

A Cognitive Processing Therapy-Based Treatment Program for Veterans Diagnosed with Co-occurring Posttraumatic Stress Disorder and Substance Use Disorder: The Relationship Between Trauma-Related Cognitions and Outcomes of a 6-week Treatment Program

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HIGHLIGHTS

- Prior to treatment, dysfunctional trauma-related cognitions were associated with PTSD and depressive symptoms, and trauma-cued craving.
- Following treatment dysfunctional trauma-related cognitions, PTSD and depressive symptoms, and trauma-cued craving decreased.
- Decreases in dysfunctional trauma-related cognitions mediated the corresponding improvement in treatment outcomes upon program completion.
- Reductions in maladaptive trauma-related cognitions appear to play an important role in recovery from PTSD.
- CPT-based interventions that modify trauma-related cognitions can lead to desirable outcomes among veterans with co-occurring PTSD and SUD.

ABSTRACT

Dysfunctional trauma-related cognitions are important in the emergence and maintenance of posttraumatic stress disorder (PTSD) and the modification of such cognitions is a proposed mechanism of trauma treatment. However, the authors are not aware of any research examining trauma-related cognitions as a treatment mechanism in a sample of individuals with comorbid PTSD and substance use disorder (SUD). Accordingly, the present study sought to address this gap in the literature and examined the relationship between trauma-related cognitions and treatment outcomes within a sample of seventy-two veterans diagnosed with PTSD and SUD. Veterans completed a 6-week day CPT-based treatment program that included cognitive processing therapy as a central component. Measures of trauma-related cognitions, PTSD symptoms, depressive symptoms, and trauma-cued substance craving were completed at pre- and

post-treatment. As expected, trauma-related cognitions were associated with several PTSD-related variables prior to treatment. Furthermore, results of a within-subjects mediational analysis indicated that maladaptive trauma-related cognitions decreased during the treatment program and accounted for a significant portion of the variance in the reduction of PTSD and depressive symptoms at post-treatment. This study provides support for the position that attempts to modify dysfunctional trauma-related cognitions among veterans with co-occurring PTSD and SUD can lead to desirable treatment outcomes.

KEYWORDS

posttraumatic stress disorder; substance use disorders; cognitive processing therapy; mediation; veterans

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1. Introduction

Posttraumatic stress disorder (PTSD) is frequently comorbid with substance use in the general population (Kessler, Chiu, Demler, & Walters, 2005; Pietrzak, Goldstein, Southwick, & Grant, 2011) as well as in substance use treatment settings (Back et al., 2000; Brady, Back, & Coffey, 2004). Approximately 39% of individuals seeking treatment for a substance use disorder (SUD) meet current diagnostic criteria for PTSD at the time of treatment and 52% meet diagnostic criteria at some point during their lifetime (Reynolds et al., 2005). In addition to individuals seeking treatment for SUD, veterans are at an increased risk for developing both PTSD and SUD relative to the general population (McCauley, Killeen, Gros, Brady, & Back, 2012) and one study indicated that 41.4% of veterans with a SUD were also diagnosed with PTSD (Petrakis, Rosenheck, & Desai, 2011).

When PTSD and SUD co-occur, substance use treatment outcomes may be negatively impacted (Brady et al., 2004; Ouimette, Ahrens, Moos, & Finney, 1997). For example, individuals with comorbid PTSD and SUD reported higher levels of substance use, depression, and psychological distress following substance use treatment in comparison to individuals with SUD alone (Norman, Tate, Anderson, & Brown, 2007; Ouimette, Finney, & Moos, 1999). Although conventional substance use treatment is frequently successful in reducing substance use and related disability, PTSD symptoms often remain unaddressed (Mills, Teesson, Ross, & Darke, 2007). As a result, veterans with PTSD may continue to struggle even after the completion of substance abuse treatment. For example, Read, Brown, and Kahler (2004) found that a PTSD diagnosis functioned as a risk factor for substance abuse relapse six months following the completion of substance abuse treatment, as patients with unremitted PTSD demonstrated poorer outcomes in comparison to patients who demonstrated a change in PTSD

status. Considered together, these findings suggest that individuals with untreated symptoms of PTSD may continue to use substances in order to avoid, escape, or relieve distress evoked by trauma cues (Khantzian, 1997). Although this strategy may be effective for managing PTSD symptoms in the short-term, the repeated pairing of substance use with trauma cues may have long-term maladaptive consequences. Indeed, experimental models indicate that individuals with co-occurring PTSD and SUD may become classically conditioned by repeated pairings of trauma memories and substance use to the extent that these individuals experience increased substance craving in response to trauma cues (Coffey et al., 2002, 2010). Accordingly, trauma-related thoughts and memories are likely to play a key role in substance use initiation, maintenance, and relapse.

Cognitive processing therapy (CPT) is a widely-disseminated trauma-focused therapy that is efficacious for the treatment of PTSD in civilians, veterans, and active duty military personnel (Forbes et al., 2012; Resick et al., 2008, 2015). CPT is considered a first line treatment for PTSD and is one of two empirically-supported trauma-focused treatments offered to veterans through the Veterans Affairs Healthcare System (VA; Chard, Ricksecker, Healy, Karlin, & Resick, 2012; Karlin et al., 2010). A growing body of research indicates that participants who receive CPT consistently report improvements in PTSD symptomatology as well as co-occurring symptoms such as anxiety, depression, and social adjustment that are significantly greater than those reported by participants assigned to wait-list and active control conditions (Forbes et al., 2012; Monson et al., 2006; Resick et al., 2008). Furthermore, treatment-related improvements in PTSD and related symptoms appear to be enduring, as participants who received CPT maintained reductions in PTSD and related symptomatology five to ten years after the end of treatment (Resick, Williams, Suvak, Monson, & Gradus, 2012).

