HHS Public Access

Author manuscript

Psychiatry. Author manuscript; available in PMC 2016 May 16.

Published in final edited form as:

Psychiatry. 2015 ; 78(3): 277–287. doi:10.1080/00332747.2015.1069659.

Relations Between Pain, PTSD Symptoms, and Substance Use in Veterans

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Abstract

Objective—The frequent co-occurrence of posttraumatic stress disorder (PTSD) and chronic pain has received much attention in the literature. However, the extant literature is limited in that these investigations generally exclude patients with co-occurring substance use disorders (SUD). Thus, the present study investigated symptoms of PTSD and SUD in veterans with high and low pain symptoms.

Method—Veterans (*N* = 136) seeking treatment for comorbid symptoms of PTSD and SUD were recruited as part of a larger study. All participants completed a baseline assessment, which included a series of diagnostic interviews and self-report questionnaires measuring symptoms of pain, PTSD and SUD.

Results—Higher levels of self-reported pain were found to be associated with both self-reported and clinician-rated PTSD symptoms above and beyond the influence of the demographic variables. However, no reliable relations were demonstrated between substance use and pain.

Conclusions—Although preliminary, the findings highlight the common occurrence of chronic pain among veterans with comorbid PTSD/SUD, and the potential impact of pain on clinical presentation. The findings may help inform special considerations for assessment and treatment practices for this high-risk population.

Posttraumatic stress disorder (PTSD) and chronic pain are two conditions of tremendous significance, especially in veterans (Gupta, 2013; Otis et al., 2010; Otis, Keane, & Kerns, 2003; Shipherd et al., 2007). Lifetime prevalence of PTSD has been reported at 8.0% in the general U.S. population (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). Among combat veterans, the rate of lifetime PTSD is two to four times higher than the general population (Seal, Bertenthal, Miner, Sen, & Marmar, 2007). Chronic pain is found at even higher rates, with nearly 50% of veterans reporting frequent, chronic pain (Kerns, Otis, Rosenberg, & Reid, 2003; Otis et al., 2010). Not surprisingly, these two conditions are found to be highly comorbid. Kerns and colleagues (2003) reported that nearly half of veterans (*N* = 685) in a Veterans Affairs (VA) pain management program endorsed symptoms consistent

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There are no conflicts of interest to disclose.

with PTSD. Similarly, Shipherd and colleagues (2007) reported that two-thirds of patients with PTSD also reported chronic pain. These findings of high PTSD and pain comorbidity are consistent with previous literature in veteran and nonveteran samples (Asmundson, Norton, Allerdings, Norton, & Larsen, 1998; Sharp & Harvey, 2001).

Several hypotheses have been presented to explain the high levels of comorbidity between PTSD and chronic pain (Otis et al., 2010). These models have hypothesized the manner in which the two conditions interact. The mutual maintenance model suggests that there are multiple pathways in which PTSD and chronic pain may exacerbate and maintain symptoms of each other following trauma (Sharp & Harvey, 2001). The shared vulnerability model (Asmundson, Coons, Taylor, & Katz, 2002) and the triple vulnerability model (Keane & Barlow, 2002) suggest that shared underlying vulnerabilities may contribute to the development of the two conditions. The fear-avoidance model (Norton & Asmundson, 2003) suggests that interactions between feared stimuli, maladaptive beliefs of physiological arousal, and avoidance contribute to the development of the two conditions.

Several biological mechanisms also have been implicated in the comorbidity of PTSD and chronic pain, such as PTSD-associated alterations to the hypothalamic-pituitary-adrenal (HPA) axis and the sympatho-adrenal medullary axis affecting neuroendocrine and immune functioning (Gupta, 2013). Recent empirical research supports these hypotheses. For example, Liedl and colleagues (2010) demonstrated that PTSD arousal symptoms played a key role in the development and maintenance of chronic pain. Similarly, persistent pain was found to mediate the relations between reexperiencing, avoidance, and arousal symptoms of PTSD. Norman, Stein, Dimsdale, and Hoyt (2008) found that peritraumatic pain increased the risk for the development of PTSD by almost seven times eight months after experiencing the traumatic event. In addition, Defrin and colleagues (2008) demonstrated that participants with PTSD display higher pain thresholds but also perceive suprathreshold stimuli as more intense than participants with anxiety and healthy controls. In addition, from a medical treatment perspective, the early administration of morphine for trauma-related pain has been shown to reduce the risk of the development of PTSD (Holbrook, Galarneau, Dye, Quinn, & Dougherty 2010).

