnerabilities, and anxiety-related psychopathology underscore the important theoretical and clinical implications of understanding IU development processes (Barlow, Bullis, Comer, & Ametaj, 2013). For example, elucidating pathways by which transdiagnostic processes lead to multiple diagnoses (i.e., multifinality) and different disorders (i.e., divergent trajectories) in different people may be critical for advancing theory, treatment, and prevention (Nolen-Hoeksema & Watkins, 2011). Indirect research and theory implicates the developmental importance of IU (Carleton, 2016); however, direct research into the development of IU is nascent and is reviewed here with a focus on potential processes and developmental origins. We consider IU as a proximal transdiagnostic risk factor akin to Nolen-Hoeksema and Watkin's (2011) proposed heuristic for developing transdiagnostic models, which incorporates distal factors, proximal factors, and linking mechanisms for psychopathology.

Distal risk factors may include early family contexts characterized by over-protective and controlling parenting. These parenting styles may decrease children's perceived control and self-efficacy, resulting in maladaptive cognitive strategies, negative perceptions of uncertainty, worry, and anxiety (Buhr & Dugas, 2006; Chorpita & Barlow, 1998). Zlomke and Young (2009) found participants who reported that their parents displayed adverse behaviors (i.e., anxious rearing and rejection) had significantly higher IU. Importantly, these researchers found that the relationship between anxious parenting and both anxiety and worry symptoms was mediated by IU. Dugas, Laugensen, and Bukowski (2012) conducted longitudinal research investigating the temporal relationship between IU and worry during adolescence, providing evidence that changes in IU



partially mediate change in worry and vice-versa. Accordingly, Dugas and colleagues (2012) suggested that worry and IU have a reciprocal relationship over time, with adolescent IU potentiating worry through threatening appraisals of uncertainty and maladaptive behaviors similarly to adults (Bredemeier & Berenbaum, 2008; Gosselin et al., 2008). These researchers observed that transition periods at the start and finish of secondary school were associated with the highest levels of IU, and they suggested that multiple changes during adolescence (e.g., emotional, social, academic; Steinberg, 2005) may have a cumulative effect of increasing IU.

Recent theoretical models (see Grupe & Nitschke, 2013; Wever, Smeets, & Sternheim, 2015) implicate several neural structures that may be impacted by, and underlie the expression of, IU. The neurologically-based models are based on functional magnetic resonance imaging evidence that has implicated the insula, amygdala, anterior cingulate cortex, orbitofrontal cortex, ventromedial prefrontal cortex, dorsolateral prefrontal cortex, and posterior frontomedian cortex as related to IU (Krain et al., 2006; Motzkin, Philippi, Wolf, Baskaya, & Koenigs, 2014; Sarinopoulos et al., 2009; Schienle, Köchel, Ebner, Reishofer, & Schäfer, 2010; Simmons, Matthews, Paulus, & Stein, 2008; Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012). Hyperactivation of these brain regions appears to be associated with maladaptive cognitive and behavioral processes, including hypervigilance for uncertain or threatening stimuli (Wever et al., 2015). Associations between IU and hypervigilance have also been supported by information processing studies indicating a cognitive bias (Fergus, Bardeen, & Wu, 2013; Fergus & Carleton, this issue). Similarly, uncertainty appears related to increases in heart rate variability (Thayer et al., 2012), implicating broad influence throughout the attentional networks and autonomic nervous system.

### 3.2 What is unknown?

There is a paucity of research on IU during childhood and adolescence; such research is critical. Different neurodevelopmental stages contribute to differences in processing uncertainty, which limits generalizability from adult studies to child populations (Krain et al., 2006). Extending research by Wright, Adams Lebell, and Carleton (this issue), future research should examine associations between IU and a range of emotional disorders to inform the transdiagnostic nature of IU in child and adolescent populations. Future research using prospective and longitudinal designs are needed. Moderators may shape the effects of trait IU into particular symptoms and disorder-specific IU, helping to explain how this vulnerability results in divergent trajectories or multifinality (Nolen-Hoeksema & Watkins, 2011). Such moderation hypotheses accord with the assertion made by Thibodeau and colleagues (2015, p. 55) that disorder-specific IU may represent a “theoretically proximal and explicit causal intermediary” between trait IU and disorder symptoms. Trait IU may shape disorder-specific IU through learning, operant conditioning, and modelling, which would shape cognitive and behavioral responses to situational stressors and consequences. A comprehensive review of the interplay between these factors is beyond the scope of this review, but further research examining these relationships is required.

