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Intolerance of uncertainty and *DSM-5* PTSD symptoms: Associations among a treatment seeking veteran sample

Amanda M. Raines[a,b,*], Mary E. Oglesby[c], Jessica L. Walton[a,b,d], Gala True[a,b,e], C. Laurel Franklin[a,b,d]

[a] South Central Mental Illness Research, Education, and Clinical Center (MIRECC), 2400 Canal St., New Orleans, LA, 70119, USA
[b] Southeast Louisiana Veterans Health Care System, 2400 Canal St., New Orleans, LA, 70119, USA
[c] Department of Psychology, Florida State University, 1107 W. Call St., Tallahassee, FL, 32306, USA
[d] Department of Psychiatry and Behavioral Sciences, Tulane University School of Medicine, 1430 Tulane Ave., New Orleans, LA, 70112, USA
[e] Division of General Internal Medicine and Geriatrics, Department of Medicine, Tulane University School of Medicine, 1430 Tulane Ave., New Orleans, LA, 70112, USA

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ABSTRACT

Intolerance of uncertainty (IU), defined as an inability to tolerate the unpleasant response triggered by the observed absence of information, has received increased empirical attention in recent years. The contribution of this cognitive behavioral construct to the etiology and maintenance of various anxiety disorders has become increasingly recognized. However, the relationship between IU and other affective disorders, including post-traumatic stress disorder (PTSD), remains largely unexplored. The current study sought to examine the relationship between IU and overall PTSD symptom and cluster severity using an outpatient sample of veterans (N = 116) assessed using the *Diagnostic and Statistical Manual of Mental Disorders, Fifth edition (DSM-5)* PTSD symptom structure. Results revealed that IU was significantly associated with overall PTSD symptom severity, above and beyond relevant covariates. Further, IU was significantly associated with the PTSD avoidance and hyperarousal clusters. Prospective IU, rather than inhibitory IU, accounted for these unique associations. These findings add to a growing body of literature establishing IU as a transdiagnostic risk factor and point to the importance of future research on the role of IU in contributing to and/or maintaining PTSD symptoms.

1. Introduction

Posttraumatic stress disorder (PTSD) is a multifaceted clinical phenomenon characterized by an array of psychological symptoms that occur following exposure to one or more extreme stressors (American Psychiatric Association, 2013a). Although clinical expression varies, a diagnosis of PTSD requires the endorsement of symptoms across four distinct domains including: intrusion; avoidance; negative alterations in cognitions and mood; and arousal and reactivity (Friedman, 2013). PTSD has an estimated twelve-month prevalence rate of 3.5% (American Psychiatric Association, 2013a) and is more common among individuals who are at increased risk of traumatic exposure, including military personnel (Richardson, Frueh, & Acierno, 2010). Among these individuals, PTSD is associated with poor social and familial relationships, as well as lower educational and occupational success (Schnurr, Lunney, Bovin, & Marx, 2009).

Research has shown that the rates of trauma exposure far outweigh the prevalence rates of PTSD. Indeed, epidemiological studies suggest that around 90% of the population will experience a traumatic event at some point in their lives (Kilpatrick et al., 2013). Although many of these individuals experience a temporary adaptive stress response, only a small minority go on to develop PTSD (Kilpatrick et al., 2013). The noticeable discrepancy between the majority of trauma survivors who can successfully adjust post-trauma and the minority who develop PTSD, calls into question the nature of the relationship between the trauma itself and the subsequent development of posttraumatic symptoms. Hence, it is critical to identify and understand malleable factors that may lead to the development and maintenance of PTSD following trauma exposure.

One factor that may convey risk for PTSD is intolerance of uncertainty (IU). 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, 2016a, p. 31Carleton, 2016aCarleton, 2016a, p. 31). Initial research on IU focused on its relationship with worry and generalized anxiety (Koerner & Dugas,

* Corresponding author at: Southeast Louisiana Veterans Health Care System, 2400 Canal St., New Orleans, LA, 70119, USA.
E-mail address: amanda.raines@va.gov (A.M. Raines).

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2006). IU has since been found to be associated with a number of emotional disorders including depression (Yook, Kim, Suh, & Lee, 2010), hoarding (Oglesby et al., 2013), social anxiety (Boelen & Reijntjes, 2009), and panic (Carleton, Fetzner, Hackl, & McEvoy, 2013), among others. As such, it has recently been suggested that a fear of the unknown may be a requisite fear underlying anxiety and neuroticism more broadly (Carleton, 2016b).