Of interest, the symptom presentation of patients with comorbid PTSD and chronic pain is more severe than of patients with either disorder alone (Otis et al., 2010; Shipherd et al., 2007; Villano et al., 2007). Villano and colleagues (2007) demonstrated higher ratings of psychiatric distress and lower ratings of mental health confidence in participants with comorbid PTSD and chronic pain than participants with PTSD or chronic pain alone. Participants with the comorbid presentation also were more likely to report a chronic medical condition and had lower ratings of positive affect. Otis and colleagues (2010) reported that participants with comorbid PTSD and chronic pain demonstrated significantly worse affective distress than participants with chronic pain alone. Similarly, Morasco and colleagues (2011) demonstrated that participants with comorbid chronic pain and PTSD endorsed greater pain severity and interference, had more symptoms of depression, and were more likely to endorse diagnostic criteria consistent with SUDs than participants with chronic pain alone. The authors also found that illness-focused pain coping and depressive symptoms mediated the relations between pain and PTSD in participants with chronic pain

(Morasco et al., 2011). Other studies have demonstrated more pain-related disability, higher pain ratings, increased functional impairment, higher rates of health care utilization, and increased health care costs among individuals with PTSD and chronic pain (Bosco, Gallinati, & Clark, 2013). However, one of the few studies of psychiatric symptoms failed to identify significant differences between patients with comorbid PTSD and chronic pain and patients with PTSD alone (Shipherd et al., 2007).

Despite the substantial literature on the prevalence and symptomatology of comorbid PTSD and chronic pain, very few studies have investigated the coping strategies employed by individuals with PTSD and chronic pain. This finding is surprising due to the significant literature on the use of substances to help cope with or self-medicate PTSD symptoms (McCauley, Killeen, Gros, Brady, & Back, 2012) and chronic pain (Morasco et al., 2011). One possible explanation is that the vast majority of studies on the comorbidity of PTSD and chronic pain exclude participants with SUDs (Moeller-Bertram, Keltner, & Strigo, 2012; Otis et al., 2010; Otis, Keane, Kerns, Monson, & Scioli, 2009; Villano et al., 2007). To date, only three studies to our knowledge have investigated PTSD, chronic pain, and SUDs (Morasco et al., 2011; Nazarian, Kimerling, & Frayne, 2012; Villano et al., 2007). Only one of these studies found differences in substance use between the comorbid group as compared to either of the single disorder groups (e.g., PTSD alone, chronic pain alone) (Morasco et al., 2013). However, Villano and colleagues (2007) was not specifically focused on SUD symptoms (i.e., limited measures and combined all substances into a single class), and Nazarian and colleagues (2012) involved a large review of medical records, limiting the sensitivity of the assessments involved. Together, these findings suggest that additional research is needed on PTSD, chronic pain, and substance use to better understand clinical presentation and treatment needs.

The present study sought to address clinically relevant gaps in the existing literature on the interaction between chronic pain, PTSD, and SUDs. The study involved a comprehensive baseline assessment of treatment-seeking veterans with symptoms of PTSD and SUD, who also completed measures of pain symptoms as part of a larger study on psychotherapy outcomes (Back et al., 2012). There were two primary goals of the current study. First, the study investigated the influence of comorbid chronic pain on affective symptoms in participants with symptoms of PTSD. Second, the study investigated the influence of comorbid chronic pain on substance use in participants with symptoms of PTSD (e.g., use/misuse of alcohol, stimulants, opiates, marijuana, and prescription drugs). Based on the limited, mixed findings in previous literature on PTSD and chronic pain, as well as literature on PTSD comorbidity with other disorders in veterans (Gros, Frueh, & Magruder, 2011; Gros, Price, Magruder, & Frueh, 2012), elevated affective symptoms and substance use behaviors were hypothesized to be associated with higher levels of self-reported pain.