Carleton and colleagues (2012) suggested that rather than investigating discrete causal factors, researchers should explore a range of environmental, genetic, or biological variables that may shape IU. Identifying neural structures related to IU may explain whether IU functions as a shared or specific vulnerability factor (Simmons et al., 2008; Wever et al., 2015). Researchers have yet to explore potential links between IU and congenital biological abnormalities; as such, future researchers and theorists should consider the potential influence of genetically based

dispositions that may confer risk for IU. Future researchers should strive to understand the connections between genetic, neural, and cognitive correlates, all of which may facilitate IU and psychopathology (Sanislow et al., 2010). Advancing our understanding of the neurobiological, genetic, and environmental origins of IU is important for advancing our understanding of multifinality and divergent disorder-specific trajectories, as well as preventative and therapeutic interventions (Mahoney & McEvoy, 2012b; Simmons et al., 2008; Wever et al., 2015).

#### **4. Assessment of Intolerance of Uncertainty**

##### **4.1 What is known?**

There are several self-report measures designed to assess IU; however, the specific content has often been revisited over the past two decades of IU theory development. The 27-item IU Scale (IUS) was the first measure developed to assess IU and responses to uncertain situations (Freeston et al., 1994). Psychometric evaluations demonstrate excellent internal consistency, test-retest reliability, and construct validity (Freeston et al., 1994); nevertheless, factor analytic evidence prior to 2007 suggested the IUS had an unstable, complex factor structure with potentially redundant items (Carleton, Norton, et al., 2007). For example, consistent with its original intent, the IUS includes items that specifically relate to GAD and worry, which may impact transdiagnostic applications (Gentes & Ruscio, 2011). Complications with the IUS factor structure coupled with suggestions that item removal would be unlikely to affect scale reliability (Norton, 2005) led to the development of a 12-item short form (i.e., IU Scale, Short Form; IUS-12; Carleton, Norton, et al., 2007). The IUS-12 comprised two factors, relabeled as *prospective IU* and *inhibitory IU* by McEvoy and Mahoney (2011). The IUS-12 has strong psychometric properties and is a viable transdiagnostic assessment tool for trait IU (Khawaja & Yu, 2010).

Subsequent research with the full IUS (Sexton & Dugas, 2009) and a very large sample demonstrated a reliable two factor structure (i.e., *uncertainty is unfair and spoils everything; uncertainty has negative behavioral and self-referent implications*), with the items for each mapping onto the IUS-12 factors (Carleton, Norton, et al., 2007; McEvoy & Mahoney, 2011). The IUS and IUS-12 overlap such that both are considered defensible and generally comparable tools for assessing IU (Khawaja & Yu, 2010); however, that same conceptual overlap in assessing general reactions to uncertainty or “trait” IU has led some researchers to posit that potential biases might arise when examining IU and emotional disorders, such as an inflated association between IU and GAD relative to other disorders (Gosselin et al., 2008). In response to such concerns, the 45-item IU Inventory (IUI) was developed (Carleton, Gosselin, et al., 2010; Gosselin et al., 2008). The IUI comprises two distinct parts and, accordingly, distinguishes between trait IU (Part A) and six associated behavioral and cognitive expressions (i.e., avoidance, doubt, overestimation, worry, control, reassurance; Part B). Psychometric evidence indicates the IUI has good reliability, temporal stability, and convergent and incremental validity (Carleton, Gosselin, et al., 2010; Gosselin et al., 2008).

Comer et al. (2009) revised the IUS items to ensure comprehensibility for children, resulting in the first validated measure of IU for children, the Intolerance of Uncertainty Scale for Children (IUSC). Preliminary psychometric evidence for the IUSC is promising (Comer et al., 2009). Another measure for use with children is the unpublished 12-item IU Scale-Revised (IUS-R; Walker, Birrell, Rogers, Leekam, & Freeston, 2010) based upon the IUS-12 (Carleton, Norton, et al., 2007). Research exploring IU with children is increasing (Comer et al., 2009; Fialko, Bolton, & Perrin, 2012; Kertz & Woodruff-Borden, 2013); however, the use of different measures limits direct comparisons between studies.

