



## Reduction of cognitive concerns of anxiety sensitivity is uniquely associated with reduction of PTSD and depressive symptoms: A comparison of civilians and veterans



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### ABSTRACT

PTSD and comorbid depression are common among civilians and veterans, resulting in substantial impairment. Anxiety sensitivity (AS) may be a common malleable vulnerability factor for PTSD and depression. The AS cognitive concerns subscale is most strongly related to symptoms of PTSD and depression, and thus, may be an efficient route to reduce these symptoms. The current study evaluated a brief computerized intervention targeting AS cognitive concerns. Specifically, we evaluated whether reduction in AS cognitive concerns was associated with reduction in symptoms of PTSD and depression. Also, we evaluated whether there was a significant difference between civilians and veterans in response to the intervention. The single session intervention utilized psychoeducation and interoceptive exposure to target AS cognitive concerns. This intervention was compared to a health information condition among a sex-matched sample of civilians and veterans with elevated AS cognitive concerns ( $N = 56$ ). Reduction in AS cognitive concerns over one month was uniquely associated with reduction in PTSD and depressive symptoms in the same time frame. There were no significant differences between civilians and veterans in response to the intervention suggesting the intervention has efficacy for both groups. Treatment implications are discussed.

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Posttraumatic stress disorder (PTSD) and comorbid depression are common among civilians and veterans (Conner et al., 2013; Schnurr et al., 2003). They are associated with significant impairment, including lower life satisfaction, decreased quality of life, and greater PTSD symptom severity than either disorder alone (Galatzer-Levy et al., 2013; Ikin et al., 2010; Kessler, 2000).

Prior research suggests that PTSD and depression may have a common vulnerability factor. PTSD increases risk for depression and vice versa after a traumatic event (Breslau et al., 1997, 2000). Also, individuals with PTSD, but not trauma-exposed individuals were at greater risk for depression (Breslau et al., 2000). These findings highlight the need for shared risk factor interventions to efficiently reduce symptoms from both disorders. However, this area is at an early stage (Kearns et al., 2012; Steenkamp and Litz, 2013) and further work evaluating common vulnerability factors for PTSD and depression is necessary to enhance interventions.

Theories of PTSD and depression emphasize cognitive vulnerability (Abramson et al., 1989; Ehlers and Clark, 2000). One common cognitive vulnerability factor of PTSD and depression may be

anxiety sensitivity (AS). AS refers to the trait-like fear of the consequences of anxiety-related sensations (Reiss, 1991) in physical, cognitive, or social domains (Zinbarg et al., 1997). AS levels are highest in panic disorder and PTSD compared to other anxiety disorders (Taylor et al., 1992; Olatunji and Wolitzky-Taylor, 2009). Additionally, elevated AS prospectively predicts anxiety symptoms and syndromes and changes in depressive symptoms (Schmidt et al., 1997, 2006, 1999).

Elevated AS prior to a traumatic event may heighten fear of anxiety symptoms during the event, which may increase avoidance and contribute to PTSD (Elwood et al., 2009). For instance, a soldier with elevated AS may misinterpret normal stress responses during combat to be indicative of catastrophic physical consequences or mental breakdown. Afterwards, the soldier may attempt to avoid trauma-related cues, such as certain smells or sounds, which may contribute to PTSD. Consistent with theory, a number of studies have found that AS was significantly associated with risk for PTSD symptoms (Asmundson and Stapleton, 2008; Collimore et al., 2008; Feldner et al., 2006, 2008; Keogh et al., 2002). Furthermore, a large study of trauma survivors found that baseline AS was associated with PTSD symptom severity one year later (Marshall et al., 2010). Thus, AS appears to act as a vulnerability factor for PTSD.

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AS also appears to be a vulnerability factor for depression. AS may heighten distress over difficulty concentrating and making decisions, both of which are part of the normal stress response and symptoms of depression. These cognitive difficulties may be perceived as cognitive incapacitation or insanity and generate feelings of depression (Taylor et al., 1996). For instance, a soldier with elevated AS may misinterpret normal stress responses (e.g., trouble concentrating) during combat as indicative of a catastrophic mental breakdown. The perception of cognitive incapacitation or insanity may produce feelings of depression.