As currently conceptualized, IU comprises two lower order dimensions: prospective IU and inhibitory IU (Carleton, Norton, & Asmundson, 2007). Prospective IU reflects anxious apprehension in anticipation of uncertainty (e.g., "One should always look ahead as to avoid surprises"), whereas inhibitory IU reflects inaction in the face of uncertainty (e.g., "When it is time to act, uncertainty paralyzes me"; Shihata, McEvoy, Mullan, & Carleton, 2016). Research indicates that the dimensions of IU are differentially related to various emotional disorders. For example, McEvoy and Mahoney (2011) found that prospective IU was uniquely associated with generalized anxiety disorder and obsessive-compulsive disorder, whereas inhibitory IU was distinctly related to depression, social anxiety disorder, and panic disorder.

Despite robust associations between IU and a number of anxiety and related conditions, researchers have only recently begun to systematically explore the relationship between IU and PTSD. Using a community based sample with heterogeneous trauma histories, Fetzner, Horswill, Boelen, and Carleton (2013) concurrently examined the relationship between IU and its dimensions and *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV)* PTSD symptom severity ratings divided into four criterion clusters (i.e., re-experiencing, avoidance, emotional numbing, and hyperarousal). The authors found IU, particularly inhibitory IU, to be significantly related to PTSD symptoms of avoidance, emotional numbing, and hyperarousal, but not re-experiencing. Oglesby, Gibby, Mathes, Short, and Schmidt (2017) extended these findings by exploring the four-factor relationship between IU and *DSM-IV* PTSD clusters within a clinical sample of trauma-exposed adults. Even after controlling for relevant psychological constructs, the authors found that overall IU was significantly related to avoidance, emotional numbing, and hyperarousal, but not re-experiencing clusters of PTSD.

Longitudinal investigations similarly suggest that IU conveys risk for PTSD. For example, Oglesby, Boffa, Short, Raines, and Schmidt (2016) prospectively examined the relationship between overall IU and PTSD symptoms within a sample of individuals with varying levels of exposure to a university campus shooting. Results revealed that even after controlling for relevant covariates, pre-trauma IU significantly predicted elevated levels of PTSD symptoms following the trauma. Moreover, Boelen, Reijntjes, and Smid (2016) prospectively found an association between IU, specifically prospective IU, and prolonged grief disorder, a related but separate construct from PTSD, among a sample of bereaved individuals.

Taken together, the results of these investigations support the notion that IU is a vulnerability factor for the development and maintenance of PTSD and related emotional problems. However, there are still several limitations with regard to the current literature. First, no studies to date have examined the associations between IU and PTSD since the release of the American Psychiatric Association's (APA) *DSM-5* (American Psychiatric Association, 2013a). As noted by the APA, *DSM-5* criteria for PTSD differ significantly from those in *DSM-IV-TR* (American Psychiatric Association, 2013b). In particular, Criterion A was revised to be more explicit with regard to how an individual experienced the traumatic event and Criterion A2, involving subjective responses of fear, helplessness, or horror was eliminated. Further, Criterion C (avoidance and numbing symptoms) was parceled into two distinct clusters: avoidance and negative alterations in cognitions and mood. The latter cluster, which retained most of the *DSM-IV* numbing symptoms, was expanded to include three new symptoms reflecting dysphoria. Finally, reckless or self-destructive behavior was added to the alterations in arousal and reactivity cluster (Criterion E). These changes, particularly the conceptual shift to include a broader array of trauma reactions, could have implications for how IU relates to overall PTSD symptom severity and clusters. Indeed, within *DSM-5* PTSD has moved beyond a narrow fear-based context to incorporate dysphoric and externalizing phenotypes (Friedman, 2013). These changes could impact the relationship between distress-based constructs such as IU and the *DSM-5* conceptualization of PTSD. However, research is needed to examine this notion.

Second, no prior research has examined these associations among veterans, a sample known to have increased risk of traumatic exposure and PTSD symptoms (Richardson et al., 2010). Indeed, past year prevalence rates of PTSD have been found to be as high as 27% among newly returning Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans seeking care within the Department of Veterans Affairs (VA; Harpaz-Rotem & Hoff, 2015). These rates are particularly concerning as it is well known, though not fully understood, that combat veterans do not fare as well in treatment as other traumatized groups (Bradley, Greene, Russ, Dutra, & Westen, 2005; Watts et al., 2013). Given the malleable nature of IU (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013), establishing a relationship between this cognitive behavioral construct and PTSD symptoms, particularly among veteran samples, could have important implications for improving treatment outcomes.