Theoretical distinctions between trait and disorder-specific IU prompted the development of the IU Scale-Situation-Specific Version (IUS-SS; Mahoney & McEvoy, 2012c). The IUS-SS is an adapted version of the IUS-12. Respondents describe a personally distressing, regularly occurring, and specific situation within one of four disorder-specific domains (social evaluative, intrusive thoughts/repetitive behaviors, worry, panic) before completing the IUS-12 items referencing the specific situation. Psychometric evidence demonstrates a unitary factor structure, good reliability, and convergent and discriminant validity. To extend the scope of other measures by focusing IU within discrete symptom categories, the 24-item Disorder-Specific IU Scale (DSIU) was designed (Thibodeau et al., 2015). The DSIU comprises eight subscales assessing IU in the context of various disorder symptoms including GAD, obsessive-compulsive disorder, social anxiety, health anxiety, panic disorder, specific phobia, posttraumatic stress disorder, and depressive disorder. Psychometric research indicates high reliability, convergent and criterion validity, but research is required to assess the temporal stability and clinical validity of the DSIU (Thibodeau et al., 2015).

#### **4.2 What is unknown?**

Psychometric evaluations of the IUI and IUSC are limited and further testing is required within a broader array of adult and child clinical populations, respectively. All measures of IU require further validation across ethnically diverse samples. Different operational definitions underlie the development of each measure (Fergus, 2013). For example, the IUS-12 and the IUI Part A assess responses to uncertainty and the tendency to consider uncertainty intolerable, respectively. Thus, when making decisions about which self-report measures to use researchers need to consider the distinct item content of each measure (Fergus, 2013) and provide an overall theoretical framework to clearly articulate how these aspects of IU relate to each other and to

other constructs. Future treatment studies also need to investigate whether existing self-report measures are able to effectively guide case formulations and treatment plans to improve outcomes for individuals with emotional disorders.

The proliferation of and focus on self-report measures has advanced our understanding of IU; however, exclusive reliance on self-report and often cross-sectional methods are also important limitations of existing research (Jacoby, Abramowitz, Buck, & Fabricant, 2014). Self-report data may be vulnerable to subjective response biases and shared method variance, which can inflate associations between variables. Cross-sectional research can provide information about the associations between theoretically related variables, but precludes the ability to draw causal conclusions. Accordingly, broad theoretical and applied progress for understanding IU will require valid and reliable multimodal assessments (Carleton, 2012, 2016; Einstein, 2014).

## **5. Insights into Intolerance of Uncertainty from Behavior**

### **5.1 What is known?**

Current research suggests that IU is characterized by cognitive, affective, and behavioral facets, and may have a broad influence on emotional disorders (Buhr & Dugas, 2002; Carleton, 2016; Freeston et al., 1994; Thibodeau, Carleton, Gómez-Pérez, & Asmundson, 2013). Researchers have experimentally induced or manipulated uncertainty and examined the correlates of self-report IU and responses to uncertain situations (Jacoby, Abramowitz, Reuman, & Blakey, this issue). The manipulations have included tasks such as overt behavioral assessments, a typing task, bead selection tasks, and a cold pressor task. The results have indicated people with higher IU 1) prefer immediately available rewards, even when they are less probable or less valuable (Luhmann, Ishida, & Hajcak, 2011); 2) are less confident about high risk decisions, but also less likely to change their decisions despite receiving new information

(Jensen, Kind, Morrison, & Heimberg, 2014); 3) are more likely to seek additional information to increase certainty in nonclinical samples (Jacoby et al., 2014; Jacoby, Abramowitz, Reuman, & Blakey, this issue; Ladouceur, Talbot, & Dugas, 1997; Rosen & Knäuper, 2009), though not consistently in clinical samples (Sternheim, Startup, & Schmidt, 2011); 4) are more likely to increase certainty by behaving, reacting, or deciding more slowly in clinical (Jacoby et al., 2014) and nonclinical samples (Jacoby et al., 2014; Jacoby et al., this issue; Thibodeau et al., 2013); and 5) are more likely to be distressed by uncertainty in clinical (Jacoby et al., 2014) and nonclinical samples (Jacoby et al., this issue). Taken together, these experimental results suggest that manipulating uncertainty may adversely impact behaviors and decision-making, even with relatively low levels of perceived threat. In addition, Jacoby and colleagues (2014) suggest the beads task could be modified to maximize external validity by focusing on specific idiosyncratic concerns of participants.