CPT is built upon a large body of research that has implicated trauma-related cognitions in the emergence and maintenance of PTSD (Brewin & Holmes, 2003; Dagleish, 2004). Specifically, CPT is based on the theory that PTSD symptomatology is driven by difficulty in altering pre-existing schemas to appropriately accommodate trauma-related information. Accordingly, individuals diagnosed with PTSD develop negative trauma-related beliefs as they interpret information about the trauma within the context of existing schemas (i.e. assimilation) or make extreme and unrealistic changes in their beliefs (i.e., overaccommodation). Consequently, CPT attempts to teach individuals to identify and challenge dysfunctional trauma-related thoughts and beliefs (Resick, Monson, & Chard, 2014). In support of this approach, recent research indicates that reductions in dysfunctional trauma-related cognitions are associated with subsequent reductions in PTSD symptomatology (Kleim et al., 2013; McLean, Su, & Foa, 2015; Scher, Suvak, & Resick, 2017) and depressive symptoms to a lesser degree (Zalta et al., 2014). Accordingly, reductions in maladaptive cognitions may function as an important mechanism for change in both cognitive and behavioral interventions for PTSD (Scher et al., 2017).

Despite the widespread implementation of CPT and high rates of substance abuse and PTSD among veterans (McCauley et al., 2012; Petrakis et al., 2011), only two studies have examined the efficacy of CPT among veterans diagnosed with comorbid PTSD and SUD. An examination of veterans with PTSD who participated in a six-week residential group CPT treatment program revealed that CPT was equally effective for veterans with and without a comorbid SUD (McDowell & Rodriguez, 2013). Further, Kaysen et al. (2014) reviewed the charts of veterans diagnosed with PTSD who received at least 1 session of CPT. Results indicated that veterans with co-occurring PTSD and alcohol use disorder (AUD) initially

presented with more severe symptoms relative to veterans with PTSD only. Despite these initial differences, CPT produced significant reductions in PTSD symptomatology and depression over time regardless of alcohol use status (Kaysen et al., 2014).

Although preliminary evidence indicates that CPT is effective in reducing PTSD symptomatology and depression in veterans even when these symptoms are comorbid with SUD (Kaysen et al., 2014; McDowell & Rodriguez, 2013), researchers have just begun to study the effectiveness of CPT for co-occurring PTSD and SUD. Specifically, research is needed to examine the impact of CPT on substance use symptoms. Accordingly, the purpose of the present study was to determine whether veterans diagnosed with co-occurring PTSD and SUD who completed a CPT-based treatment program demonstrated decreases in PTSD symptomatology and substance use craving at post-treatment. Additionally, the present study sought to examine whether trauma-related cognitions functioned as a mechanism of change for PTSD-relevant treatment outcomes. We hypothesized that: (a) trauma-related cognitions would be positively correlated with PTSD symptoms, substance use craving, and depressive symptoms at pre-treatment; (b) veterans would demonstrate significant reductions in trauma-related cognitions, PTSD symptomatology, depressive symptoms, and substance craving from pre- to post-treatment; and (c) changes in dysfunctional trauma-related cognitions would mediate changes in PTSD symptomatology, depressive symptoms, and substance craving from pre- to post-treatment.

2. Method and Materials

2.1 Participants

Potential participants included a total of 95 military veterans who were referred to a PTSD/SUD clinic at a southeastern VA medical center. Participants were recruited at the time of enrollment into a 6-week CPT-based residential day-treatment program within the PTSD/SUD clinic. All veterans met Diagnostic and Statistical Manual of Mental Disorders (4th ed., text revision; DSM-IV-TR; American Psychiatric Association, 2000) diagnostic criteria for both PTSD and SUD, as assessed via the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) prior to treatment. Of the 95 veterans who enrolled in the treatment program, 23 (24.2%) did not complete post-treatment assessments. Because the goal of the present study was to investigate changes in dysfunctional trauma-related cognitions as a mediator of change in treatment outcomes, the present analyses only included the 72 veterans who completed the entire 6-week program and post-treatment assessment.

2.2 Procedure

Participants completed demographic and substance use questionnaires along with pre- and post-treatment questionnaires to assess trauma-related thoughts and beliefs, depressive symptoms, trauma-cued craving, and PTSD symptoms as part of a larger program evaluation and treatment outcomes study. Veterans provided informed consent prior to participating in the study and approval was obtained from The G.V. (Sonny) Montgomery VA Medical Center Institutional Review Board.

2.3 Intervention

Veterans attended a 6-week CPT-based day treatment program that consisted of approximately 4–5 h of daily treatment activities. As part of the program, veterans were offered housing to reduce travel burden. CPT (Resick et al., 2014) was the central component of the

treatment program. CPT is a 12-session, manualized treatment for PTSD that places an emphasis on restructuring dysfunctional trauma-related cognitions, or stuck points, that are posited to maintain PTSD symptoms. Furthermore, CPT facilitates emotional processing of the traumatic event (Resick & Schnicke, 1992). In the present study, CPT-based content was delivered in the combined individual and group format detailed in the treatment manual (Resick et al., 2014). Although the treatment program was largely based on the work of Resick et al. (2014), veterans were scheduled to attend three sessions per week for a total of 15 individual and group sessions rather than the 12 sessions utilized with traditional CPT. Following session 12, treatment emphasized content developed by the corresponding author that focused on challenging unresolved stuck points related to trauma and substance use.