Considering these limitations, the purpose of the current study was to replicate and extend prior research examining the associations between IU and its dimensions and *DSM-5* PTSD symptom and cluster severity using a sample of trauma-exposed veterans. Consistent with prior research, we sought to determine the nature of these associations while controlling for previously identified risk and maintenance factors for PTSD. PTSD is highly comorbid with depression. In fact, approximately 50% of veterans with PTSD are diagnosed with depression (Rytwinski, Scur, Feeny, & Youngstrom, 2013). In addition, anxiety sensitivity (AS), a related yet distinct construct from IU, reflecting a fear of physiological arousal (Taylor et al., 2007), has been implicated in the development and maintenance of PTSD (Marshall, Miles, & Stewart, 2010; Stephenson, Valentiner, Kumpula, & Orcutt, 2009). Although IU and AS are related (Carleton, Sharpe, & Asmundson, 2007), and possibly lower-order dimensions of neuroticism, each may still retain disorder-specific elements that are vital to understanding the etiology of PTSD (Hong & Cheung, 2015). As such, establishing a relationship between IU and PTSD independent of AS and depression would increase the degree of specificity of this cognitive behavioral construct and highlight its utility as a potential treatment target.

Consistent with prior research, it was hypothesized that IU would be positively and significantly associated with overall PTSD symptom severity as well as the avoidance, negative alterations in cognitions and mood, and hyperarousal clusters. Given equivocal findings regarding the relationship between IU and intrusion (formerly re-experiencing) related symptoms (Fetzner et al., 2013; Oglesby et al., 2016; Oglesby, Gibby et al., 2017), no specific a priori predictions were made regarding this cluster. Further, consistent with previous work and the notion that PTSD symptoms may be more related to uncertainty causing inaction (Fetzner et al., 2013), it was hypothesized that PTSD symptoms would be associated with inhibitory IU rather than prospective IU. To control for the possibility that the relationship between IU and PTSD was not better accounted for by relevant third variables, depression and AS were used as covariates in all analyses.

2. Method

2.1. Participants and procedures

The sample consisted of 116 veterans presenting to a PTSD specialty clinic at a large Southeastern VA hospital to receive psychological services. As a part of their intake evaluation, veterans completed a

diagnostic interview and brief battery of self-report questionnaires to assist with diagnostic clarification and treatment planning. Given that the data were collected as part of routine clinical care, informed consent was not obtained. However, the VA Institutional Review Board approved use of this data for research purposes.

Veterans were primarily male (94%) with a mean age of 41.03 years (*SD* = 11.03). The racial/ethnic breakdown was as follows: 46.6% Caucasian; 44.8% African-American; 1.7% Asian/Pacific Islander; and 6.9% other (e.g., biracial). Regarding marital status, 36.2% of the sample was divorced, 31.0% never married, 23.3% married, 7.8% separated, and 1.7% widowed. In terms of military characteristics, most of the sample served in the Army (50.9%), followed by Army National Guard (19.8%), Navy (9.5%), Marine Corps (9.5%), Air Force (5.2%), and Coast Guard (0.9%), with 4.2% serving in more than one branch. Further, the majority of individuals served in combat operations in Iraq and Afghanistan (67.3%), followed by Operation Desert Storm (8.6%), Vietnam (6.0%), and other (4.3%; e.g., peace keeping missions), with 4.3% serving in multiple war zones, and 9.5% never having served in a war zone.

In terms of primary diagnoses, 38.8% of the sample had a primary Trauma-and Stressor-Related Disorder, 25.9% primary Substance-Related and Addictive Disorder, 24.2% primary Depressive Disorder, and 5.2% primary Anxiety Disorder, with 6% missing data due to a failure to complete the intake appointment. An additional 6.2% of the sample met for a Trauma-and Stressor-Related Disorder diagnosis that was not primary (e.g., secondary). Finally, trauma type for the full sample was as follows: 66.4% combat; 12.1% witnessing someone killed or abused; 4.3% physically or sexually abused as an adult; 1.7% serious accident; 0.9% victim of a serious crime; and 14.6% other (e.g., natural disaster).

