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The Association Between Negative Trauma-Related Cognitions and Pain-Related Functional Status Among Veterans with Posttraumatic Stress Disorder and Alcohol Use Disorder

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Abstract

Among veterans with posttraumatic stress disorder (PTSD), alcohol use disorders (AUDs) are highly prevalent. Furthermore, PTSD frequently co-occurs with chronic pain (CP), and CP is associated with an increased risk of AUD. Pain-related beliefs and appraisals are significantly associated with poorer pain-related functional status yet few studies have examined negative trauma-related cognitions and their impact on pain-related functional disability in veterans with co-occurring PTSD and AUD. Accordingly, we examined the association between negative trauma-related cognitions and pain severity and pain disability in 137 veterans seeking treatment for PTSD and AUD. Using hierarchical multiple linear regression, we found that higher levels of negative trauma-related cognitions (e.g., “I am completely incompetent”) were associated with a higher level of pain severity, after controlling for PTSD symptom severity and frequency of alcohol use, total R^2 = .07, ΔR^2 = .06. Additionally, as hypothesized, we found that higher levels of negative trauma-related cognitions were associated with higher levels of pain disability, after controlling for PTSD symptom severity, frequency of alcohol use, and pain severity, total R^2 = .46, ΔR^2 = .03. Given that negative trauma-related cognitions contributed to pain severity and pain disability, even when controlling for PTSD severity and frequency of alcohol use, future studies should explore the potential impact of interventions that address negative trauma-related cognitions (e.g., prolonged exposure or cognitive processing therapy) on pain severity and disability.

Posttraumatic stress disorder (PTSD) is the most common military service–related mental health condition (Seal, Bertenthal, Miner, Sen, & Marmar, 2007) and is highly comorbid

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with other psychological and physical health conditions, including alcohol use disorder (AUD; Seal et al., 2011). One recent study found that although 26% of veterans met criteria for PTSD, among veterans with AUD, the prevalence of PTSD was 4 times higher (63%; Seal et al., 2011). Individuals with both PTSD and AUD compared to those with either disorder alone are at increased risk for other psychiatric conditions, have poorer outcomes in AUD treatment, and have a significantly increased risk of suicidal ideation and attempts (Norman, Haller, Hamblen, Southwick, & Pietrzak, 2018).

Furthermore, approximately 30%–65% of veterans seeking treatment for PTSD have pain conditions (Otis et al., 2010; Porter, Pope, Mayer & Rauch, 2013). Likewise, chronic pain (CP) has a negative impact on psychological and physical health (e.g., Haggman, Maher, & Refshauge, 2004) and is positively associated with alcohol use (Castillo, MacKenzie, Wegener, & Bosse, 2006) and AUD (Demyttenaere et al., 2007). Moreover, a higher level of pain-related disability has been found among individuals with CP who have AUD and comorbid psychiatric disorders compared to those with CP alone (Dersh, Polatin, & Gatchel, 2002). Given the complex associations between PTSD and alcohol use (Norman et al., 2018), the presence of comorbid pain likely contributes to negative outcomes among veterans with PTSD and AUD although these complex dynamics are understudied.

Foa and Kozak (1986) used the emotional processing theory to explain the development of PTSD through changes in preexisting cognitions of one's own competence and beliefs about one's safety and the danger in the world. Indeed, negative trauma-related cognitions have been identified as important factors in the development, maintenance, and severity of PTSD (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999; Scher, Suvak, & Resick, 2017), and negative beliefs have been linked to more alcohol cravings in individuals with comorbid PTSD and alcohol dependence (Jayawickreme, Yasinski, Williams, & Foa, 2012). Similarly, negative pain-related cognitions, such as "catastrophizing" (i.e., unrealistic, negative self-evaluations related to pain), have been linked to increased pain intensity as well as poorer mental health and functional status (Vowles, McCracken, & Eccleston, 2008). Thus, negative cognitions appear to be a theme underlying both PTSD and CP severity, an observation that led to the development of the *mutual maintenance model* (Sharp & Harvey, 2001). This model posits that certain negative cognitions, such as heightened expectation and overestimation of harm or injury risk, underlie PTSD and CP comorbidity (Liedl et al., 2010). This model has received some empirical support. For example, in a sample of veterans with CP, those with clinically significant PTSD symptoms endorsed more negative cognitions and beliefs about pain than those without PTSD (Alschuler & Otis, 2012).