## **5.2 What is unknown?**

There is a relative paucity of research exploring the relationship between self-reported IU on behavior and decision-making. A multi-modal approach will help researchers and clinicians to better assess the latent IU construct and its consequences. To advance our understanding of the associations between the latent IU construct and a broad range of behaviors, researchers should investigate behaviors characterized by higher-order processes (e.g., probability-based decision-making) as well as common daily behaviors (e.g., public speaking). Researchers should address whether behaviors are driven by uncertainty itself or by the emotional consequences associated with uncertainty (Luhmann et al., 2011), as well as understanding the compounding influence of anticipated reinforcers (e.g., threat, reward). Moreover, a variety of experimental studies should be designed to elucidate whether uncertainty and the latent IU construct are associated with

explicit behavioral responses (e.g., impairment), perceptions of distress, cognitive consequences (Jacoby et al., this issue), or all three.

Researchers could manipulate trait IU, disorder-specific IU, probability, and threat across disorder-congruent and -incongruent contexts and explore the interactive effects therein on emotional symptoms and behavior. For example, increasing uncertainty in situations pertinent to social anxiety (e.g., fear of being evaluated, performance anxiety), obsessive-compulsive concerns (e.g., contamination concerns, inflated perceptions of responsibility), a specific phobia, or health concerns (e.g., Rosen & Knäuper, 2009), while investigating emotional and behavioral correlates, including decision-making. Within different disorders, reduced decision-making confidence in varying domains (e.g., social scenarios) may exacerbate disorder-specific concerns contributing to anxiety or depressive symptoms (e.g., fear of negative evaluation for social anxiety disorder; Jensen et al., 2014). Research involving decision-making confidence, behavior, and IU would also provide insights into the content specificity or disorder-specific aspects of IU. Methodologically varied approaches with diverse samples will enhance our understanding of the trait and state expressions of IU and psychopathology (Jacoby et al., 2014). Future researchers should examine how the prospective and inhibitory IU dimensions are differentially related to behavior across more general and disorder-specific contexts.

## **6. Intolerance of Uncertainty, Threat, and Risk**

### **6.1 What is known?**

According to Krohne's (1989) coping theory, ambiguous or unpredictable situations may be viewed as threatening and difficulty tolerating uncertainty may result in an excessive tendency to search for threat cues. Vigilance to uncertainty and overestimating the probability and cost of threat appears to be involved in the development and perpetuation of fear and anxiety and



engagement in safety behaviors (Mathews & MacLeod, 1994, 2002; Reuman, Jacoby, Fabricant, Herring, & Abramowitz, 2015). A link between high IU and the tendency to overestimate the likelihood of negative events has been documented (Dugas, Buhr, & Ladouceur, 2004; Dugas et al., 2005; Koerner & Dugas, 2008; Ladouceur et al., 1997), with uncertainty itself perceived as threatening. Attending to the uncertain aspects of a situation has been conceptualized as uncertainty-based reasoning (Reuman et al., 2015). Relatedly, IU may be sufficiently threatening that it leads to worry (Bredemeier & Berenbaum, 2008; Dugas, Buhr, et al., 2004). Scenarios characterized by explicit uncertainty and high threat, instead of implicit or low threat, produced higher anxiety and urges to engage in safety behaviors; moreover, a low threat situation may be perceived as highly threatening when uncertainty is explicit (Reuman et al., 2015).

## **6.2 What is unknown?**

Research examining the interaction between uncertainty and threat in anxiety and emotion is scant and more work is needed to clarify the associations. Researchers should design *in vivo* manipulations of threat, explicit uncertainty, and implicit uncertainty. Examining threat through vignettes or *in vivo* situations across a spectrum of symptoms may inform relationships between perceptions of threat and risk in disorder-specific contexts. Such designs may pose ethical challenges for researchers who will benefit most from ecologically valid scenarios; in any case, experimental and longitudinal designs are required to understand causal relationships between IU and estimations of probabilities and costs. In addition, evidence from multiple clinical samples will inform the generalizability across anxiety and depressive disorders.