Consistent with this idea, AS was associated with depression and suicidal ideation cross-sectionally (Capron et al., 2012a, 2013, 2012c; Cox et al., 2001b; Taylor et al., 1996) and over time (Capron et al., 2012b; Schmidt et al., 1998). Also, AS was prospectively associated with changes in depressive symptoms (Schmidt et al., 1997), suggesting that AS acts as a vulnerability factor for depression. Taken together, AS appears to play a key role in PTSD and depression.

Fortunately, there is increasing evidence for the efficacy of brief AS interventions. Several AS interventions have demonstrated reductions in AS and AS subfactors using one-session computerized treatments (Keough and Schmidt, 2012; Schmidt et al., 2007). These reductions appear to be durable at a two-year follow-up (Schmidt et al., 2007). Recently, an AS reduction program was utilized in a sample of adults exposed to trauma (Vujanovic et al., 2012). Three months after the prevention program, participants displayed reduced AS, posttraumatic stress, and panic attack frequency, suggesting that targeting AS may be an efficient route to reduce symptoms of anxiety and trauma.

Cognitive concerns of AS - beliefs that anxiety-related sensations have catastrophic psychological outcomes such as going crazy or losing control of mental processes - appear to be particularly relevant to PTSD and depression. Among AS subfactors, the cognitive concerns subfactor is most strongly associated with symptoms of PTSD (Lang et al., 2002; Vujanovic et al., 2008) and depression (Cox et al., 2001b; Naragon-Gainey, 2010; Taylor et al., 1996). Moreover, AS cognitive concerns predicted depression severity in depressed individuals (Cox et al., 2001a), clinically anxious individuals (Schmidt et al., 1998; Taylor et al., 1996; Zinbarg et al., 2001), and nonclinical individuals (Deacon et al., 2003; Schmidt et al., 1998). Targeting the cognitive concerns facet of AS may represent a fruitful approach to reduce symptoms of PTSD and depression.

To our knowledge, this is the first report to evaluate whether reducing AS cognitive concerns impacts PTSD and depression. Because military personnel are one subgroup at great risk for PTSD (Keane et al., 2006), it is important to evaluate whether the brief intervention is effective for both veterans and civilians. Prior PTSD and depression interventions among military samples have utilized in-person, large group formats (Kearns et al., 2012). The present study utilized a brief computerized intervention, which could expedite transportability and dissemination in this population. Also, the intervention can be administered before deployment. In contrast, other psychological interventions used among military samples are administered after combat. Furthermore, previous studies examining the role of AS in PTSD have often used the Anxiety Sensitivity Index (ASI; Peterson and Reiss, 1992) to assess AS cognitive concerns. However, the ASI cognitive concerns subscale is limited to four items, suggesting it has lower content validity and reliability relative to the longer physical concerns subscale (Taylor et al., 2007). The Anxiety Sensitivity Index-3 (ASI-3 Taylor et al., 2007) was developed to provide a better assessment of AS subscales and appears to provide a more accurate measurement of AS cognitive concerns.

The present study evaluated an intervention targeting AS cognitive concerns among veterans and civilians with elevated AS

cognitive concerns with and without PTSD and/or depression. The intervention was based on previous global AS interventions (Schmidt et al., 2007) and consisted of psychoeducation and interoceptive exposure exercises. To target AS cognitive concerns, psychoeducation focused on faulty beliefs common in those with elevated AS cognitive concerns (e.g., when my thoughts race it means I'm going crazy). In the interoceptive exposure section, we chose hyperventilation because symptoms of hyperventilation are most consistent with AS cognitive concerns (depersonalization, derealization). The intervention is conceptualized as a treatment to reduce symptoms of PTSD and depression among those with high AS cognitive concerns. The first aim was to extend previous research on overall AS and PTSD/depression by evaluating whether reduction in AS cognitive concerns was associated with reduction in PTSD and depressive symptoms. Because prior work has shown that AS cognitive concerns were related to symptoms of PTSD and depression (Lang et al., 2002; Naragon-Gainey, 2010; Olatunji and Wolitzky-Taylor, 2009; Taylor et al., 1996; Vujanovic et al., 2008), it was predicted that reduction in AS cognitive concerns would be associated with reduction in symptoms of PTSD and depression. The second aim was to determine whether reductions in AS cognitive concerns, symptoms of PTSD, and symptoms of depression were significantly different between civilians and veterans. Although military personnel are one of the subgroups at greatest risk for PTSD (Keane et al., 2006), it was thought that reduction in AS cognitive concerns would act similarly for civilians and veterans. Thus, it was predicted that there would be no significant differences between veterans and civilians in reductions of AS cognitive concerns, symptoms of PTSD, and symptoms of depression.