2.2. Measures

2.2.1. Diagnostic interview

PTSD diagnoses were determined using a gold standard PTSD assessment, the Clinician Administered PTSD Scale for the *DSM-5* (CAPS-5; Weathers, Blake et al., 2013). The CAPS-5 is a 30-item structured interview designed to assess for current and lifetime *DSM-5* PTSD diagnostic status and symptom severity. In addition to assessing the 20 *DSM-5* PTSD symptoms, the CAPS-5 includes questions regarding the onset and duration of symptoms, subjective distress, and impact of symptoms on social and occupational functioning. The CAPS-5 was administered by doctoral-level psychologists, some of whom had formal CAPS-5 training (i.e., with the developer of the instrument) and others who had informal training (i.e., instruction, observation, and supervision by formally trained clinicians). All other psychiatric diagnoses (e.g., depressive, anxiety, and substance-related and addictive disorders) were determined using an unstructured clinical interview. All diagnostic interviews were reviewed with a licensed clinical psychologist during a weekly supervision meeting. However, given that these interviews were administered as part of routine clinical care, no inter-rater reliability data were collected.

2.2.2. Anxiety sensitivity index-3 (ASI-3)

The ASI-3 is an 18-item self-report questionnaire designed to measure sensitivity to, and fear of, anxious arousal. (Taylor et al., 2007). Veterans were asked to indicate the degree to which they agree with each item on a five-point Likert-type scale ranging from zero (very little) to four (very much). In addition to a total score, the ASI-3 yields three subscales reflecting fears of the physical, cognitive, and social consequences of anxiety. The ASI-3 has been found to have strong psychometric properties (Taylor et al., 2007). Consistent with prior research, this scale demonstrated excellent internal consistency (Cronbach's α = .95).

2.2.3. Intolerance of uncertainty scale- short form (IUS-12)

The IUS-12 is a 12-item self-report questionnaire designed to measure one's ability to tolerate the uncertainty of ambiguous situations, cognitive and behavioral responses to uncertainty, perceived implications of uncertainty, and attempts to control the future (Carleton, Norton et al., 2007). Veterans were asked to indicate the extent to which each item is representative of their typical experience on a five-point Likert-type scale ranging from one (not at all characteristic of me) to five (entirely characteristic of me). In addition to a total score, the IUS-12 yields two subscales: prospective IU and inhibitory IU. The IUS-12 has been found to have strong psychometric properties (Carleton, Norton et al., 2007). In the current study, the IUS-12 total score demonstrated excellent internal consistency (Cronbach's α = .91). In addition, both subscales demonstrated good internal consistency: prospective IU (Cronbach's α = .85) and inhibitory IU (Cronbach's α = .87).

2.2.4. Posttraumatic stress disorder checklist for DSM-5 with criterion A (PCL-5)

The PCL-5 with Criterion A is a 20-item self-report questionnaire designed to measure each of the *DSM-5* PTSD symptom criteria (Weathers, Litz et al., 2013). After identifying the worst Criterion A event experienced (i.e., a very stressful experience involving actual or threatened death, serious injury, or sexual violence), veterans were instructed to read a list of symptoms and indicate their level of distress as it relates to each symptom within the past month. Items are rated using a five-point Likert-type scale ranging from zero (Not at all) to four (Extremely). The PCL-5 has been demonstrated to have strong psychometric properties (Bovin et al., 2015). In the current study, the PCL-5 total score demonstrated excellent internal consistency (Cronbach's α = .93). Additionally, all criterion clusters demonstrated good internal consistency: intrusion (Cronbach's α = .83); avoidance (Cronbach's α = .79); negative alterations in cognition and mood (Cronbach's α = .84); and arousal and reactivity (Cronbach's α = .82).

2.2.5. Patient health questionnaire (PHQ-9)

The PHQ-9 is a nine-item self-report questionnaire designed to measure depression related symptoms (Kroenke, Spitzer, & Williams, 2001). Veterans were asked to read a list of symptoms and indicate how often they have been bothered by each symptom within the past two weeks on a four-point Likert-type scale ranging from zero (Not at all) to three (Nearly every day). The PHQ-9 has been demonstrated to have strong psychometric properties (Kroenke et al., 2001). In the current study, the PHQ-9 total score demonstrated good internal consistency (Cronbach's α = .86).