Despite the prevalence of comorbid PTSD and pain among veterans, few studies have focused on the association between negative trauma-related cognitions and pain outcomes. One previous study found that negative trauma-related cognitions were positively associated with pain-related interference, but not pain severity, among veterans seeking PTSD treatment (Porter et al., 2013). In the present study, we have expanded upon previous research by examining the association between trauma-related negative cognitions and pain severity and pain disability in veterans with comorbid PTSD and AUD. We hypothesized that negative trauma-related cognitions would be positively associated with both pain severity and pain disability.

Method

Participants and Procedure

Participants were 137 U.S. military veterans who completed measures at the baseline visit of a randomized controlled trial comparing the effects of two psychosocial treatments for co-occurring PTSD and AUD (see Norman et al., 2015). All participants met diagnostic criteria for PTSD whereas 4.4% met criteria for alcohol abuse and 95.6% met criteria for dependence, (see Measures section for additional details). The average age of participants was 40.8 years (*SD* = 12.95). Participants reported experiencing, on average, 8.24 (*SD* = 2.75) traumas in their lifetime (range: 2–15 lifetime traumas). The three most commonly experienced trauma types were combat (83.9%), physical assault (81.0%), and transportation accidents (73.7%). Participants were 90.5% male, 62.8% White, and 29.2% Hispanic. In terms of military branch, 38.0% of participants served in the U.S. Army, 29.9% served in the U.S. Navy, 27.7% served in the U.S. Marine Corps, and 2.9% served in the U.S. Air Force; 84.0% were deployed to a combat zone. Additionally, 64.0% of our sample completed high-school or less, 26.3% were employed full time, 7.2% were employed part time, 9.5% were retired, 37.2% were on disability, and 10.2% were unemployed at the time of the study. All study procedures were approved by the Veterans' Affairs (VA) Institutional Review Board and Research and Development committee. Written informed consent was obtained from all veterans prior to participation.

Measures

Negative trauma-related thoughts.—The Posttraumatic Cognitions Inventory (PTCI; Foa et al., 1999), a 33-item self-report scale, was used to measure negative appraisals and beliefs related to trauma. The questionnaire is rated on a Likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*) and includes items such as "I can't stop bad things from happening to me" and "I have to be on guard at all times." Foa et al. (1999) suggest the use of total score; there was a high degree of intercorrelation between the measure's three subscales, *r*s = .48–.54. For the present study, the total score was used. The PTCI has demonstrated good-to-excellent internal consistency, Cronbach's α = .97; test–retest reliability, Spearman's ρ = .74; and convergent and discriminative validity. In the current sample, Cronbach's alpha was .97.

Pain and functioning.—The Pain Disability Questionnaire (PDQ; Anagnostis, Gatchel, & Mayer, 2004) is a 15-item self-report questionnaire of disability and functional status related to musculoskeletal pain conditions. The questionnaire is rated on a Likert-type scale ranging from 0 to 10 and includes items such as "Does your pain interfere with your normal work inside and outside the home?" (for which 0 = *work normally* and 10 = *unable to work at all*). The total disability score ranges from 0 to 150 and is the sum of the two components, which measure severity of the disability and impact on functioning; a score of 0–70 indicates mild/moderate impact, 71–100 indicates severe impact, and 101–150 indicates extreme severity and impact. The test–retest reliability, *r* = .95; internal consistency, Cronbach's α = .96; and construct validity have all been demonstrated to be excellent (Anagnostis et al., 2004). In the current sample, Cronbach's alpha was .94.

Functional impairment and well-being.—An item from the Short-Form Health Survey (SF-36; Ware & Sherbourne, 1992) was used to measure pain severity. The SF-36 is a 36-item self-report questionnaire that consists of eight subscales, which assess functioning and well-being. For the purpose of this study, we used an item from the Functioning Due to Bodily Pain subscale to assess for pain severity; responses range from 1 (*none*) to 6 (*very severe*).