METHOD

Participants

Veterans ($N = 136$) seeking treatment for comorbid PTSD and SUD were recruited via VA treatment clinics, newspaper and Internet advertisements, and flyers posted at local mental health clinics and colleges. Baseline inclusion criteria involved (a) veteran, reservist, or

member of the National Guard status, (b) 18 to 65 years old, (c) report of significant symptoms of PTSD and SUD, (d) report of use in the past 90 days, and (e) fluency in English. Baseline exclusion criteria included (a) report of current or history of psychotic or bipolar affective disorders; (b) report of current suicidal or homicidal ideation and intent; (c) report of current eating disorder or dissociative identity disorder; (d) individuals already participating in ongoing PTSD or SUD treatment; and (e) severe cognitive impairment as indicated by a Mini Mental Status Exam score ≤21. Data were collected as part of an ongoing National Institute on Drug Abuse (NIDA)-sponsored randomized controlled trial investigating the efficacy of an integrated psychosocial treatment for co-occurring PTSD and SUD among veterans (Back et al., 2012).

Procedures

Potential participants were given a full description of the study procedures and asked to read and sign an institutional review board–approved informed consent form before any study procedures or assessments were conducted. The baseline assessment involved semistructured clinical interviews, including the Clinician-Administered PTSD Scale (CAPS) to assess PTSD symptoms (Blake et al., 1995) and the Mini International Neuropsychiatric Interview (MINI) to assess SUD and other disorders (Sheehan et al., 1998). Participants also completed a series of self-report measures. The PTSD Checklist (PCL) (Weathers, Litz, Herman, Huska, & Keane, 1993), Beck Depression Inventory–II (BDI-II) (Beck, Steer, & Brown, 1996), and State-Trait Anxiety Inventory–Trait Version (STAI) (Spielberger, 1989) were used to assess symptoms of PTSD, depression, and anxiety, respectively. The Addictions Severity Index–Lite (ASI) (McLellan, Cacciola, Alterman, Rikoon, & Carise, 2006) and Timeline Follow-Back (TLFB) (Sobell & Sobell, 1992) were used to assess symptoms of SUD and SUD use in the past 60 days. The Patient Health Questionnaire (PHQ) (Kroenke, Spitzer, & Williams, 2002) was used to assess pain symptoms.

Measures

Diagnostics

Clinician-Administered PTSD Scale: The CAPS is a clinician-rated scale designed to diagnose current and lifetime PTSD (Blake et al., 1995). CAPS targets the 17 specific PTSD symptoms from the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (*DSM*-IV) to assess the intensity and frequency of each symptom on a 5-point Likert scale. CAPS was focused on the past month at baseline assessment. Providers of CAPS attended a two- to four-hour CAPS training, watched and corated at least two administrations of CAPS, administered at least two CAPS under the direct supervision of a corating supervisor, and demonstrated acceptable interrater reliability on their administrations. Although a full assessment of past trauma was completed, active combat-related PTSD was the focus of the symptom assessments and related diagnosis. CAPS has been shown to have adequate internal consistency, interrater reliability on the same interview, and test-retest reliability over different interviewers.

Mini International Neuropsychiatric Interview: The MINI is a clinician-rated structured diagnostic interview designed to provide a brief but accurate assessment of a wide range of

DSM-IV psychiatric disorders, including mood disorders, anxiety disorders, and substance use disorders (Sheehan et al., 1998). MINI was used to assess all of its targeted disorders with the exception of PTSD. Similar training procedures were used for MINI as were used for CAPS. MINI has demonstrated adequate interrater and test-retest reliability across most disorders, and specifically has shown good inter-rater reliability with other structured diagnostic interviews (Sheehan et al., 1998).

Substance Use

Addictions Severity Index–Lite: The ASI is a semistructured clinician-rated instrument that assesses seven functional domains related to addictions, including drug use, alcohol use, medical status, psychiatric status, family and social status, employment status, and legal status (McLellan et al., 2006). The ASI contains 111 items and is administered by a trained assessor. The ASI has demonstrated good psychometric properties in the literature, including internal consistency, intercorrelations between subscales, and comparable findings to the full ASI scale (Cacciola, Alterman, McLellan, Lin, & Lynch, 2007). For the purposes of the present study, only the psychiatric status, drug use, and alcohol use scales were investigated.