## 1. Methods

### 1.1. Participants

Fifty-six participants were selected from a larger investigation evaluating the effects of a computerized intervention targeting AS cognitive concerns in anxiety, PTSD, and suicide among individuals recruited from the community. The current sample consisted of 28 civilians and 28 veterans matched only on sex. To be eligible, individuals had to be 18 years or older, speak English, and report elevated AS cognitive concerns. Exclusion criteria included current psychotic and/or bipolar-spectrum disorders, not stabilized on medications, or were an immediate threat to self or others. The sample was primarily male (80.4%) with a mean age of 39.98 years ( $SD = 17.04$ ). The racial/ethnic composition of the sample was 73.2% Caucasian, 16.1% African American, 1.8% Hispanic, 1.8% Asian, and 7.1% Other.

### 1.2. Procedure

#### 1.2.1. Timepoints

Individuals were recruited from the local community through various media outlets including newspaper advertisements and flyers. Those deemed potentially eligible after a telephone screen were scheduled for a baseline appointment in which they completed various self-report questionnaires and a semi-structured diagnostic interview for the DSM-IV-TR (SCID; First et al., 2001). After the baseline appointment, eligible participants were scheduled for a single session intervention appointment. In the intervention appointment, individuals were randomly assigned to either an AS cognitive intervention or a health information control condition. Individuals were followed up at one month post-treatment. This appointment included completion of various self-report questionnaires and the PTSD module of the SCID. The study was conducted at a large southeastern public university and

all procedures were approved by the Institutional Review Board before data collection.

### 1.2.2. Experimental conditions

**1.2.2.1. Cognitive anxiety sensitivity treatment (CAST).** CAST was designed to model the psychoeducational and behavioral strategies typically used in treatment for anxiety. CAST lasted approximately 45 min. The psychoeducation component was adapted from a prior AS intervention (Schmidt et al., 2007) designed to dispel popular myths about the immediate threat of stress on cognitive and physical processes. It focused on the nature of stress and its effects on the body and mind. This component explained that psychological arousal due to stress is not threatening and individuals have become conditioned to fear the sensations, as shown by their heightened AS cognitive concerns. The behavioral component taught interoceptive exposure (IE) exercises to correct conditioned fear to psychological sensations. CAST demonstrated IE exercises (e.g., hyperventilation and mirror staring) that provoke sensations (e.g., derealization) similar to AS cognitive concerns. A brief hyperventilation exercise was completed and participants reported their fear on a ten-point Likert scale. The exercise and fear rating was repeated ten times. Participants were instructed to practice the IE exercises at home until none of them elicited any fear.

**1.2.2.2. Health information treatment.** The health information treatment was developed to control for the impact of general psychoeducation provided in CAST. This treatment lasted approximately 45 min. The health information treatment provided information about the importance and advantages of maintaining a healthy lifestyle. It covered information on diet, alcohol and water consumption, exercise, sexual health, and sleep. This treatment also reviewed how to track daily health habits to obtain a healthy lifestyle. Participants were instructed to incorporate healthy habits into their daily lives.