## **7. Intolerance of Uncertainty as a Cognitive Vulnerability Process**

### **7.1 What is known?**

Recent research suggests that many vulnerability factors are associated with multiple disorders and are thus transdiagnostic (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Harvey, Watkins, Mansell, & Shafran, 2004; Naragon-Gainey, 2010; Starcevic & Berle, 2006). Theory and empirical evidence has also supported a hierarchical conceptualization of emotional disorders, such that the influence of higher-order distal traits on disorder symptoms is mediated by intermediate cognitive factors (Norton & Mehta, 2007; Norton, Sexton, Walker, & Norton, 2005; Paulus, Talkovsky, Heggeness, & Norton, 2015; Sexton, Norton, Walker, & Norton, 2003; van der Heiden et al., 2010). Researchers have focused on two distal temperament factors, namely neuroticism and extraversion, and evidence for a relationship between neuroticism and psychopathology is strong (Barlow, 2002; Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014; Brown & Naragon-Gainey, 2013; Kotov, Gamez, Schmidt, & Watson, 2010; Watson, 2005). Neuroticism is closely related and largely overlapping with trait anxiety (Clark & Beck, 2010). Neuroticism could be referred to as reflecting a generalized biological vulnerability, although learned experiences are also likely to influence this vulnerability, as highlighted in Barlow's (2000, 2002) triple vulnerability model. IU may reflect a generalized psychological vulnerability that stems from unknowns and perceptions of absent agency over emotions and environment, all of which facilitate neuroticism (Carleton, 2016, this issue).

IU appears to be a transdiagnostic cognitive vulnerability factor (Carleton, 2016) associated with a host of other factors (e.g., anxiety sensitivity; ruminative style). Hong and Cheung (2015) suggested that several cognitive vulnerabilities may share a common core of IU and, therein, fearing the unknown. Indeed, IU mediates the relationship between neuroticism and

symptoms of worry, depression, social anxiety, and obsessive-compulsive disorder (Fergus & Wu, 2011; Hong, 2013; McEvoy & Mahoney, 2012; Norton & Mehta, 2007; Norton et al., 2005; Sexton et al., 2003; van der Heiden et al., 2010). Researchers have also evidenced that prospective and inhibitory IU partially mediate the link between neuroticism and emotional disorders (McEvoy & Mahoney, 2011).

## **7.2 What is unknown?**

The need remains to disentangle the trait and disorder-specific cognitive vulnerabilities and overlapping transdiagnostic factors in emotional disorders. Carleton (2016) has offered an overview of processes through which IU may influence psychopathology; however, substantial work remains to be done investigating the specific processes. Inconsistencies in the extant IU literature exploring those specific processes may have resulted from discrepancies in methodological and analytical procedures (Hong, 2013). Future research should continue to evaluate hierarchical models of psychopathology, including IU (Norton & Paulus, 2015; Watson, 2005), considering recent theoretical developments.

Norton and Paulus (2015) assert that hierarchical conceptualizations can aid in identifying transdiagnostic processes with incremental explanatory power beyond higher-order factors like neuroticism or negative affect. Using a meta-analytic approach, Hong and Cheung (2015) examined the overlap among a range of vulnerabilities and found a lack of support for symptom specificity. In line with this and to address limitations of prior studies, future research should include multiple vulnerabilities simultaneously to examine the unique and shared magnitude of associations with different disorder symptoms (Brown & Naragon-Gainey, 2013; Hong & Cheung, 2015; Norton & Mehta, 2007). Furthermore, researchers should investigate how IU relates to, interacts with, and predicts other potential maintaining vulnerabilities such as

metacognitive beliefs, perceived control, and behavioral avoidance with longitudinal designs. Such research would increase our understanding of the general and specific importance of IU for cognitive vulnerabilities and corresponding disorder symptoms. The resulting insights will help identify risk factors and advance understanding of the temporal precedence and the relative importance of IU and other constructs (Carleton, 2016; Mahoney & McEvoy, 2012c; Norton & Paulus, 2015; Treanor, Erisman, Salters-Pedneault, Roemer, & Orsillo, 2011).