Timeline Follow-Back: The TLFB is a retrospective measurement of daily substance use (Sobell & Sobell, 1992). The measure is completed via a calendar format and at the direction of a trained assessor to enhance recall. In the present study, TLFB was used to assess the use/misuse of alcohol, stimulants (e.g., cocaine), opiates (e.g., heroin), marijuana, prescription drugs (e.g., prescription opioids, benzodiazepines, psychostimulants), and several other substances over the past 60 days. The TLFB has demonstrated good psychometric properties in the literature, including test-retest reliability, convergent and discriminant validity with other measures, and agreement with collateral informants and urine assays (Fals-Stewart, O'Farrell, Freitas, McFarlin, & Rutigliano, 2000).

Affective Symptoms

Beck Depression Inventory–Second Edition: The BDI-II is a 21-item self-report measure designed to assess the cognitive, affective, behavioral, motivational, and somatic symptoms of depression in adults and adolescents (Beck et al., 1996). Each item is rated on a 4-point Likert scale with different responses based on the targeted symptom content. BDI-II has demonstrated excellent test-retest reliability over a one-week interval, internal consistency, and convergent and discriminant validity in multiple samples (Beck et al., 1996).

PTSD Checklist: The PCL is a 17-item self-report measure designed to assess PTSD symptom severity related to military/combat-related trauma (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). Respondents are presented with 17 specific symptoms of PTSD and asked to rate "How much you have been bothered by that problem in the last month?" on a 5-point Likert scale. The PCL has been shown to have excellent internal consistency in veterans, victims of motor vehicle accidents, and sexual assault survivors, and it has shown excellent test-retest reliability in veterans. In addition, the PCL has demonstrated excellent convergent validity with alternative measures of PTSD.

State-Trait Anxiety Inventory–Trait: STAI is a measure of trait anxiety. The self-report scale consists of 20 items that are rated on a 4-point Likert scale. STAI has demonstrated good internal consistency, test-retest reliability, and convergent and discriminant validity (Spielberger, 1989).

Pain

Patient Health Questionnaire–Pain Scale: PHQ is a 15-item self-report measure designed to assess somatic symptoms. All items are rated on a 3-point Likert scale, ranging from 0 (*Not bothered at all*) to 2 (*Bothered a lot*). PHQ assesses several areas of pain, including stomach pain, back pain, arms/legs/joints pain, menstrual pain, headaches, chest pain, and pain during sexual intercourse (Kroenke et al., 2002). These pain items were used to create a pain sub-scale of the PHQ (PHQ-Pain). The PHQ-Pain scale evidenced a Cronbach's alpha of 0.54 and was correlated with the full PHQ at 0.87 and with the remaining items of the PHQ at 0.62.

Data Analysis

Of the initial 136 participants, 15 participants were excluded due to missing all data on the PHQ pain scale. All remaining participants were included in the analyses. A series of hierarchical regression analyses were conducted to identify the unique predictive effect of pain on affective symptoms and substance use. In the first step of each of these analyses, demographic variables (age, gender, race, relationship status, and employment status) were entered as covariates. PHQ-Pain was entered in the second step. The analyses were conducted multiple times, with each measure of affective symptoms (BDI, STAI, ASI-Psychiatric Status, CAPS, and PCL) and substance use (ASI-Alcohol Use, ASI-Drug Use, TLFB-Alcohol Use, TLFB-Stimulant Use, TLFB-Opiate Use, TLFB-Marijuana Use, TLFB-Prescription Drug Misuse) entered as a dependent variable.

RESULTS

Demographics of the Sample

The average participant was 41.3 years old (SD = 12.2), male (89.6%), White (53.4%) or Black (43.6%), unemployed (67.9%), served in the Army (62.6%), and received disability benefits from the VA (73.5%). The majority of participants were either married (30.6%) or divorced (44.0%). The average number of years of education was 13.8 years (SD = 1.8), and 38.1% had deployed to Operations Enduring Freedom, Iraqi Freedom, or New Dawn.

The majority of participants were diagnosed with PTSD (80.1%) and endorsed severe self-report symptoms of PTSD on the PCL (M = 59.6; SD = 12.8). The majority of participants also were diagnosed with alcohol dependence (82.2%) and reported 27.6 total days used within the past 60 days (SD = 23.2). A significant minority of participants (39.2%) also endorsed current substance dependence. Average PHQ-Pain scores were 7.4 (SD = 2.4) and were normally distributed within the sample (skewness = −0.09; kurtosis = −0.74).