2.3. Data analytic plan

First, means, standard deviations, and zero order correlations for all variables of interest were examined. Next, a series of hierarchical regression analyses were performed to assess the relationships between IU (as measured by the IUS-12) and overall PTSD symptom and cluster severity (as measured by the PCL-5) as well as IU subfactors, after controlling for AS (as measured by the ASI-3) and depression symptoms (as measured by the PHQ-9). Due to the number of analyses being conducted statistical significance was adjusted to reduce the possibility of Type I error. The Benjamini-Hochberg procedure was used (Benjamini & Hochberg, 1995), resulting in all p values < .02 being significant. Preliminary analyses for all models indicated no threats or violations of normality, multicollinearity, or homoscedasticity. In each regression equation, ASI-3 and PHQ-9 total scores were entered into the first step of the model. In the second step of each model, IUS-12 total scores or IUS-12 subscale scores were added. Table 1 contains the means, standard deviations, and zero-order correlations for all variables. Table 2 contains a summary of the hierarchical regression analyses for overall IU predicting PCL-5 total and cluster scores. All other

Table 1
Means, standard deviations, and zero-order correlations for all self-report variables used in the current analyses.

	1	2	3	4	5	6	7	8	9	10
1. ASI-3	–									
2. PHQ-9	.55	–								
3. IUS-12	.58	.55	–							
4. IUS-12 Pros	.50	.44	.94	–						
5. IUS-12 Inhib	.58	.57	.92	.73	–					
6. PCL-5 Total	.57	.80	.63	.57	.60	–				
7. PCL-5 Int	.54	.57	.55	.49	.52	.87	–			
8. PCL-5 Avoid	.39	.44	.55	.50	.49	.73	.66	–		
9. PCL-5 NACM	.44	.79	.52	.44	.52	.91	.67	.52	–	
10. PCL-5 AR	.49	.71	.56	.53	.52	.91	.72	.61	.75	–
Mean	39.70	17.80	41.59	25.77	15.75	57.59	14.31	6.21	19.60	17.70
SD	18.63	6.12	10.69	6.15	5.21	15.39	4.37	1.94	6.04	4.80

Note. All correlations were significant at $p < .001$. ASI-3, ASI-3 total score; PHQ-9, PHQ-9 total score; IUS-12, IUS-12 total score; IUS-12 Pros, IUS-12 prospective dimension; IUS-12 Inhib, IUS-12 inhibitory dimension; PCL-5 Total, PCL-5 total score; PCL-5 Int, PCL-5 intrusion cluster; PCL-5 Avoid, PCL-5 avoidance cluster; PCL-5 NACM, PCL-5 negative alterations in cognitions and mood cluster; PCL-5 AR, PCL-5 arousal and reactivity cluster.

Table 2
Summary of hierarchical regression analyses for IU predicting PCL-5 total and cluster scores.

Step and variable	β	*t*	sr^2	R^2	ΔR^2
Predicting PCL-5 total score					
Step 1				.66**	
PHQ-9 total scores	.70	9.61	.34**		
ASI-3 total scores	.19	2.56	.02		
Step 2					.03*
IUS-12 total score	.24	3.19	.03*		
Predicting PCL-5 intrusion cluster					
Step 1				.40*	
PHQ-9 total scores	.39	4.05	.11**		
ASI-3 total scores	.33	3.46	.08*		
Step 2					.03
IUS-12 total score	.24	2.37	.03		
Predicting PCL-5 avoidance cluster					
Step 1				.22**	
PHQ-9 total scores	.33	3.02	.08*		
ASI-3 total scores	.21	1.88	.03		
Step 2					.11**
IUS-12 total score	.43	3.86	.11**		
Predicting PCL-5 negative alterations in cognitions and mood cluster					
Step 1				.63**	
PHQ-9 total scores	.79	10.39	.43**		
ASI-3 total scores	.02	.20	.00		
Step 2					.01
IUS-12 total score	.15	1.78	.01		
Predicting PCL-5 arousal and reactivity cluster					
Step 1				.52**	
PHQ-9 total scores	.64	7.45	.28**		
ASI-3 total scores	.14	1.64	.01		
Step 2					.04*
IUS-12 total score	.25	2.73	.04*		

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

analyses (i.e., summary of hierarchical regression analyses for IU subscales predicting PCL-5 total and cluster scores) are presented in the text.