In addition to CPT-based content, veterans attended Alcoholics Anonymous (AA) meetings (three times per week), a family group discussing the impact of PTSD/SUD on family processes (once per week), and a group that focused on co-occurring PTSD/SUD and the connection between the two disorders (four times per week). Topics presented in the PTSD/SUD group included: (a) differences between PTSD and SUD triggers and how to effectively manage each; (b) cognitive-behavioral therapy (CBT) for relapse prevention (Monti, Kadden, Rohsenow, Cooney, & Abrams, 2002) addressing craving/trigger management, anger management, mood improvement, and assertiveness; (c) motivational enhancement; and (d) various modules of Seeking Safety (Najavits, 2002) to elicit discussion of the relationship between PTSD and SUD.

2.4 Measures

2.4.1 Baseline measures

In addition to a demographics questionnaire, the following measures were administered prior to treatment.

The MINI (Sheehan et al., 1998) is a widely used psychodiagnostic interview that assesses DSM-IV-TR diagnostic criteria for mood, anxiety, and SUDs. In the present study, the PTSD and substance use modules of the MINI were used to screen for the presence of PTSD and SUDs (including alcohol, illicit substances, and legal substances that were not used as prescribed).

The Brief Addiction Monitor (BAM; Cacciola et al., 2013) is a 17-item measure that was used to assess frequency of substance use over the month prior to treatment.

2.4.2 Outcome measures

Trauma-related thoughts and beliefs were assessed using the 36-item Posttraumatic Cognitions Inventory (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). The PTCI is composed of three subscales: negative cognitions about the self, negative cognitions about the world, and self-blame as well as a total negative cognitions score that is the sum of the three subscales. Items are rated on a 7-point Likert-type response scale (1 = “totally disagree”, 7 = “totally agree”). Subscale scores are calculated by summing the items that compose each subscale with higher scores indicating a tendency to think negatively. The PTCI has demonstrated good consistency, test-retest reliability, and validity (Foa et al., 1999). In the current sample, internal consistency (Cronbach’s alpha) across subscales was excellent at both time points ($\alpha = 0.94$ and 0.96).

Self-reported PTSD symptoms were assessed using the Posttraumatic Stress Disorder Checklist – Specific (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993). The PCL-S is a 17-item self-report measure that is based on DSM-IV criteria. Items are rated on a 5-point Likert-type response scale (1 = “not at all”, 5 = “extremely”) according to how much they bother the

respondent and assess each of the PTSD symptom clusters (avoidance, hyperarousal, intrusions, and numbing; King, Leskin, King, & Weathers, 1998; Yufik & Simms, 2010). The PCL is one of the most commonly administered self-report measures of PTSD and has demonstrated excellent psychometric properties in a variety of populations (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Ruggiero, Del Ben, Scotti, & Rabalais, 2003). For the present study, internal consistency was acceptable at both time points ($\alpha = 0.81$ and 0.94).

Depressive symptoms were assessed using the Beck Depression Inventory-II (BDI-II). The BDI-II is a commonly used 21-item self-report measure that assesses the presence and severity of depressive symptoms. Items are rated on a 4-point Likert-type response scale that ranges from (0 = “not at all”, 3 = “severely”). Scores are summed to calculate a total score. The BDI-II has demonstrated good reliability and validity (Beck, Steer, & Brown, 1996). Cronbach’s alpha was excellent at pre- and post-treatment in the present study ($\alpha = 0.91$ and 0.93 , respectively).

Finally, craving for alcohol and/or drugs was assessed using the Craving Questionnaire – Short Form Revised (CQSFR) which was adapted from the Alcohol Craving Questionnaire – Short Form Revised (ACQ-Now-SF-R; Singleton, Tiffany, & Henningfield, 1995). In the present study, veterans completed the CQSFR immediately after they provided a detailed verbal description of their primary traumatic event. Thus, the CQSFR assessed trauma-cued craving. The CQSFR is a 12-item questionnaire designed to measure self-reported craving symptoms in the present moment. The original questions on the ACQ-Now-SF-R were modified by adding the assessment of drug craving in addition to alcohol craving. Veterans indicated the degree to which they agreed with each statement along a 7-point Likert-type scale ranging from “strongly disagree” to “strongly agree.” Scores were summed to calculate a total score. For the present study, internal consistency was good at both time points ($\alpha = 0.83$ and 0.84).

2.5 Data analytic strategy

Descriptive statistics (means, standard deviations [SD], frequencies, percentages) were used to describe the sociodemographic and baseline characteristics of this sample. Analyses of variance and chi-square tests were used to examine differences between veterans who did and did not complete the program and/or post-treatment assessment. In order to evaluate the relationship between trauma-related cognitions and PTSD symptoms, depressive symptoms, and substance craving at pre-treatment, correlational analyses were conducted using Pearson bivariate correlations.

Next, to test the main hypothesis that changes in trauma-related cognitions mediated the effect of the CPT-based treatment program on veteran’s PTSD symptomatology, depressive symptoms, and substance craving, we implemented a causal steps within-subjects mediational approach described by Judd, Kenny, and McClelland, (2001) and expanded upon by Montoya and Hayes (2017). The mediation and moderation analysis for repeated measures design (MEMORE; Montoya & Hayes, 2017) macro was used to estimate direct and indirect effects of the independent variable (X) on dependent variables (Y) through a mediator (M) using SPSS (SPSS Inc., Chicago, IL). To determine whether trauma-related cognitions functioned as a mediator in the present models, the MEMORE SPSS macro computed the difference between means of the mediator (M) at pre- and post-treatment and the difference between measurements of each dependent variable (Y) at pre- and post-treatment (see Montoya & Hayes, 2017 for a detailed description). Given that all participants in the present study completed the same intervention and were assessed at pre- and post-treatment, the independent variable (X) is the

passage of time and corresponds to the intervention period. Accordingly, path a in Fig. 1, Fig. 2, Fig. 3 is the mean difference in M between the two time points and is interpreted as the effect of the CPT-based treatment program on trauma related cognitions (PTCI scores). Further, path b in Fig. 1, Fig. 2, Fig. 3 is the average effect of M on Y across the two time points (or the effect of the difference between the two M measurements on the difference between Y measurements) and can be interpreted as the effect of changes in trauma related cognitions on each of the outcome measures. Based on these calculations, it is possible to determine the indirect effect of the CPT-based treatment program on PTSD symptomatology, depressive symptoms, and substance craving through trauma related cognitions (X-M-Y) by examining the product of $a*b$.