Regression Analyses

In the first set of analyses (summarized in Table 1), pain was used to predict the scales assessing affective symptoms. The first step included demographics as predictors, which did not prove significant in the models (Fs < 2.0; ps > .09). The second step added pain symptoms as predictors and significantly increased the variance explained in models for PTSD (PCL and CAPS) (F_{change}s > 6.2; ps < .05). With the addition of the second step, pain symptoms emerged as a significant predictor of self-reported and clinician-rated PTSD symptoms in each of the models (ts > 2.4; ps < .05). The remaining models for overall psychiatric status (ASI), depressive symptoms (BDI), and trait anxiety (STAI) did not prove to be significant at the second step (Fs < 1.9; ps > .09). In a second set of analyses, demographic variables and pain symptoms were used to predict substance use symptoms. However, none of these models was significant at either step (Fs < 2.1; ps > .06).

DISCUSSION

The present study investigated symptoms of PTSD and SUD in veterans with pain symptoms. There were two primary sets of findings based on each of the study goals. First, in the investigation of the relations between affective symptoms and pain, higher levels of self-reported pain were associated with both self-reported and clinician-rated PTSD symptoms above and beyond the influence of the demographic variables. Second, in the investigation of the relations between substance use and pain, no reliable relations were demonstrated between these variables. Together, these findings highlight the significance of the presence of pain in the clinical presentation of PTSD and SUD symptoms and its potential relation to PTSD symptom severity.

There are several important findings to consider from the present study. The present findings are among the first to demonstrate a relation between heightened pain and PTSD symptoms. Previous studies have reported increased psychiatric distress (Otis et al., 2010; Villano et al., 2007) and functional impairment (Bosco et al., 2013); however, minimal differences in psychiatric symptoms were found (Shipherd et al., 2007). The difference in findings could be due in part to differences in methodologies between the studies. While the present study assessed self-reported and clinician-rated continuous PTSD symptoms and self-reported continuous pain symptoms during the baseline evaluation, Shipherd and colleagues (2007) relied on a retrospective chart review for the presence or absence of dichotomous chronic pain diagnoses and other comorbidities. The assessment practices in the present study likely improved our ability to detect differences. These findings are consistent with other comorbidity studies of PTSD, in which the presence of two or more disorders amplifies the symptoms of both conditions (Gros et al., 2011; Gros et al., 2012).

Another important finding involves SUD behaviors. As reviewed earlier, previous research on PTSD and pain either excluded participants with SUDs from their studies (Moeller-Bertram et al., 2012; Otis et al., 2010; Otis et al., 2009; Villano et al., 2007) or had significant limitations in their assessment practices (Nazarian et al., 2012; Villano et al., 2007). The lack of findings for alcohol use was surprising given the literature on SUDs in patients with PTSD symptoms (McCauley et al., 2012) and with chronic pain (Morasco et al., 2011). This finding may be related to a possible ceiling effect, as participants were

selected in part due to their problematic alcohol use. However, ultimately, no significant relations were found between pain and any of the substances, demonstrating a reliable pattern of findings.

Several implications can be drawn from the findings. From an assessment standpoint, clinics treating either PTSD and/or pain should be sensitive to the high rates of these overlapping conditions in their patients. Brief, self-report assessments for PTSD (e.g., PCL) and pain (e.g., PHQ-Pain) symptoms should be considered for incorporation into standard intake evaluations. This may be particularly important as the presence/absence of these conditions in chart reviews has not been shown to be sensitive to these effects (Nazarian et al., 2012; Shipherd et al., 2007).

From a treatment perspective, several options should be considered for patients with PTSD and high comorbidity. Several studies have made recommendations for the psychosocial treatment of comorbid PTSD and chronic pain (Bosco et al., 2013; McGeary, Moore, Vriend, Peterson, & Gatchel, 2011), including ways to incorporate interdisciplinary pain programs into evidence-based psychotherapy programs for PTSD (Bosco et al., 2013). Specific psychosocial treatment protocols have been developed to treat patients with comorbid PTSD and pain, including a combination of cognitive processing therapy for PTSD and cognitive behavioral therapy for chronic pain management (Otis et al., 2009) and behavioral activation psychotherapy (Plagge, Lu, Lovejoy, Karl, & Dobscha, 2013). Similar approaches involving stepped and/or collaborative care models have been investigated for comorbid depression and pain with some success (Kroenke et al., 2009; Thielke, Corson, & Dobscha, 2015).