### 1.3. Measures

#### 1.3.1. Clinician Administered

**Structured Clinical Interview for DSM-IV-TR (SCID; First et al., 2001).** The presence of psychiatric diagnoses was determined using the SCID. The SCID is a widely administered and well validated semi-structured interview designed to assess for the presence of lifetime and current Axis I disorders. All SCIDs were administered by highly trained, advanced clinical psychology graduate students. Training included viewing SCID training tapes and recorded SCID interviews, observing live SCID administrations, and conducting practice interviews with other trained individuals. Throughout the training process, all trainees received feedback until they demonstrated a high degree of reliability. Additionally, all SCIDs were reviewed by a licensed clinical psychologist to ensure accurate diagnoses. This training process has been used for other research studies in our laboratory and rates of agreement between clinical interviewers within our laboratory have been found to be over 80% with a kappa of .77 (Timpano & Schmidt, 2013). In the current study, the PTSD section of the SCID was used to assess for a full range of traumatic events and the symptoms associated with the most traumatic event (Criterion A through F).

#### 1.3.2. Self-report

**Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007).** The ASI-3 is an 18-item self-report questionnaire assessing fear of the consequences of anxiety-related sensations in physical, cognitive, and social domains (Taylor et al., 2007). This questionnaire has shown the best psychometric properties of all AS measures thus far (Taylor et al., 2007). In the current analyses, only the cognitive

concerns subscale was used to assess fears of the consequences of cognitive incapacitation. The internal consistency for this subscale was excellent at baseline, post-intervention, and one month follow-up ( $\alpha \geq .90$ ).

**Beck Depression Inventory – 2nd edition (BDI-II; Beck et al., 1979).** The BDI-II is a 21-item self-report questionnaire assessing current symptoms of depression. This measure has shown good psychometric properties in a clinical sample (Dozois et al., 1998). In the present study, the BDI-II was administered at baseline and one-month follow-up to assess current symptoms of depression. The BDI-II demonstrated excellent reliability at both timepoints ( $\alpha \geq .92$ ).

**Posttraumatic Stress Disorder Checklist – Civilian Version (PCL-C; Weathers et al., 1994).** The PCL-C contains 17 items that assess symptoms of PTSD. The PCL-C has shown good psychometric properties (Wilkins et al., 2011). In the present study, the PCL-C was administered at baseline and one-month follow-up to assess current symptoms of PTSD. The PCL-C showed excellent reliability at both timepoints ( $\alpha = .95$ ).

### 1.4. Data analytic plan

First, a hierarchical linear regression was constructed to examine whether the presence of a current PTSD diagnosis influenced reduction in AS cognitive concerns from baseline to one month follow-up because not all participants had current PTSD. In step one, age and AS cognitive concerns at baseline were entered. Age was entered as a covariate because veterans were significantly older than civilians. In step two, presence of a current PTSD diagnosis was entered. AS cognitive concerns at one month follow-up served as the dependent variable.

Second, two hierarchical linear regressions were constructed to examine the association between reduction in AS cognitive concerns and reduction in symptoms of PTSD and depression at one month follow-up. In the first step of each regression, age was entered as a covariate. Also, AS cognitive concerns, PCL-C, BDI-II at baseline and treatment condition were entered in step one. Symptoms of PTSD and depression at baseline were entered to examine the specificity of the effects. In the second step of each regression, AS cognitive concerns at one month follow-up was entered. PCL-C or BDI-II scores at one month follow-up served as the dependent variable in each regression.

Finally, we calculated whether reductions in AS cognitive concerns, PCL-C, and BDI-II were clinically significant according to Jacobson and Truax's (1991) guidelines.

## 2. Results

### 2.1. Preliminary analyses

Four participants did not complete the one month follow-up. These non-completers were all veterans. There were no significant differences between completers and non-completers on age, sex, race, baseline AS cognitive concerns, baseline symptoms of depression, or baseline symptoms of PTSD (all  $ps > .23$ ). Mean imputation was used to handle the missing data from the four participants.

Veterans were significantly older than civilians,  $t(54) = 2.86$ ,  $p = .006$ . There was no significant difference between the groups on race,  $\chi^2(4, N = 56) = 5.80$ ,  $p = .21$ . Data collected from the SCID indicated that 48.2% of the sample had a current anxiety disorder, 16.1% had a current mood disorder, 5.3% had a current alcohol use disorder, 5.3% met for another current disorder, and 25% had no current diagnosis. Additionally, 28.6% of the sample had a current or past diagnosis of PTSD and 55.3% of the sample

had a current or past depressive disorder diagnosis. There was no significant difference between the groups on the presence of a current diagnosis,  $\chi^2(1, N = 56) = .38, p = .54$ . Moreover, there were no significant differences between the groups at baseline on AS cognitive concerns, symptoms of PTSD, or depression (all  $ps > .11$ ).