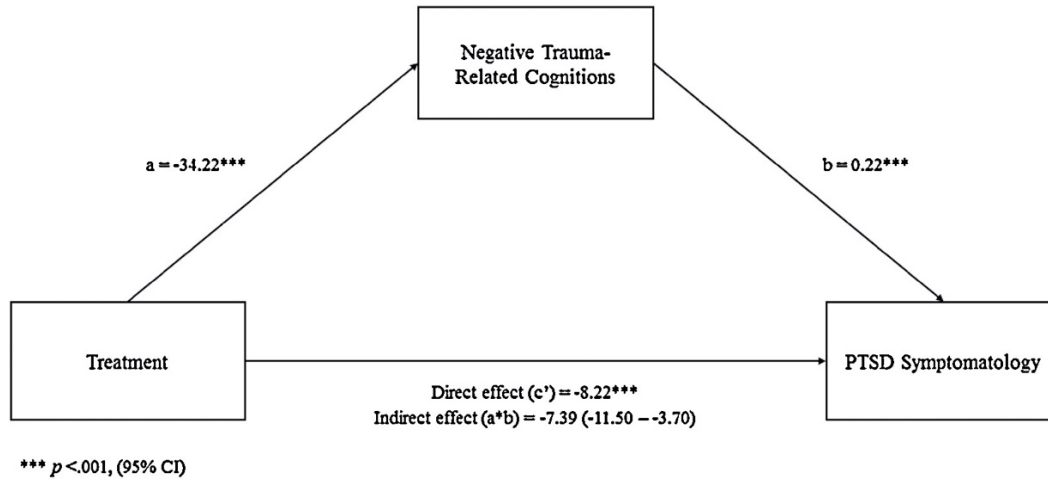


Fig. 1. Within-subjects mediation outcomes for reduced PTSD symptomatology by reductions in negative trauma-related cognitions.

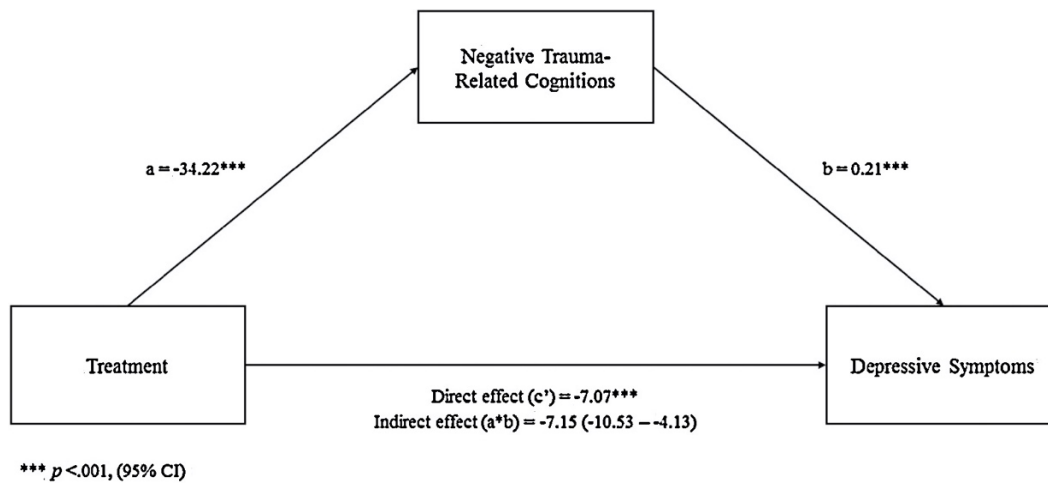


Fig. 2. Within-subjects mediation outcomes for reduced depressive symptoms by reductions in negative trauma-related cognitions.

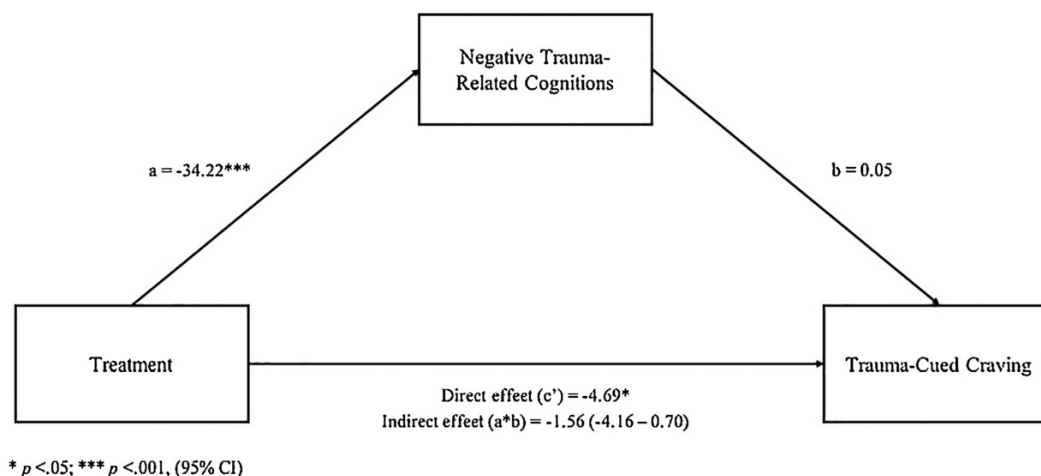


Fig. 3. Within-subjects mediation outcomes for reduced trauma-cued craving by reductions in negative trauma-related cognitions.