3. Results

3.1. Preliminary analyses

The mean PHQ-9 total score was in the moderately severe range and consistent with that found in other veteran samples (Hurlocker, Vidaurri, Cuccurullo, Maieritsch, & Franklin, 2018). The mean ASI-3 score was consistent with that found in other treatment seeking samples (Schmidt, Norr, Allan, Raines, & Capron, 2017). Conversely, the mean IUS-12 total score ($d = .91$)[1] and subscale scores (prospective $d = .92$ and inhibitory $d = .78$) were considerably higher than those found in other treatment seeking samples (Oglesby, Allan, Short, Raines, & Schmidt, 2017). Similarly, the mean PCL-5 total score ($d = 1.34$) and cluster scores (*d's* range from 1.10 to 1.37) were substantially larger than those found in other veteran samples (Bovin et al., 2015). As expected, all correlations between constructs of interest were significant.

3.2. Primary analyses

3.2.1. PTSD symptom severity

The first regression equation was computed to examine the association between IU and overall PTSD symptom severity. Depression and AS scores were entered into the first step of the model accounting for 66.1% of the variance in PTSD symptom severity (F (2, 92) = 89.77, $p < .001$). In the second step of the model, IU total scores were added accounting for an additional 3.4% of the variance (F Change = 10.17, $p = .002$). IU was significantly associated with overall PTSD symptom severity.

A second regression equation was computed to examine the association between IU subscales and overall PTSD symptom severity. Once again, depression and AS scores were entered into the first step of the model. In the second step of the model, IU subscale scores were added accounting for an additional 4.3% of the variance (F Change = 6.48, $p = .002$). Prospective IU was significantly associated with overall PTSD symptom severity (β = .24, $t = 2.87$, $p = .005$, $sr^2 = .03$) whereas inhibitory IU was not (β = .01, $t = .08$, $p = .940$, $sr^2 = .00$).

3.2.2. PTSD intrusion

A third regression equation was computed to examine the association between IU and the PTSD intrusion cluster. Depression and AS scores were entered into the first step of the model accounting for 40.1% of the variance in PTSD intrusion symptoms (F (2, 93) = 31.19, $p < .001$). In the second step of the model, IU total scores were added accounting for an additional 3.4% of the variance (F Change = 5.60, $p = .020$). IU was not significantly associated with PTSD intrusion symptoms.

A fourth regression equation was computed to examine the association between IU subscales and PTSD intrusion symptoms. Once again, depression and AS scores were entered into the first step of the model. In the second step of the model, IU subscale scores were added accounting for an additional 3.3% of the variance (F Change = 2.67,

[1] Of note, differences between sample means were qualified using *d*-type effect sizes wherein the reference sample mean was subtracted from the current sample mean and divided by the current sample *SD*.

$p = .075$). Neither prospective IU (β = .18, $t = 1.54$, $p = .126$, $sr^2 = .01$) nor inhibitory IU (β = .06, $t = .49$, $p = .627$, $sr^2 = .00$) was significantly associated with PTSD intrusion symptoms.

3.2.3. PTSD avoidance

A fifth regression equation was computed to examine the association between IU and the PTSD avoidance cluster. Depression and AS scores were entered into the first step of the model accounting for 22.4% of the variance in PTSD avoidance symptoms (F (2, 93) = 13.46, $p < .001$). In the second step of the model, IU total scores were added accounting for an additional 10.8% of the variance (F Change = 14.88, $p < .001$). IU was significantly associated with PTSD avoidance symptom severity.

A sixth regression equation was computed to examine the association between IU subscales and PTSD avoidance symptoms. Once again, depression and AS scores were entered into the first step of the model. In the second step of the model, IU subscale scores were added accounting for an additional 9.5% of the variance (F Change = 6.49, $p = .002$). Neither prospective IU (β = .28, $t = 2.22$, $p = .029$, $sr^2 = .04$) nor inhibitory IU (β = .14, $t = .99$, $p = .325$, $sr^2 = .01$) was significantly associated with PTSD avoidance symptoms.

3.2.4. PTSD negative alterations in cognitions/mood

A seventh regression equation was computed to examine the association between IU and the PTSD negative alterations in cognitions and mood cluster. Depression and AS scores were entered into the first step of the model accounting for 62.9% of the variance in PTSD negative alterations in cognitions and mood symptoms (F (2, 93) = 78.75, $p < .001$). In the second step of the model, IU total scores were added accounting for an additional 1.2% of the variance (F Change = 3.18, $p = .078$). IU was not significantly associated with PTSD negative alterations in cognitions and mood symptom severity.