In addition, 43% of the sample scored in the clinical range on the PCL-C at baseline. The mean PCL-C score at baseline was above the mean obtained among a large sample of trauma patients (Marshall et al., 2010), but below the mean obtained among a sample of Korean War veterans with PTSD (Ikin et al., 2010). A considerable portion of our sample scored similarly or above the mean in Ikin et al. (2010). Furthermore, 57% of our sample reported at least moderate symptoms of depression. The mean BDI-II score at baseline was similar to the mean obtained among those with Major Depressive Disorder (Taylor et al., 1996).

Eighty percent of the sample reported a history of traumatic events in the PTSD module of the SCID. Within this group, the mean number of traumatic events endorsed was 1.82 (SD = .92; range = 1–4) and 52.3% of them experienced a traumatic event first-hand (e.g., physical or sexual assault). We also examined history of traumatic events by veteran status. A total of 85.2% of veterans reported a traumatic event. The average number of traumatic events in this group was 2 (SD = 1.09) and 36.8% endorsed a non-combat trauma. A total of 75.0% of civilians reported a traumatic event. The average number of traumatic events in this group was 1.62 (SD = .67). There were no significant differences between veterans and civilians on the presence of a traumatic event,  $t(53) = -.93, p = .35$ , or number of traumatic events reported,  $t(42) = -1.38, p = .17$ .

## 2.2. Primary analyses

AS cognitive concerns significantly reduced from baseline to post-intervention,  $t(55) = -3.98, p = .000$  (Table 1). There was no significant difference between AS cognitive concerns from post-intervention to one month follow-up,  $t(55) = -.30, p = .77$ . Reduction in AS cognitive concerns persisted at one month follow-up relative to baseline,  $t(55) = -3.21, p = .002$ . Symptoms of depression (assessed by the BDI-II) also reduced from baseline to one month follow-up, but the difference was not significant,  $t(55) = -.30, p = .77$ . Furthermore, symptoms of PTSD (assessed by the PCL-C) significantly reduced from baseline to one month follow-up,  $t(55) = -2.60, p = .01$ . Moreover, reductions in AS cognitive concerns, symptoms of PTSD, and symptoms of depression were not significantly different between veterans and civilians (Table 2).

Next, we evaluated whether presence of current PTSD was associated with AS cognitive concerns at one month follow-up. In the first step, age was not associated with AS cognitive concerns at

**Table 1**  
Means and standard deviations of the study variables at baseline, post-intervention, and one month follow-up.

	Baseline		Post-intervention		One month follow-up	
	M	SD	M	SD	M	SD
ASI-3 Cognitive	9.14 <sup>a,b</sup>	6.75	6.95 <sup>a</sup>	6.60	6.77 <sup>b</sup>	6.23
BDI-II	21.61	13.23	n/a	n/a	18.23	13.49
PCL-C	42.79 <sup>b</sup>	16.14	n/a	n/a	39.37 <sup>b</sup>	15.44

Note: ASI-3 Cognitive = Anxiety Sensitivity Index – 3 Cognitive concerns; BDI-II = Beck Depression Inventory, 2nd edition; PCL-C = Posttraumatic Stress Disorder Checklist, Civilian Version; n/a = Not assessed at post-intervention.

<sup>a</sup> Significant difference between baseline and post-intervention score.

<sup>b</sup> Significant difference between baseline and one month follow-up score.