In the present models, a significant indirect (or mediational) effect would indicate that completion of the CPT-based treatment program was associated with reductions in dysfunctional trauma-related cognitions that were in turn associated with corresponding reductions in PTSD symptoms, depressive symptoms, or trauma-cued craving. The significance of the indirect effect was tested by utilizing a bootstrapping approach in which 5000 samples were taken from the original data set via random sampling with replacement. The result was an empirically derived sampling distribution of the indirect effect in which the upper and lower bounds of the 95% confidence interval (95% CI) matched the 2.5% and 97.5% points of the sampling distribution. A significant indirect effect is indicated when the CIs do not contain zero.

3. Results

3.1 Demographics

Participants included 71 men (98.6%) and 1 woman (1.4%), who were on average 49.26 ($SD = 10.56$) years of age. The majority of participants identified as Black ($n = 50$; 69.4%) and 51.4% of veterans in our sample were service connected. In terms of military experience, veterans served in a variety of conflicts including 21 (29.2%) in Vietnam, 25 (34.7%) in post-Vietnam, 15 (20.8%) in the Persian Gulf, and 10 (13.9%) in Operation Iraqi Freedom (OIF), Operation Enduring Freedom (OEF), or Operation New Dawn (OND). Many veterans included in the sample (48.6%) sought treatment for combat-related trauma; however, veterans also sought treatment for the following non-combat-related traumas: assault during adulthood (11.1%), military sexual trauma (5.6%), childhood physical/sexual abuse (5.6%), and a variety of other traumatic experiences that occurred throughout the lifespan (29.1%). Regarding past year MINI SUD diagnosis, 47 (65.3%) met diagnostic criteria for AUD, 22 (30.6%) met criteria for cocaine use disorder, 17 (23.6%) met criteria for cannabis use disorder, 6 (8.3%) met criteria for opiate use disorder, 4 (5.6%) met criteria for amphetamine use disorder, and 1 (1.4%) met criteria for anxiolytic use disorder. On average, veterans met criteria for 1.35 ($SD = 1.08$) SUD diagnoses at baseline. At baseline, when Veterans were asked about substance use during the past 30 days, 22 (30.6%) endorsed alcohol use and 16 (22.2%) endorsed the use of illicit drugs or the misuse of prescription medications. Additional demographic and clinical data are provided on Table 1.

Table 1
Participant Demographic and Baseline Characteristics (n = 72).

Characteristic	Mean (SD) or Number (%)
Age years, mean (SD)	49.26 (10.56)
Education years, mean (SD)	13.24 (1.97)
Gender male	71 (98.6%)
Race	
White	21 (29.2%)
Black	50 (69.4%)
Hispanic	1 (1.4%)
Employment Status	
Currently employed	9 (12.5%)
Unemployed	27 (37.5%)
Disabled	29 (40.3%)
Retired	7 (9.7%)
Marital Status	
Never married	15 (20.8%)
Married	13 (18.1%)
Separated, widowed, or divorced	44 (61.1%)
Primary Trauma	
Combat	35 (48.6%)
Non-combat	37 (51.4%)
Years Served in Military	6.79 (5.71)
Service Connected	37 (51.4%)
Military Branch	
Army	44 (61.1%)
Navy	8 (11.1%)
Marines	5 (6.9%)
Air Force	7 (9.7%)
National Guard	8 (11.1%)

Note. SD = standard deviation.

There were no significant baseline group differences between veterans who completed ($N = 72$) and did not complete ($N = 23$) post-treatment assessments for the following demographic and outcome variables: age [$t(93) = .68, p = .50$], ethnicity [$\chi^2(1, N = 95) = 0.43, p = .81$], marital status [$\chi^2(1, N = 95) = 0.66, p = .99$], type of trauma [$\chi^2(1, N = 95) = 0.44, p = .51$], years of military service [$t(92) = .16, p = .87$], service connected status [$\chi^2(1, N = 95) = 0.44, p = .51$], employment status [$\chi^2(1, N = 94) = 1.12, p = .29$], current substance use [$\chi^2(1, N = 95) = 1.27, p = .26$], PTCI score [$t(84) = .90, p = .37$], PCL total score [$t(92) = .30, p = .77$], PCL Avoidance subscale [$t(92) = .52, p = .61$], PCL Hyperarousal subscale [$t(92) = .02, p = .98$], PCL Intrusion subscale [$t(92) = .30, p = .77$], PCL Numbing subscale [$t(92) = .68, p = .50$], BDI-II score [$t(92) = .80, p = .43$], and CQSFR score [$t(92) = 1.75, p = .08$].