There are several limitations in the methodology of the present study. First, the study involved a single assessment time point. Thus, the cross-sectional design limited our ability to investigate the relations between PTSD, SUDs, and pain over time. Second, the recruitment of treatment-seeking participants with problematic symptoms of PTSD and SUD may have limited the variability in the sample to detect the relations between pain and alcohol and other common substances of abuse. In addition, all participants were military veterans recruited for a clinical trial, so the findings may not generalize to all populations. Third, the study did not incorporate pharmacokinetic/pharmacodynamics information, and no data were available on the pain medication use or metabolism levels to determine their role on the relations between pain, PTSD, and substance use. Fourth, the measure of pain (PHQ) was not originally designed to investigate only pain, resulting in a subscale (PHQ-Pain) with less desirable psychometric properties, including its internal consistency and discriminant validity. A more specific measure of pain should be used in future research. Finally, the assessment tools focused on total days of use for the SUD behaviors and therefore were unable to provide other details on other use behaviors potentially associated with PTSD and pain. The time frames for the measures also varied slightly from measure to measure.

In summary, the present study investigated the relations between PTSD, SUD, and pain symptoms in veterans. Although preliminary, the findings are among the first to identify significant relations between PTSD symptoms and pain in PTSD/SUD patients. These

findings highlight the need to improve assessment and treatment practices for patients presenting in both PTSD and pain treatment settings to better identify and help this high-risk patient population.

Acknowledgments

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of NIDA, Department of Veterans Affairs, or the U.S. government.

FUNDING

This research was supported by NIDA grant DA021228 (PI: Back) and Department of Veteran Affairs CSR&D Career Development Award CX000845 (PI: Gros).

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TABLE 1

Hierarchical Regression Analysis Testing Pain Predicting Affective Symptoms

Step	Variable	*B*	SE	β	*t*	*F*	ΔR^2
Beck Depression Inventory–Second Edition							
1	Age	− 0.06	0.10	−.06	−0.58	0.72	.03
	Gender	2.20	3.60	.06	0.61		
	Race	− 0.98	1.29	−.07	−0.76		
	Relationship Status	− 1.19	1.38	−.08	−0.86		
	Employment Status	− 1.44	2.36	−.05	−0.61		
2	PHQ Pain Scale	0.64	0.47	.13	1.36	0.91	.02
State Trait Anxiety Inventory–Trait Version							
1	Age	− 0.11	0.09	−.12	−1.22	1.92	.08
	Gender	2.63	3.43	.07	0.77		
	Race	− 1.60	1.31	−.12	−1.22		
	Relationship Status	− 1.99	1.28	−.15	−1.56		
	Employment Status	− 0.43	2.20	−.02	−0.19		
2	PHQ Pain Scale	0.55	0.43	.12	1.27	1.88	.01
Addictions Severity Index–Psychiatric Status							
1	Age	0.01	0.01	.07	0.70	0.87	.038
	Gender	− 0.07	0.12	−.06	−0.56		
	Race	− 0.02	0.04	−.04	−0.39		
	Relationship Status	− 0.08	0.05	−.17	−1.77		
	Employment Status	0.04	0.08	.05	0.47		
2	PHQ Pain Scale	0.02	0.02	.13	1.33	1.03	.015
Clinician-Administered PTSD Scale							
1	Age	− 0.25	0.22	−.12	−1.12	0.98	.044
	Gender	1.39	7.96	.02	0.18		
	Race	− 4.28	3.21	−.13	−1.33		
	Relationship Status	3.96	3.15	.13	1.26		
	Employment Status	− 3.69	5.35	−.07	−0.69		
2	PHQ Pain Scale	3.16	0.99	.31	3.200**	2.60*	.085**

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Step	Variable	*B*	SE	β	*t*	*F*	ΔR^2
PTSD Checklist							
1	Age	− 0.05	0.11	− .05	−0.45	1.59	.065
	Gender	− 3.46	3.94	− .08	−0.88		
	Race	− 1.74	1.41	− .12	−1.24		
	Relationship Status	− 2.67	1.51	− .17	−1.77		
	Employment Status	0.05	2.58	.01	0.02		
2	PHQ Pain Scale	1.25	0.50	.24	2.49*	2.41*	.049*

Note. PHQ = Patient Health Questionnaire.

* $p < .05$;

** $p < .01$.