**Table 2**  
Veteran status and baseline to follow-up change in key variables.

	Veteran		Civilian		<i>t</i>	<i>p</i>
	M	SD	M	SD		
ASI-3 Cognitive	2.28	5.63	2.46	5.55	.12	.63
BDI-II	1.00	13.66	5.75	11.03	1.43	.07
PCL-C	2.66	10.94	4.18	8.74	.57	.58

Note. ASI-3 Cognitive = Anxiety Sensitivity Index – 3 Cognitive concerns; BDI-II = Beck Depression Inventory, 2nd edition; PCL-C = Posttraumatic Stress Disorder Checklist, Civilian Version.

baseline. AS cognitive concerns at baseline were significantly associated with AS cognitive concerns at one month follow-up. The first step accounted for 40% of the variance. In the second step, presence of a current PTSD diagnosis (assessed by the SCID) was not associated with AS cognitive concerns at one month follow-up. The second step accounted for .1% additional variance (Table 3).

Then, we examined association between reduction in AS cognitive concerns and reduction in symptoms of PTSD at one month follow-up. In the first step, age, AS cognitive concerns and BDI-II at baseline, and treatment condition were not significantly associated with PCL-C (Table 4). As expected, baseline PCL-C was significantly associated with PCL-C at one month follow-up. The first step accounted for 67% of the variance. In the second step, AS cognitive concerns at one month follow-up was significantly associated with PCL-C at one month follow-up. The second step accounted for seven percent additional variance.

Similar results were found for symptoms of depression at one month follow-up. In the first step, age, AS cognitive concerns at baseline, and treatment condition were not associated with BDI-II at one month follow-up. As expected, baseline BDI-II was significantly associated with BDI-II at one month follow-up. Baseline PCL-C was also significantly associated with BDI-II at one month follow-up. The first step accounted for 47% of the variance. In the second step, AS cognitive concerns at one month follow-up were significantly associated with BDI-II at one month follow-up. The second step accounted for 18% additional variance.

Due to the overlap of PTSD and substance use, we reran the analyses controlling for substance use. Similar results were obtained. Thus, we report the analyses without controlling for substance use.

## 2.3. Clinically significant change

To determine whether the reductions in AS cognitive concerns and symptoms of PTSD and depression were clinically significant as well as statistically significant, we calculated Reliable Change Index (RCI) scores (Jacobson and Truax, 1991). An RCI score of 1.96 or greater indicates clinically significant change. None of the reductions were clinically significant (RCIs  $\leq -.79$ ).

**Table 3**  
Association between presence of a current PTSD diagnosis and change in AS cognitive concerns.

	$\Delta R^2$	$\beta$	<i>t</i>	<i>p</i>
<i>Dependent variable: M1 ASI-3 Cognitive</i>				
Step 1				
Age	.40	-.001	-.04	.97
Baseline ASI-3 Cognitive		.58	5.89	.000
Step 2				
Current PTSD diagnosis	.001	.41	.26	.79

Note. PTSD = Posttraumatic stress disorder; AS = Anxiety sensitivity; M1 = One month follow-up; ASI-3 Cognitive = Anxiety Sensitivity Index 3 – Cognitive concerns; Current PTSD diagnosis = Presence or absence of a current PTSD diagnosis.

**Table 4**

Association of AS cognitive concerns at one month follow-up with symptoms of PTSD and depression at one month follow-up.

	$\Delta R^2$	$\beta$	<i>t</i>	<i>p</i>
<i>Dependent variable: PCL-C at one month follow-up</i>				
Step 1	.67			
Age		.06	.74	.46
Baseline ASI-3 Cognitive		-.09	-.36	.72
Baseline PCL-C		.71	7.13	.000
Baseline BDI-II		.16	1.16	.25
Treatment condition		-.04	-.02	.99
Step 2	.07			
M1 ASI-3 Cognitive		.90	3.62	.001
<i>Dependent variable: BDI-II at one month follow-up</i>				
Step 1	.47			
Age		-.04	-.44	.66
Baseline ASI-3 Cognitive		-.44	-1.66	.10
Baseline BDI-II		.42	2.75	.008
Baseline PCL-C		.38	3.43	.001
Treatment condition		-2.46	-.88	.39
Step 2	.18			
M1 ASI-3 Cognitive		1.23	4.89	.000

Note. AS = Anxiety sensitivity; PTSD = Posttraumatic stress disorder; PCL-C = Posttraumatic Stress Disorder Checklist, Civilian Version; ASI-3 Cognitive = Anxiety Sensitivity Index 3 – Cognitive concerns; BDI-II = Beck Depression Inventory, 2nd edition; Treatment condition = Cognitive AS treatment condition or health information control condition; M1 = One month follow-up.