## **8. Intolerance of Uncertainty as a Transdiagnostic Process**

### **8.1 What is known?**

IU was initially developed within the context of worry, a hallmark symptom of GAD, as outlined in the IU model (Dugas, Gagnon, Ladouceur, & Freeston, 1998; Freeston et al., 1994). IU was thought to distinguish persons with GAD from other heterogeneous anxiety disorders (Dugas et al., 2001; Dugas et al., 2004; Ladouceur et al., 1999); however, the assertion of broad specificity for GAD was challenged by accumulating cross-sectional and meta-analytic evidence highlighting the significance of IU to other symptom constructs and disorders (e.g., Carleton et al., 2012; Gentes & Ruscio, 2011; Hong & Cheung, 2015; McEvoy & Mahoney, 2011, 2012; Norton & Mehta, 2007; Starcevic & Berle, 2006). IU has been associated with symptoms of obsessive-compulsive disorder (Holaway, Heimberg, & Coles, 2006; Tolin et al., 2003), social anxiety disorder (Boelen & Reijntjes, 2009; Carleton, Collimore, & Asmundson, 2010), panic disorder with or without agoraphobia (Carleton, Fetzner, Hackl, & McEvoy, 2013; Fetzner, Horswill, Boelen, & Carleton, 2013), health anxiety (Boelen & Carleton, 2012; Fetzner et al., 2013; Wright et al., this issue), posttraumatic stress symptoms and disorder (Banducci, Bujarski, Bonn-Miller, Patel, & Connolly, this issue; Bardeen, Fergus, & Wu, 2013; Boelen, Reijntjes, & Smid, this issue; Fetzner et al., 2013; Oglesby, Boffa, Short, Raines, & Schmidt, this issue), and

depression (de Jong-Meyer, Beck, & Riede, 2009; Gentes & Ruscio, 2011). More recently, evidence suggests IU plays an important role in eating disorders (Konstantellou, Campbell, Eisler, Simic, & Treasure, 2011; Renjan, McEvoy, Handley, Fursland, & Byrne, this issue; Sternheim et al., 2011), autism spectrum disorders (Boulter, Freeston, South, & Rodgers, 2014), prolonged grief (Boelen, 2010; Boelen et al., this issue), hoarding behaviors (Oglesby et al., 2013; Wheaton, Abramowitz, Jacoby, Zwerling, & Rodriguez, 2016), adult separation anxiety (Boelen, Reijntjes, & Carleton, 2014), and anger-related emotions (Anderson, Deschênes, & Dugas, this issue; Fracalanza, Koerner, Deschênes, & Dugas, 2014). Not only is IU associated with multiple disorders, but trait and disorder-specific IU are correlated with escalating comorbidity (Dupuy & Ladouceur, 2008; McEvoy & Mahoney, 2012; Yook, Kim, Suh, & Lee, 2010). Moreover, many clinical features of disorders can be conceptualized as efforts to alleviate or avoid uncertainty (Krohne, 1989). Taken together, the overwhelming evidence supports IU as a transdiagnostic process linked to an array of disorders.

The prospective and inhibitory dimensions of IU have been differentially associated with emotional disorder symptoms (Carleton, Norton, et al., 2007; McEvoy & Mahoney, 2011). McEvoy and Mahoney (2011) found associations between prospective IU and symptoms of GAD and obsessive-compulsive disorder, while inhibitory IU was associated with symptoms of social anxiety, depression, and panic disorder, agoraphobia in a clinical sample. Their results are consistent with research linking inhibitory IU with social anxiety, depression (Carleton, Collimore, et al., 2010; Mahoney & McEvoy, 2012c), and panic disorder (Boelen et al., this issue), but inconsistent with an association between inhibitory IU and GAD and obsessive-compulsive disorder (Mahoney & McEvoy, 2012c). Furthermore, inhibitory IU has been associated with posttraumatic stress disorder (Boelen et al., this issue; Fetzner et al., 2013). The

results may indicate higher IU produces conflicting cognitive-motivational states. For example, prospective IU may promote approach strategies evident in some disorders, while inhibitory IU may promote avoidance behaviors (e.g., avoidance of situations that may induce panic in panic disorder). The recent conceptualization of these dimensions means relatively little research is available (e.g., Carleton, Collimore, et al., 2010; Carleton, Norton, et al., 2007; Mahoney & McEvoy, 2012c; McEvoy & Mahoney, 2011), and the available results have not been entirely consistent.

## **8.2 What is unknown?**

The original IU model comprehensively outlined the centrality of IU for anxiety symptoms (Dugas et al., 1998), but was designed within the context of GAD symptoms. Despite the success and longevity of the model, the mechanisms by which IU exerts influence on worry remain less clear (Bredemeier & Berenbaum, 2008). Different cognitive and behavioral constructs may be involved at different stages of worry (Meeten, Dash, Scarlet, & Davey, 2012; Thielsch, Andor, & Ehring, 2015); as such, prospective longitudinal designs appear necessary to understand how IU and other constructs initiate and perpetuate repetitive negative thinking and cyclical interrelationships with disorder symptoms (e.g., Oglesby et al., this issue; Thielsch et al., 2015).