An eighth regression equation was computed to examine the association between IU subscales and PTSD negative alterations in cognitions and mood symptoms. Once again, depression and AS scores were entered into the first step of the model. In the second step of the model, IU subscale scores were added accounting for an additional 1.2% of the variance (F Change = 1.50, $p = .229$). Neither prospective IU (β = .08, $t = .87$, $p = .386$, $sr^2 = .00$) nor inhibitory IU (β = .07, $t = .70$, $p = .487$, $sr^2 = .00$) was significantly associated with PTSD negative alterations in cognitions and mood symptoms.

3.2.5. PTSD arousal and reactivity

A ninth regression equation was computed to examine the association between IU and the PTSD arousal and reactivity cluster. Depression and AS scores were entered into the first step of the model accounting for 52.3% of the variance in PTSD arousal and reactivity symptoms (F (2, 93) = 51.03, $p < .001$). In the second step of the model, IU total scores were added accounting for an additional 3.6% of the variance (F Change = 7.48, $p = .008$). IU was significantly associated with PTSD arousal and reactivity symptom severity.

A tenth and final regression equation was computed to examine the association between IU subscales and PTSD arousal and reactivity symptoms. Once again, depression and AS scores were entered into the first step of the model. In the second step of the model, IU subscale scores were added accounting for an additional 4.7% of the variance (F Change = 5.14, $p = .008$). Prospective IU was significantly associated with PTSD arousal and reactivity symptoms (β = .29, $t = 2.86$, $p = .005$, $sr^2 = .04$) whereas inhibitory IU was not (β = -.06, $t = -.52$, $p = .608$, $sr^2 = .00$).

4. Discussion

The present investigation sought to replicate and extend prior research examining the associations between IU and PTSD symptom and cluster severity within an outpatient treatment-seeking sample of veterans assessed using *DSM-5* PTSD symptom structure. Consistent with prediction, results revealed that IU was positively and significantly associated with overall PTSD symptom severity. These results remained significant even after accounting for AS and depression symptoms, two well-established risk and maintenance factors for PTSD (O'Donnell, Creamer, & Pattison, 2004; Raines et al., 2016). These findings are consistent with previous research (Fetzner et al., 2013; Oglesby et al., 2016; Oglesby, Gibby et al., 2017) and add to a growing body of literature establishing IU as an important transdiagnostic risk factor for various emotional disorders (Carleton, 2016b).

As predicted, results indicated that IU was significantly and robustly related to the avoidance cluster of PTSD. This finding is consistent with previous research (Fetzner et al., 2013; Oglesby, Gibby et al., 2017) and fits within the broader theoretical framework of IU. Specifically, extant research suggests that individuals high in IU may engage in increased cognitive and/or behavioral avoidance strategies in response to uncertainty (Bardeen, Fergus, & Wu, 2013). This may be particularly true among trauma-exposed samples due to uncertainty regarding the future occurrence of a traumatic stressor and/or trauma cue. Consistent with this notion, individuals with elevated levels of IU and PTSD symptoms may be motivated to eliminate ambiguity and future threat by engaging in increased avoidance behaviors.

Findings also revealed a significant association between IU and the arousal and reactivity cluster of PTSD. This finding is consistent with prediction and previous research in this area (Fetzner et al., 2013; Oglesby et al., 2016; Oglesby, Gibby et al., 2017). Individuals high in IU may experience increased arousal and reactivity based symptoms (e.g., hypervigilance, increased startle) due to the uncertainty associated with experiencing another traumatic stressor. This finding is particularly important as previous research has found that hyperarousal symptoms are associated with a more chronic course and reduced recovery among individuals with PTSD (Marshall, Schell, Glynn, & Shetty, 2006; Schell, Marshall, & Jaycox, 2004). Thus, elucidating modifying variables, like IU (Boswell et al., 2013) that could aid in the identification of novel treatment targets, is increasingly important.

Inconsistent with expectation, we did not find a significant association between IU and the negative alterations in cognition and mood cluster of PTSD. Although this finding is in opposition to the larger IU and PTSD literature (Fetzner et al., 2013; Oglesby, Gibby et al., 2017), similar findings were found within a sample of individuals exposed to a university campus shooting (Oglesby et al., 2016). One possible explanation for these discrepant findings could be due to sample selection. For example Fetzner et al. (2013) and Oglesby, Gibby et al. (2017) utilized community based samples with varying trauma types, whereas the current investigation utilized a veteran sample, the majority of whom were exposed to combat. Research has found that the clinical presentation of PTSD can differ as a function of trauma type (Kelley, Weathers, McDevitt-Murphy, Eakin, & Flood, 2009). In line with this hypothesis, individuals exposed to combat and/or sudden violent death (e.g., university campus shooting) may display differential trauma trajectories than community-based samples comprised of varying trauma types.