PTSD.—The Clinician-Administered PTSD Scale for *DSM-5* (CAPS-5; Weathers et al., 2013), a semistructured interview, was administered to establish PTSD diagnosis and symptom severity. Scores on the CAPS-5 range from 0 to 80, with higher scores indicating a higher level of PTSD severity. Severity ratings from the CAPS-5 have displayed strong internal consistency (Cronbach's α = .88) and interrater reliability (intraclass correlation coefficient [ICC] = .91) as well as convergent validity with CAPS for *DSM-IV* severity scores, r = .83, in military veteran samples (Weathers et al., 2018). In the current sample, CAPS-5 severity ratings displayed strong internal consistency, Cronbach's α = .83.

Alcohol abuse.—The Structured Clinical Interview for the *DSM-IV-TR* (SCID-IV-TR; First, Spitzer, Gibbon, & Williams, 2002) was used to assess for the presence of alcohol abuse and alcohol dependence. The SCID-IV-TR has evidenced adequate psychometric properties for the diagnosis of alcohol abuse and dependence, including good validity (Kranzler, Kadden, Bador, Tennen, & Rounsaville, 1996). All participants in the current study met the criteria for either alcohol abuse or dependence. We created an alcohol use severity score by summing the number of criteria met for alcohol abuse and alcohol dependence. Scores ranged from 0 for no symptoms endorsed to 11 for all symptoms endorsed. Internal consistency for SCID-IV-TR alcohol use severity was acceptable in the current sample, Cronbach's α = .68.

Alcohol consumption.—The Timeline Follow-Back Procedure (TLFB; Sobell & Sobell, 1992) utilizes a self-report calendar method to examine daily alcohol consumption patterns and frequency of alcohol use over a specified period of time. The TLFB yields measures of frequency of drinking days (FDD) and maximum drinking quantity (MDQ). The TLFB has evidenced adequate reliability, κ = .77, and validity among psychiatric outpatients (Carey, 1997). Participants were asked about the frequency of their drinking over the 90 days they were not in a restricted environment prior to their baseline visit.

Data Analysis

All analyses were conducted using SPSS software (Version 24.0). Models included cases with no missing values for any of the variables used. If data were missing for any variable in a model, cases were excluded from analyses list-wise (n = 27). Covariates were determined via one-way analysis of variance or correlations with the two outcome variables. Demographic variables, AUD severity, and MDQ were not significantly associated with pain severity or pain disability; however, PTSD symptom severity and FDD were associated with pain disability and therefore included as covariates in all models. Hierarchical multiple linear regression models were used to evaluate the association between negative trauma-related cognitions and pain severity and disability while controlling for PTSD symptom

severity and number of drinking days. We also included pain severity as a covariate in the model with pain disability as the outcome variable.

Results

Table 1 shows descriptive statistics and bivariate Pearson correlations among the study variables. Pain disability was significantly and positively associated with pain severity, $r = .60$, $p < .001$; negative trauma-related cognitions, $r = .40$, $p < .001$; PTSD symptom severity, $r = .30$, $p < .001$; and FDD, $r = .20$, $p = .010$. However, pain disability was not significantly correlated with AUD severity, $r = -.01$, $p = .911$. After controlling for PTSD symptom severity and number of drinking days, negative trauma-related cognitions were significantly associated with pain severity, $R^2 = .07$, $F(3, 134) = 3.42$, $p = .019$ (see Table 2). Likewise, after controlling for PTSD symptom severity, number of drinking days, and pain severity, negative trauma-related cognitions were significantly associated with pain-related functional disability, $R^2 = .46$, $F(4, 132) = 28.43$, $p < .001$ (see Table 3).

Discussion

Very few studies have examined the impact of negative trauma-related cognitions on pain severity and disability in individuals with PTSD, and, to our knowledge, no previous studies have included veterans with comorbid PTSD and AUD, a clinically complex population. As expected, we found positive associations between negative trauma-related cognitions and both pain severity and pain disability, even after we controlled for relevant covariates although these effect sizes were modest. These findings have important clinical implications.