The relative influence of IU across disorders also remains uncertain (Mahoney & McEvoy, 2012c). Anxiety appears inherently dependent upon uncertainty (Carleton, 2016; Grupe & Nitschke, 2013; Hong & Cheung, 2015); as such, most contemporary research has justifiably focused on anxiety disorders. Despite the current research indicating IU is transdiagnostic and phenomenologically concurrent with anxiety disorders, mood disorders, personality disorders, and normative processes, there is a relative paucity of research exploring the causal,

precipitating, maintaining, mediating, and moderating aspects of the relationships. Future research should clarify the relative significance of IU dimensions across disorders.

Accordingly, researchers should explore IU as contextualized within extant cognitive-behavioral models for all such disorders, normative processes, and transdiagnostic models (Carleton, 2012; Einstein, 2014; Mahoney & McEvoy, 2012c). The exploration should explicitly incorporate IU into existing theoretical and treatment models, while also facilitating novel theoretical frameworks and broader integrations with psychology (e.g., Brosschot, Verkuil, & Thayer, this issue; Carleton, 2016). Doing so would inform case formulation, treatment planning, and novel interventions targeting diagnosis-specific and transdiagnostic processes.

## **9. Intolerance of Uncertainty and Clinical Applications**

### **9.1 What is known?**

Theoretical progression in psychopathology research has been complemented by laudable developments in the treatments of emotional disorders. In line with this, maladaptive thoughts and behavioral processes have been considered valuable targets for intervention (Barlow, 2000). There has also been a shift in perspective from diagnosis-specific conceptualizations and treatment approaches to transdiagnostic models highlighting the substantial similarities (Barlow, Allen, & Choate, 2004; Barlow et al., 2014; Norton & Paulus, 2015). Relatedly, robust relationships between IU and psychopathology implicate IU as a potentially critical transdiagnostic treatment target.

Dugas and colleagues (Dugas et al., 2010; Dugas & Ladouceur, 2000; Dugas et al., 2003; Dugas & Robichaud, 2007) have developed a cognitive-behavioral intervention for GAD, targeting IU reductions by fostering less negative beliefs about uncertainty. The intervention has been supported by several randomized clinical trials with moderate to large effects (Dugas et al.,

2010; Dugas et al., 2003; Gosselin, Ladouceur, Morin, Dugas, & Baillargeon, 2006; Ladouceur, Dugas, et al., 2000; see Robichaud, 2013).

Research has also examined other cognitive-behavioral interventions that do not specifically target IU, but nonetheless have shown a reduction in IU and symptoms of social anxiety (Hewitt, Egan, & Rees, 2009; Mahoney & McEvoy, 2012b), health anxiety (Langlois & Ladouceur, 2004), anxiety and depressive disorders (Bomyea et al., 2015), delivered as individual and group transdiagnostic interventions (Boswell et al., 2013; Talkovsky & Norton, this issue). A randomized control trial for GAD compared the effectiveness of an IU-therapy, metacognitive therapy, and a delayed treatment control condition (van der Heiden, Muris, & van der Molen, 2012). Results indicated significant symptom reductions and clinically significant change in both therapy conditions; however, metacognitive therapy was superior across the range of outcome measures. Interestingly, metacognitive therapy was also associated with the largest reductions of IU, suggesting interventions from alternative theoretical frameworks may influence IU (McEvoy & Erceg-Hurn, this issue; van der Heiden et al., 2012).

Increasing evidence suggests that changes in IU may be driving changes in symptoms of multiple emotional disorders (i.e., transdiagnostic) and across different treatment protocols (i.e., transtherapy, e.g., McEvoy & Erceg-Hurn, this issue; Roemer & Orsillo, 2007; Treanor et al., 2011). Changes in IU have been uniquely linked to changes in repetitive negative thinking across all disorders and treatment programs even after controlling for trait negative affectivity (McEvoy & Erceg-Hurn, this issue). Those changes in IU were also associated with changes in GAD and social anxiety disorder symptoms, but not depression symptoms. Taken together, the results suggest that IU is a transdiagnostic change factor associated with changes in repetitive negative



thinking and symptoms across different disorders and treatment interventions (Boswell et al., 2013; McEvoy & Erceg-Hurn, this issue; Talkovsky & Norton, this issue).