3.2 Relationship between trauma-related cognitions, depression, substance use, and PTSD symptomatology

To examine the relationship between trauma-related cognitions and other PTSD-relevant variables, Pearson bivariate correlations were conducted using data collected prior to treatment (see Table 2). As expected based on prior research (Kleim et al., 2013; McLean et al., 2015; Scher et al., 2017; Zalta et al., 2014), results indicated that there were significant positive correlations (all p 's < .05) between dysfunctional trauma-related cognitions and PTSD symptomatology, depressive symptoms, and trauma-cued craving. Dysfunctional trauma-related cognitions were significantly (all p 's < .05) and positively correlated with several PCL subscales,

including hyperarousal, intrusion, and numbing. However, dysfunctional trauma-related cognitions were not significantly associated with the avoidance subscale of the PCL ($p = .07$). Apart from trauma-cued craving, dysfunctional trauma-related cognitions were not significantly correlated with any substance use variables (all p 's $> .05$). Means and standard deviations at admission and discharge for all outcome measures are presented in Table 3.

Table 2
Bivariate Correlation Coefficients between Baseline Study Measures.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. PTCI	–	–	–	–	–	–	–	–	–	–	–
2. PCL – Total	.61***	–	–	–	–	–	–	–	–	–	–
3. PCL – Avoidance	.21	.45***	–	–	–	–	–	–	–	–	–
4. PCL – Hyperarousal	.52***	.84***	.26*	–	–	–	–	–	–	–	–
5. PCL – Intrusion	.27*	.78***	.27*	.58***	–	–	–	–	–	–	–
6. PCL – Numbing	.66***	.73***	.22	.46***	.29*	–	–	–	–	–	–
7. BDI – II	.75***	.55***	.17	.48***	.25*	.58***	–	–	–	–	–
8. CQSFR	.25*	.20	.07	.12	.16	.19	.18	–	–	–	–
9. Total SUD Diagnoses	–.05	.07	.16	.03	–.01	.08	–.07	.11	–	–	–
10. BAM – Days Drinking	–.04	.08	.02	.03	.09	.08	.09	.28*	.29*	–	–
11. BAM – Days Using Illegal Drugs or Prescriptions	.08	.13	–.08	.10	.04	.21	.17	.18	.30**	.61***	–

Note. PTCI = Posttraumatic Cognitions Inventory; PCL = Posttraumatic Stress Disorder Checklist; BDI = Beck Depression Inventory – II; CQSFR = The Craving Questionnaire – Short Form Revised; SUD = substance use disorder; BAM = Brief Addiction Monitor.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3
Baseline and Post-Treatment Levels of Negative Trauma-Related Cognitions, PTSD Symptomatology, Depressive Symptoms, and Substance Use.

	Baseline <i>M</i> (<i>SD</i>)	Post-treatment <i>M</i> (<i>SD</i>)	Statistical comparison (paired samples t-test)
PTCI	146.58 (34.99)	112.36 (37.45)	$t(71) = 7.16^{***}$
PCL-Total	66.42 (8.92)	50.81 (14.49)	$t(71) = 8.69^{***}$
PCL-Avoidance	8.72 (1.36)	6.40 (2.32)	$t(71) = 7.84^{***}$
PCL-Hyperarousal	20.15 (3.46)	16.00 (4.39)	$t(71) = 6.97^{***}$
PCL-Intrusion	19.60 (3.53)	15.17 (4.74)	$t(71) = 7.31^{***}$
PCL-Numbing	17.94 (3.63)	13.24 (5.03)	$t(71) = 7.81^{***}$
BDI-II	30.53 (11.42)	16.31 (11.37)	$t(71) = 9.86^{***}$
CQSFR	32.01 (14.69)	25.76 (12.77)	$t(71) = 3.91^{***}$

Note. PTCI = Posttraumatic Cognitions Inventory; PCL = Posttraumatic Stress Disorder Checklist; BDI-II = Beck Depression Inventory - II; CQSFR = The Craving Questionnaire – Short Form Revised.

*** $p < .001$.

3.3 Trauma-related cognitions as a mediator of treatment outcome

3.3.1 PTSD symptomatology (PCL-S)

First, results indicated that veterans reported significantly fewer dysfunctional trauma-related cognitions following completion of the CPT-based treatment program, such that PTCI scores decreased by more than 34 points on average ($\beta = -34.22$, $SE = 4.78$, 95% CI = -43.75 , -24.69 ; see Fig. 1). Additionally, the treatment program was associated with significant reductions in PTSD symptomatology such that veterans reported post-treatment PCL-S scores that were approximately 15 points lower on average (PCL-S; $\beta = -15.61$; $SE = 1.80$; 95% CI =

–19.19, –12.03) compared to PCL-S scores reported at enrollment. Most relevant to the mediation hypothesis, the indirect pathway ($a*b$ pathway) was significant ($\beta = -7.39$, $SE = 1.99$, 95% CI = –11.50, –3.70). The present findings support the mediational hypothesis and indicate that trauma-related cognitions not only decreased during the treatment program, but also accounted for a significant portion of the variance in the reduction of PTSD symptomatology at the end of treatment.

3.3.2 Depressive symptoms (BDI-II)

As above, results indicated that veterans reported significantly fewer dysfunctional trauma-related cognitions following the completion of the CPT-based treatment program. In addition, there was a significant total treatment effect for depressive symptoms such that BDI-II scores decreased by more than 14 points on average ($\beta = -14.22$, $SE = 1.44$, 95% CI = –17.10, –11.35) from pre- to post-treatment. The indirect effect was also significant ($\beta = -7.15$, $SE = 1.63$, 95% CI = –10.53, –4.13), consistent with hypotheses that positive changes in trauma-related thoughts and beliefs accounted for a significant proportion of the variance in the reduction of depressive symptoms at the end of treatment (Fig. 2).