Unlike the study by Porter et al. (2013), our study revealed a significant association between negative trauma-related cognitions and pain severity. This finding is consistent with previous literature that demonstrates a robust association between optimism and overall physical health as well as the protective role of optimism in the course and experience of pain (Rasmussen, Scheier, & Greenhouse, 2009). In addition, compared to veterans with PTSD alone, veterans with co-occurring PTSD and AUD have been shown to be more likely to screen positive for major depression and generalized anxiety disorder and to exhibit lower levels of cognitive and physical functioning (Norman et al., 2018). It is possible these CP risk factors (e.g., low optimism, higher incidence of depressive and anxiety disorders) result in a stronger association between negative trauma-related cognitions and pain severity in veterans with co-occurring PTSD and AUD although this is an area for further research.

Notably, we did not find significant direct associations between pain severity and AUD severity or drinking days. Nonetheless, it is possible that, compared to veterans with PTSD alone, veterans with co-occurring PTSD and AUD are particularly sensitive to pain and therefore more vulnerable the potential impact of negative trauma-related cognitions on pain severity; however, this potential explanation requires additional research.

Interestingly, we found that frequency of alcohol use, but not AUD severity, was significantly correlated with pain disability. The authors of a recent meta-analysis reported mixed findings with respect to whether alcohol use frequency or severity of AUD are associated with differences in pain disability (Morasco et al., 2011). In addition, Zale,

Maisto, and Ditrea (2015) found a curvilinear association between alcohol consumption and pain outcomes in their recent review. The authors explained that moderate alcohol use may serve to relieve pain whereas excessive consumption is related to worse pain outcomes. Perhaps for that reason, AUD symptom severity does not fit into this complex association between drinking and pain disability. Our findings suggest that frequency of alcohol use may be a better predictor of pain disability than AUD severity among veterans with comorbid PTSD and AUD.

Our results support and expand on the biopsychosocial model of pain; specifically, negative trauma-related cognitions uniquely contribute to pain severity and pain disability. Furthermore, our findings are consistent with the mutual maintenance models of co-occurring PTSD and pain (Liedl et al., 2010; Sharp & Harvey, 2001) and suggest one potential pathway by which PTSD symptoms maintain pain—namely, negative trauma-related cognitions appear to maintain pain severity and increase pain-related functional disability. Consistent with these theoretical models, our findings suggest that targeting and reducing negative trauma-related cognitions may lead to reductions in pain severity and improvements in functioning.

Emotional processing theory posits that trauma-related cognitions are implicated in functional impairment in individuals with PTSD (Foa & Rothbaum, 2001). Our findings expand upon emotional processing theory by showing that negative trauma-related cognitions are associated with a higher level of pain-related functional disability. Importantly, trauma-focused therapy, such as prolonged exposure therapy (PE) or cognitive processing therapy (CPT), has been associated with reductions in negative trauma-related cognitions, and decreases in trauma-related cognitions are a mechanism of PTSD symptom reduction (Foa & Rauch, 2004). Additionally, PE and CPT have been shown to be effective for individuals with PTSD and AUD (Roberts, Roberts, Jones, & Bisson, 2015; Veterans Affairs/Department of Defense, 2017). Future research should evaluate whether reductions in trauma-related cognitions during trauma-focused treatment are also associated with reduced pain disability.

This study had several limitations. Pain-specific thought patterns, such as pain catastrophizing, have been associated with worse pain outcomes (Vowles et al., 2008); future studies should also examine general maladaptive cognitions (e.g., catastrophizing, psychological inflexibility) and pain-specific cognitions (e.g., worry about pain, pain catastrophizing, low pain self-efficacy) in combination with trauma-related cognitions. Furthermore, in the present study, we examined AUD severity, number of drinking days, and PTSD symptom severity as covariates of the two pain outcomes. Examining other covariates (e.g., trauma types, depression severity) was beyond the scope of the present study but would be an important area for further exploration in future studies. We did not specifically recruit for participants with CP; the average level of pain disability in our sample was mild to moderate, which was consistent with acute musculoskeletal pain condition samples but lower than CP samples (Anagnostis et al., 2004). Recent epidemiological studies estimate that up to 65% of U.S. veterans experience CP (Nahin, 2017); many veterans in our sample are likely to have or be at risk for CP conditions. Finally, this study included primarily male

veterans with co-occurring PTSD and AUD; thus, results may need to be carefully considered for populations outside of this particular subgroup.