### 3. Discussion

The present study is the first to demonstrate that reductions in AS cognitive concerns are associated with reductions in symptoms of PTSD and depression. Moreover, this study is the first to demonstrate that a brief intervention targeting AS cognitive concerns may be effective for civilians and veterans. The findings are consistent with prior work that AS cognitive concerns are particularly relevant for PTSD and depression (Cox et al., 2001b; Lang et al., 2002; Naragon-Gainey, 2010; Taylor et al., 1996; Vujanovic et al., 2008) and that brief AS reduction programs are an efficient method to reduce anxiety symptoms (Keough and Schmidt, 2012; Schmidt et al., 2007; Vujanovic et al., 2012).

The present study adds to evidence of the importance of AS cognitive concerns in symptoms of PTSD and depression. These findings are consistent with theory and prior research (Elwood et al., 2009; Naragon-Gainey, 2010; Olatunji and Wolitzky-Taylor, 2009) and extend the research by demonstrating that reduction in AS cognitive concerns accounts for significant additional variance in its association with reduction in PTSD and depressive symptoms in civilians and veterans. Furthermore, these results also demonstrate specificity of the effects. The relation between reduction in AS and reduction in PTSD symptoms was not confounded by depressive symptoms. Similarly, the relation between reduction in AS and reduction in depressive symptoms was not confounded by PTSD symptoms. The results highlight the unique role of AS cognitive concerns as a modifiable risk factor for symptoms of PTSD and depression.

The present study also adds to understanding of brief programs to reduce symptoms of PTSD and depression. Past work (Fedoroff et al., 2000; Vujanovic et al., 2012) has utilized multiple sessions of cognitive-behavioral therapy (CBT) or a single session general AS reduction program. Due to the specific relation between AS cognitive concerns and PTSD as well as depression (Naragon-Gainey, 2010), the present study compared a cognitive AS intervention to a health information control condition. The longitudinal design of the present study allowed examination of reduction in cognitive AS concerns and symptoms of PTSD and depression over an extended period of time. Consistent with prior work (Keough and Schmidt, 2012; Schmidt et al., 2007), reductions in AS

cognitive concerns from the brief intervention were durable, as the reductions were maintained at a one month follow-up. Extending previous work, the intervention demonstrated reductions in PTSD and depressive symptoms at a one month follow-up. This underscores the brief intervention's applicability to reduce AS cognitive concerns and related PTSD and depressive symptoms.

Furthermore, the present study adds to our understanding of brief interventions for PTSD and depressive symptoms in military samples. Past work has utilized psychological debriefing and Battlemind Program (Kearns et al., 2012). Similarly, the present study utilized a brief intervention that consisted of one 45 min session. The present study extends prior work in this area by utilizing a computerized intervention, which can facilitate transportability and dissemination. Another strength of the intervention is that it is preventative. It can be administered *before* deployment to reduce specific risk factors for PTSD and depression. In contrast, psychological debriefing and Battlemind Program are designed for use *after* combat trauma(s). The findings suggest the potential utility of this brief intervention among soldiers with elevated AS cognitive concerns before they are deployed to reduce risk of PTSD and depression.

Contrary to prediction, the intervention failed to produce clinically significant reductions in symptoms of PTSD and depression. Several factors may have contributed to the lack of clinically significant findings. First, only a portion of the sample met diagnostic criteria for current PTSD and/or depression. This may have reduced the likelihood of producing clinically significant change in these symptoms. Second, there was no significant difference between conditions in response to treatment. The CAST condition may not have been potent enough or the health information condition may have been more of an active placebo condition than presumed. This may have prevented observation of clinically significant change for the CAST condition as we would predict. Finally, the single session intervention may not have been sufficient to produce clinically significant reductions in symptoms.