3.3.3 Trauma-cued craving (CQSFR)

Results of the third model indicated that veterans reported significant reductions in trauma-cued craving, such that scores on the CQSFR decreased by more than 6 points on average ($\beta = -6.25$, $SE = 1.60$, 95% CI = –9.44, –3.06) from pre- to post-treatment. However, unlike the two previous models, the indirect effect was non-significant ($\beta = -1.56$, $SE = 1.24$, 95% CI = –4.16, 0.70). Thus, the present findings indicate that trauma-related cognitions did not mediate the relationship between the CPT-based treatment program and reductions in trauma-cued cravings for substances.

4. Discussion

The purpose of the present study was to evaluate the role of changes in trauma-related thoughts and beliefs in treatment outcomes for a sample of veterans diagnosed with co-occurring PTSD and SUD ($N = 72$) who completed a CPT-based treatment program. Consistent with previous research (Scher et al., 2017; Zalta et al., 2014), results of this study demonstrated a significant relationship between dysfunctional trauma-related cognitions and treatment outcomes, including PTSD symptomatology and depressed mood. Furthermore, results indicated that veterans reported significant decreases in dysfunctional trauma-related cognitions after completing a 6-week CPT-based treatment program, and that this decrease was a significant mediator of the corresponding improvement in treatment outcomes (i.e., PCL symptomatology and depressed mood) upon program completion. The current findings underscore the important role of trauma-related cognitions in PTSD treatment outcomes for veterans.

As predicted, the results of the present study parallel the findings of Kaysen et al. (2014) and provide further support for the utility of CPT-based interventions for reducing both PTSD symptomatology and depressive symptoms for veterans with co-occurring PTSD and SUD. Together, these findings suggest that CPT-based interventions are not only tolerated in a comorbid population, but are in fact associated with a decrease in PTSD symptoms. Furthermore, the finding that depressive symptoms improved following treatment suggests that components of the CPT-based treatment program, such as cognitive restructuring may generalize and benefit patients with comorbid depressive disorders. To the authors' knowledge, the present study is the first to examine the effect of a CPT-based intervention on trauma-cued substance craving. Veterans in the present sample reported significant reductions in trauma-cued craving at post-

treatment. As such, CPT-based interventions may address symptoms that perpetuate both PTSD and substance use symptoms. Furthermore, the finding that the intervention was associated with decreased craving at post-treatment directly contradicts the long-held belief that the intensity of trauma-focused treatment will lead to a worsening of substance craving. Although the treatment program incorporated activities that are not included in traditional CPT (e.g., AA meetings and CBT for relapse prevention), it should be noted that the majority of clinical activities were comprised of CPT sessions and homework assignments. Therefore, it seems likely that CPT-based treatment components significantly contributed to improvements in substance use symptomatology. Future studies may empirically examine the unique effects of the traditional CPT protocol on substance use symptoms by comparing the effects of traditional CPT with CPT plus substance use treatment.

When considered in conjunction with previous research, the present findings suggest that CPT-based treatments are effective for veterans with co-occurring PTSD and SUD. Given that the completion of CPT-based treatments is associated with a wide-range of positive outcomes, veterans with comorbid PTSD and SUD should be encouraged to enroll in such treatment. Furthermore, treatment providers should not be hesitant to refer veterans with PTSD for CPT-based interventions, even if the veteran endorses current substance use or a history of substance abuse.

The finding that reductions in dysfunctional trauma-related cognitions served as a mechanism of change in a CPT-based treatment program for PTSD and SUD is consistent with previous clinical research (Kleim et al., 2013; McLean et al., 2015; Scher et al., 2017) and theoretical models of PTSD (Foa, Steketee, & Rothbaum, 1989). Taken together, these findings suggest that this CPT-based program likely contributed to improvements in treatment outcomes, in part because CPT-based content facilitates the modification of dysfunctional cognitions. Although the importance of trauma-related cognitions in PTSD treatment is well-documented, the present findings address an important gap in the literature by extending these findings to a sample of trauma-exposed veterans with co-occurring SUD. Because maladaptive trauma-related cognitions functioned as a mediator of change in PTSD and depressive symptoms, our data indicate that veterans with SUDs are capable of coping with distress, engaging with and modifying maladaptive trauma-related cognitions, and developing more adaptive coping mechanisms despite the neurological changes (e.g., impaired processing speed and working memory) that commonly result from extensive substance use (Ouimette, Goodwin, & Brown, 2006; Rosenbloom, Pfefferbaum, & Sullivan, 2004).

Although CPT does not traditionally directly address symptoms of substance abuse, previous research indicates that negative self-perception, negative beliefs about the world, and self-blame are significantly associated with the intensity of substance craving in males with co-occurring PTSD and AUD (Jayawickreme, Yasinski, Williams, & Foa, 2012). Contrary to our hypothesis, changes in trauma-related cognitions did not function as a mediator of treatment-related improvements in trauma-cued substance craving. Though the CPT-based program was associated with reductions in trauma-cued craving, these reductions may be mediated by other factors. For example, reductions in substance craving that occur with cognitive interventions for PTSD and SUD may result from changes in expectancies for drug use (e.g., “I expect to feel less depressed when I drink” or “I expect to feel lousy the day after I drink”; Marlatt, 1978; Marlatt & Gordon, 1985).