In conclusion, we found that negative trauma-related cognitions were associated with pain severity and pain disability, above and beyond variance explained by severity of PTSD and frequency of alcohol use in veterans with comorbid PTSD and AUD. Due to the unique association between negative trauma-related cognitions and pain, future studies should examine the impact of psychotherapies that address negative cognitions due to trauma (e.g., PE or CPT) as a potential avenue for parsimoniously reducing the negative functional impact of pain and potentially mitigating long-term disability.

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Table 1

Descriptive Statistics and Bivariate Correlations Between Pain-Related Disability, Pain Severity, Negative Trauma-Related Cognitions, Frequency of Alcohol Use, Posttraumatic Stress Disorder (PTSD) severity, and Alcohol Use Disorder (AUD) Severity

Variable	1.	2.	3.	4.	5.	6.	*M*	*SD*
1. Pain-related disability (PDQ)	-	.60***	.40***	.20*	.30***	−.02	55.02	39.47
2. Pain severity		-	.25**	.09	.10	−.08	3.65	1.21
3. Posttraumatic cognitions (PTCI)			-	−.01	.58***	.31***	139.47	36.55
4. Frequency of alcohol use (FDD)				-	.03	.12	68.09	56.04
5. PTSD severity (CAPS-5)					-	.42***	40.75	11.53
6. AUD severity (SCID-IV)							7.55	2.23

Note. PDQ = Pain Disability Questionnaire; PTCI = Posttraumatic Cognitions Inventory; FDD = frequency of days drinking; CAPS-5 = Clinician-Administered PTSD Scale for *DSM-5*; SCID-IV = Structured Clinical Interview for *DSM-IV*.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Hierarchical Regression Analysis for Variables Predicting Pain Severity

Variable	β	*B*	*SE*	*t*	*df*	*p*	ΔR^2
Step 1					136		.008
CAPS-5	.09	0.01	0.01	1.04		.300	
Step 2					135		.007
CAPS-5	.09	0.01	0.01	1.00		.317	
Alcohol use frequency (FDD)	.09	0.001	0.001	1.00		.321	
Step 3					134		.056*
CAPS-5	−.09	−0.01	0.01	−0.84		.403	
Alcohol use frequency (FDD)	.10	0.001	0.001	1.14		.258	
Trauma-related negative cognitions (PTCI)	.30	0.01	0.002	2.84		.005	
Total R^2 = .07							

Note. CAPS-5 = Clinician-Administered PTSD Scale for DSM; FDD = frequency of days drinking; PTCI = Posttraumatic Cognitions Inventory.

* $p < .05$.

Table 3

Hierarchical Regression Analysis for Variables Predicting Functional Impairment due to Pain

Variable	β	*B*	*SE B*	*t*	*df*	*p*	ΔR^2
Step 1					134		.088***
CAPS-5	.30	1.02	0.28	3.61		< .001	
Step 2					133		.329***
CAPS-5	.24	0.83	0.23	3.64		< .001	
Pain severity	.58	26.26	3.02	8.69		< .001	
Step 3					132		.020*
CAPS-5	.24	0.82	0.22	3.64		<.001	
Pain severity	.56	25.70	3.00	8.58		< .001	
Alcohol use frequency (FDD)	.14	0.10	0.05	2.15		.034	
Step 4					131		.027*
CAPS-5	.12	0.41	0.27	1.53		.130	
Pain severity	.52	23.83	3.02	7.88		< .001	
Alcohol use frequency (FDD)	.15	0.11	0.05	2.35		.020	
Trauma-related negative cognitions (PTCI)	.21	0.22	0.09	2.56		.012	
Total R^2 = .46							

Note. CAPS-5 = Clinician-Administered PTSD Scale for DSM; FDD = frequency of days drinking; PTCI = Posttraumatic Cognitions Inventory.

* $p < .05$.

*** $p < .001$.