Results from the present study should be considered in the context of its limitations. First, not all participants met diagnostic criteria for current PTSD and/or depression, which decreased the ability to examine the full impact of the intervention in reducing AS cognitive concerns and symptoms of PTSD and depression. Presence of current PTSD was not associated with AS cognitive concerns at one month follow-up after controlling for age and AS cognitive concerns at baseline. The intervention appeared to reduce AS cognitive concerns regardless of the presence of current PTSD. Future work should evaluate whether similar effects are obtained among those with PTSD and depression. Second, although AS cognitive concerns and symptoms of PTSD and depression decreased over time, the effects of the cognitive AS intervention condition were not significantly different from the health information control condition. To more stringently test whether reduction in AS cognitive concerns is associated with reduction in PTSD and depressive symptoms over time, a more potent cognitive AS intervention condition is necessary. Third, as mentioned earlier, a one-session AS cognitive intervention failed to produce clinically significant reductions in PTSD and depressive symptoms. Future work may want to evaluate whether adding more sessions produces clinically significant change. Specifically, extended coverage of psychoeducation on AS cognitive concerns and practice of IE exercises targeting AS cognitive concerns may be required to elicit clinically significant reductions in symptoms of PTSD and depression. Fourth, the correlational findings of the present study prevent evaluation of causality. Future work should evaluate whether an AS cognitive focused intervention causes a reduction in PTSD and depressive symptoms compared to a control condition. Fifth, the use of self-report questionnaires may contribute to method variance. Use of various assessments, such as biological challenge

paradigms, behavioral assessments, and physiological assessments, of these constructs are necessary. In particular, assessing PTSD with stronger measures, such as the Clinician Administered PTSD Scale (Blake et al., 1990) or Posttraumatic Diagnostic Scale (Foa, 1995) is important. Sixth, the relatively small sample size prevented us from evaluating whether group status moderated response to the intervention. Future work should evaluate whether these findings are replicated in larger samples consisting of civilians and veterans and whether response to the intervention depends on group status. Seventh, participants were matched on sex, but not age. Our smaller sample also prevented us from matching on trauma characteristics. Although age did not significantly affect our results, it reduces the extent to which we can conclude the intervention is effective for individuals, regardless of age or sex. Future work should match participants on various demographics and trauma characteristics. Eighth, the analyses did not covary for the number, type, severity, and recency of trauma(s) reported. It is important to evaluate whether these factors significantly impact reductions in AS cognitive concerns, symptoms of PTSD, or symptoms of depression observed in the present study. Finally, the sample was quite homogeneous, as most participants were Caucasian men. However, our sample's demographic characteristics were similar to prior veteran samples that examined PTSD and depression (Conner et al., 2013; Ikin et al., 2010). It is important to evaluate whether similar results are obtained with females and more racially/ethnically diverse samples to more stringently test the effectiveness of the single session cognitive AS intervention.

Future AS reduction work can build upon the present study in several ways. First, future research may want to examine whether a multi-session AS cognitive intervention produces clinically significant reductions among those with PTSD with or without comorbid depression. Second, future work may want to evaluate whether incorporating an AS cognitive reduction program into current effective treatments for PTSD enhances treatment response. Finally, future research may want to examine whether reduction of AS prior to likely trauma exposure prevents the later development of PTSD. For example, soldiers with elevated AS and no history of psychopathology could receive the AS reduction program before they are deployed, where they are at increased risk for trauma exposure. They could be followed-up for a period of time once their tour ends to evaluate for the presence of PTSD.

In conclusion, the present study increases understanding of common vulnerability factors in PTSD and depression. Reduction in AS cognitive concerns via a single session computerized intervention appears to be a promising method to reduce symptoms of PTSD and depression for civilians and veterans. Current effective treatments may be enhanced by targeting common vulnerability factors, such as AS cognitive concerns.

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### Contributors

The first author designed the idea for the manuscript, analyzed the data, wrote the majority of the introduction, results, and discussion, wrote a significant portion of the methods, and coordinated

the co-authors' contributions. The second author provided feedback on the drafts and helped collect the data for the study. The third author helped write the methods and provided feedback on the drafts. The fourth author collected data for the study and provided feedback on all sections of the manuscript. All authors have contributed to and have approved the final manuscript.

### Conflict of interest

The authors have no conflicts of interest in terms of their authorship or publication of this manuscript.

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