Regarding the magnitude of improvement in PTSD symptomatology, reductions in PCL scores are similar to those previously reported in a trial of CPT for military-related trauma

(Forbes et al., 2012). Furthermore, Monson et al. (2008) reported that a 10 point reduction represents clinically significant improvement on the PCL. In addition, prior research suggests that a 17.5% reduction in scores from baseline corresponds to minimally important clinical difference on the BDI-II (Button et al., 2015). Veterans in the present sample reported average reductions of 15.61 points on the PCL-S and 14.22 points on the BDI-II that corresponded to 23.5% and 46.6% reductions, respectively. Thus, veterans in the present sample reported significant decreases in treatment outcomes. An additional strength of the present study was the racial diversity of the sample. In the current sample, more than half of the participants self-identified as black. As such, the present study replicates the findings of previous studies (Forbes et al., 2012; Resick et al., 2015) in a more diverse veteran sample. Despite the racial diversity of the veterans enrolled in the treatment program, the present sample was overwhelmingly composed of male veterans. Thus, future research is needed to examine the effects of CPT for co-occurring PTSD and SUD among female veterans. Despite the significant strengths of the present study, several limitations are worth bearing in mind. First, a number of veterans dropped out of treatment, and therefore were not included in the analyses. As such, estimates of the effect of the CPT-based treatment program may be inflated. However, it should be noted that the purpose of this study was to assess whether changes in dysfunctional trauma-related cognitions would mediate changes in PTSD symptomatology, depressive symptoms, and substance craving following completion of a CPT-based treatment, or a full dose of treatment that is expected to facilitate decreased maladaptive cognitions. Further, preliminary analyses indicated that treatment completers and non-completers did not differ significantly on any demographic characteristics or baseline measures of PTSD symptoms, depression, or trauma cued craving. Thus, the results of the present study provide a valuable starting point for future research efforts by highlighting the potential benefits of CPT-based programming for veterans with comorbid PTSD and SUD when they receive an adequate dose of treatment. Future studies should expand on these findings by utilizing randomized-controlled designs and intention-to-treat analyses, to better understand the unique effects of CPT in this dually diagnosed population of veterans. Additional efforts are needed to identify predictors of treatment dropout and methods for increasing retention rates in this population.

Although veterans reported clinically significant improvements in PTSD and depressive symptoms, a substantial proportion of veterans continued to report clinically significant PCL and BDI-II scores at post-treatment. Because the veterans included in this sample struggled with high levels of distress and avoidance at baseline, they may not have received the maximal benefits of the CPT-based treatment program. Accordingly, there is substantial room for improvement of treatment outcomes for veterans with comorbid diagnoses. An additional limitation of the present study was our inability to establish causality using a within-subjects mediational approach. Although the model utilized does not demonstrate causation, the proposed direction is consistent with theory and prior research establishing that changes in trauma-related cognitions precede changes in PTSD symptomatology and depressive symptoms (McLean et al., 2015; Zalta et al., 2014). To address this limitation, future research examining the effect of CPT for co-occurring PTSD and SUD should include a mid-treatment assessment. Furthermore, because the current treatment program included three therapy sessions that emphasized the use of CPT-based strategies for thoughts related to substance use, it may be the case that substance use expectancies and cognitions were modified as a result of this treatment. Accordingly, changes in substance use-related cognitions may function as a mediator of decreased trauma-cued substance craving at post-treatment. Future research should assess such cognitions separate from trauma-

related beliefs. Because there was no control group and the intervention included additional treatment components that are not included in traditional CPT, changes in cognitions, PTSD symptomatology, and depressive symptoms cannot be attributed to CPT-based content alone. Indeed, other treatment components most likely did contribute to these changes. Despite this limitation, it should be noted that, unlike the other treatment components, CPT-based content is associated with change in trauma related cognitions, PTSD symptomatology, and a number of other co-occurring symptoms (Forbes et al., 2012; Kleim et al., 2013; McLean et al., 2015; Monson et al., 2006; Resick et al., 2008; Scher et al., 2017; Zalta et al., 2014). As such, our findings align with and build upon several well-established theoretical models and a large body of empirical research. Future studies should use comparison conditions (e.g., waitlist, traditional CPT, individual vs. group therapy conditions) to examine the relative contributions of CPT-based content versus other treatment components.

The present study was additionally limited in that there was no long-term follow-up assessment, making it impossible to establish the durability of treatment-related improvements in PTSD and related symptoms in a population with co-occurring SUD. However, prior research indicates that CPT produces lasting changes in PTSD and related symptoms that endure five to ten years following the end of treatment (Resick et al., 2012). Accordingly, future studies may utilize longitudinal designs to examine the durability of treatment effects obtained in this protocol. Finally, biological measures of substance use were not included as part of the post-treatment assessment. Instead, the study focused on self-reported alcohol and drug craving, as changes in trauma-related cognitions were expected to precede changes in trauma-cued substance craving. Future studies should consider the inclusion of biological measures of substance use in addition to self-report measures of substance use and craving (i.e., not cued by trauma-related stimuli) in order to better understand the potential benefits associated with CPT-based treatments in this population.

An emerging body of evidence suggests that trauma-focused treatment is safe and effective for individuals with co-occurring PTSD and SUD (Coffey et al., 2016; Foa et al., 2013; Kaysen et al., 2014; Mills et al., 2012; Sannibale et al., 2013). Despite strong evidence to support the use of exposure-based interventions, such as PE, for the treatment of PTSD in substance abusing samples, relatively little research has examined the utility of cognitive interventions such as CPT. Accordingly, the present study addressed a significant gap in the literature and indicates that the present CPT-based intervention was associated with significant reductions in PTSD symptomatology, depressive symptoms, and trauma-cued substance craving in a sample of veterans with PTSD and SUD. In the present study, reductions in PTSD and depressive symptoms were mediated by reductions in trauma-related thoughts and beliefs. As such, reductions in maladaptive trauma-related cognitions appear to play an important role in recovery from PTSD. Additional research should continue to examine best treatment approaches for comorbid PTSD and SUD, and how relevant mediating factors such as trauma-related cognitions impact treatment outcomes.

DECLARATION OF INTENT

None.

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