Abramowitz and Arch (2014) made a compelling argument that exposure-driven cognitive-behavioral treatment for obsessive-compulsive disorder may benefit from strengthening inhibitory learning of nonthreatening associations (e.g., uncertainty is intolerable), such that uncertainty becomes increasingly acceptable as normal across contexts. Abramowitz and Arch (2014) suggest treatment should emphasize tolerating uncertainty through exposure, which may strengthen inhibitory associations. Others have argued that “in many ways, all therapies can be described as attempts to mitigate IU” (Carleton, 2012, p. 942); accordingly, future researchers should examine whether principles of IU exposure can be applied transdiagnostically and across treatment protocols to support broad symptom improvements.

## **9.2 What is unknown?**

There are many unknowns associated with IU treatment and emotional disorders. Extant cognitive-behavioral therapies can be readily modified to target fears related to IU and avoidance behaviors; however, research is needed to establish the efficacy of such treatments (Mahoney & McEvoy, 2012a). Currently IU is an implicit component within treatment protocols derived from alternative theoretical frameworks; nevertheless, research suggests that IU could also be more explicitly assessed and targeted. Evidence suggests cognitive-behavioral treatments decrease IU (Mahoney & McEvoy, 2012a), though some researchers have found evidence that directly targeting IU may be no more effective than indirectly targeting IU (van der Heiden et al., 2012). Accordingly, there is a need for more research evaluating and comparing interventions designed to directly target IU with interventions that are non-specific to IU. For a more complete understanding of change processes, Treanor (2011) recommended treatment mechanism research

grounded in specific theoretical models. More recently, Einstein (2014) proposed a transdiagnostic IU treatment model with several potential pathways for explicitly targeting different IU dimensions, all of which remains to be explored.

In the interim, the processes by which IU changes in therapy remain relatively unknown. Bomyea and colleagues (2015) found that over the course of treatment changes in IU significantly mediated changes in worry, which is an important step (Kazdin, 2007), but research is needed to understand the mechanisms of such change across different treatment interventions. Currently there are many different therapies and a thorough understanding of the most critical change mechanisms may contribute to a more parsimonious and efficient therapeutic approach. Specific (e.g., exposure) and non-specific therapeutic factors (e.g., therapist features, motivation to engage in treatment) need to be measured when evaluating treatment interventions so we can better understand the relative contributions to changes in IU.

The potential clinical utility of targeting disorder-specific IU should also be investigated. Disorder-specific IU predicts symptoms of a range of disorders (e.g., Thibodeau et al., 2015), suggesting treatment protocols may benefit from tailored modification of disorder-specific IU. For example, tolerating uncertainty about others' evaluations might improve social anxiety symptoms and relapse rates beyond reducing the perceived probability and cost of such evaluations. Thus there are questions remaining about whether clinicians should target trait IU, disorder-specific IU, or a combination of various proportions that may vary by disorder (Thibodeau et al., 2015).

Experimental and clinical research using behavioral methods to corroborate IU before, during, and after treatment would also be beneficial to assess clinical impacts more broadly (Boswell et al., 2013; McEvoy & Erceg-Hurn, this issue). Much of the available treatment

literature has been carried out by the same research team and replications are needed. Moreover, there still remains a predominant focus on GAD and future studies should investigate the impact of these interventions across a broader range of disorders.

### **10. Continuing the Search for Certainties**

IU is increasingly considered to be important to the development, perpetuation, and treatment of psychopathology. Basic IU research offers novel and exciting perspectives for understanding psychopathology. The current paper provides a broad IU research agenda with several methodological suggestions for exploring trait, disorder-specific, and transdiagnostic conceptualizations. The review also highlights the need to research normative responses, developmental origins, behaviors, decision-making, and cognitive vulnerabilities related to IU, while understanding relationships with threat and risk. In all cases, explicit integration of IU into theoretical and therapeutic models appears warranted. The increasing focus of research into uncertainty and IU has generated numerous avenues for exploring unknown territory in psychology; as such, future researchers should not fear the unknowns, but rather face them head on as we strive to address the uncertainties that remain.

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