Inconsistent with prediction and previous research (Fetzner et al., 2013), we also found a unique association between prospective IU and overall PTSD symptom and cluster severity but not inhibitory IU. As previously noted, prospective IU reflects anxiety in anticipation of ambiguity, whereas inhibitory IU reflects inactivity in the face of ambiguity (Carleton, Norton et al., 2007). It is possible that certain aspects of military culture could account for this relationship. Indeed, service members are often taught to manage or reduce future uncertainty when planning, preparing, and executing operational missions. Such practices are critical to their success and safety, particularly during times of war. In line with this hypothesis, Banducci, Bujarski, Bonn-Miller, Patel, and Connolly (2016) found that the zero-order correlation between prospective IU and PCL symptom severity was stronger ($r = .50$) than that found between inhibitory IU and PCL symptom severity ($r = .33$) using

an outpatient sample of veterans.

In addition to extending our understanding of the relations between IU and PTSD, the current study also has important clinical implications. For example, over the last few decades several front-line treatments have been established and refined for PTSD including both pharmacological and psychological interventions. With regard to psychological interventions, the two treatments with the strongest empirical support are prolonged exposure (PE) therapy and cognitive processing therapy (CPT; Department of Veterans Affairs & Defense, 2010). The effectiveness of these cognitive behavioral treatments has been demonstrated in a wide range of trauma populations relative to wait-list and active control conditions (Monson et al., 2006; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). Nevertheless, these treatments incite a considerable amount of anxiety among PTSD patients with a suggested 60% refusing trauma focused therapy (Kehle-Forbes, Meis, Spoont, & Polusny, 2016) and another 20–34% failing to complete a successful treatment trial (Forbes et al., 2012; Tuerk et al., 2011). As such, it may be useful to incorporate risk and maintenance factors, such as IU, into existing trauma focused treatments to improve to increase adherence and tolerability. Notably, previous research has found that IU is a malleable construct (Boswell et al., 2013; Ladouceur, Gosselin, & Dugas, 2000). Thus, it seems plausible that addressing patients' uncertainty regarding trauma related cues could augment current trauma-focused treatments for PTSD.

Limitations of the present study should be considered in light of future work. First, all analyses were conducted cross-sectionally, therefore precluding causal inferences. Although previous work has found IU to be a significant and robust predictor of PTSD symptoms (Oglesby et al., 2016), we cannot conclusively rule out the alternative or that a bidirectional relationship exist. Future work is needed to examine the sequential relationships between these constructs, particularly among veteran samples. Second, all constructs of interest were measured using self-report. Although valid measures of IU and PTSD were utilized (Carleton, Norton et al., 2007; Weathers, Litz et al., 2013), future work would benefit from multimethod assessment approaches. For example, combining information from self-report measures and behavioral assessments would strengthen the current findings. A third limitation of the current study involves the relatively small sample size, which may have led to insufficient power to detect associations between IU and certain PTSD clusters. Finally, the sample consisted primarily of treatment seeking male veterans. While all individuals endorsed a *DSM-5* Criterion A stressor, all did not meet full diagnostic criteria for PTSD. Thus, results may not generalize to other PTSD-diagnosed or traumatized populations.

Despite these limitations, the current study adds to a growing body of literature on the relationship between IU and PTSD symptoms. To our knowledge, this investigation is the first to explore these associations using a veteran sample. Furthermore, our findings are the first to examine these relations using *DSM*-5 PTSD symptom structure. Given the malleable nature of IU (Boswell et al., 2013), as well research to suggest that current trauma focused treatments are not efficacious for all (Steenkamp, Litz, Hoge, & Marmar, 2015), future research should examine the extent to which targeting this cognitive behavioral variable improves treatment outcomes.

Contributions

Author one formulated the research question and wrote the introduction and results sections. Author two wrote the discussion section. Author three wrote the methods section. Author four helped with conceptualization of research idea and provided substantial feedback to the manuscript. Author five refined the research idea, and assisted with formatting manuscript and table, and provided substantial feedback on all drafts of the manuscript. All authors provided critical feedback and contributed substantially to the overall manuscript and/or data collection.

Conflict of interest

The authors declare no conflict of interest.

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