

ORIGINAL ARTICLE

Impact of residential PTSD treatment on suicide risk in veterans

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Abstract

Introduction: In 2019, 17 veterans died by suicide every day. Various suicide prevention treatments have emerged, yet limited research has explored the impact of Post Traumatic Stress Disorder (PTSD) treatment on suicidal ideation and behaviors.

Methods: This study examines the impact of Cognitive Processing Therapy (CPT) on suicidal ideation among veterans in three residential PTSD programs (women's, men's, and PTSD/Traumatic Brain Injury). Interview and self-report data were collected from veterans ($n = 446$) throughout treatment.

Results: Over 50% of veterans reported current suicidal ideation and a history of suicide attempts prior to treatment. Variables that predicted change in suicidal ideation included prior suicide attempt ($\beta = 0.21$, $p = 0.022$), change in CAPS-5 total score ($\beta = 0.28$, $p = 0.038$), employment status ($\beta = -0.20$, $p = 0.035$) and history of suicide attempt ($\beta = 0.25$, $p = 0.009$). Those without a previous suicide attempt made greater gains in CPT treatment than those with a previous suicide attempt.

Conclusion: Following 7 weeks of CPT residential treatment, a decrease in PTSD symptoms was significantly associated with a reduction in suicidal ideation. Implications are that CPT can reduce suicide risk in a variety of Veteran cohorts with differing trauma types.

KEYWORDS

Cognitive Processing Therapy, PTSD, suicide

INTRODUCTION

Since 1999, suicide rates have risen nearly 30%, and suicide is currently the 10th leading cause of death in the general population of the United States (Barnhorst et al., 2021). In 2005, suicide rates among active-duty US soldiers began

to increase drastically from 10.3 per 100,000 to 16.8 per 100,000 in 2008. In 2017, the nation lost 6139 veterans to suicide, or 16.8 lives per day. Veterans are 1.5 times more likely to die by suicide than age-adjusted adult civilians (Department of Veterans Affairs, 2019). Starting in 2008, rates of suicide in veterans surpassed those of

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age-adjusted civilians for the first time since records were kept (Kuehn, 2009; Nock et al., 2013). In that same year, although veterans made up 10% of the US adult population, they accounted for 20% of all suicide deaths (Kaplan et al., 2012). One group of veterans who are at particular risk for suicide are those diagnosed with PTSD (Gradus et al., 2015).

Difficulty of suicide prediction

Despite years of research trying to grapple with the problems of suicide, particularly within military populations over the last 10–15 years (e.g., Army STARRS, Military Suicide Research Consortium), the ability to predict who will die by suicide is still very difficult (Franklin et al., 2017). One explanation for this difficulty is that suicide risk is now being understood as fluid and unstable. The fluid vulnerability theory (Bryan & Rudd, 2018) suggests that risk fluctuates depending on environmental factors, acute stressors, and one's own internal capacity to tolerate those variables (i.e., cognitive flexibility and emotion regulation). Examining environmental factors within a group of veterans with PTSD could enhance understanding of suicidal thoughts and behaviors.

Prevalence of PTSD in US veterans

PTSD and its accompanying symptomology are highly associated with increased suicide risk (Krysinska & Lester, 2010); therefore, PTSD symptom reduction may play an important role in decreasing suicidal ideation and behaviors in veterans. Given the high rates of exposure to combat and other traumas (e.g., military sexual trauma (MST) and severe human suffering), veterans across multiple periods of service have high rates of PTSD diagnoses (Koven, 2017). During the height of the wars in Iraq and Afghanistan, over 17,000 active-duty combat veterans were diagnosed with PTSD between 2008 and 2013 (Fischer, 2014). Additionally, PTSD among Vietnam veterans is higher than was previously believed (Kessler et al., 1995), with prevalence rates of 3.5% among those not wounded and as high as 20% among those who were wounded (Helzer et al., 1987). Approximately 25% of veterans from Operation Enduring Freedom (OEF)/Operation Iraqi Freedom (OIF) received mental health diagnoses, with the youngest age group (18–24) being at the greatest risk for a PTSD diagnosis (Seal et al., 2007). In a meta-analysis of veterans across service eras, the highest rates of PTSD were among service members who were exposed to combat and those serving in infantry brigades or as combat troops (Koven, 2017).

Known correlates of suicidal thoughts and behaviors in veterans with PTSD

To better understand suicide risk in veterans, it is first necessary to discuss risk factors in the current literature. There are several known correlates of suicidal thoughts and behaviors in veterans with PTSD, including but not limited to demographic factors (e.g., employment and marital status), combat exposure, MST, childhood trauma, traumatic brain injury (TBI), depression, and history of suicide attempts (Barnes et al., 2012; Brenner et al., 2011; Freeman et al., 2000; Wisco et al., 2014). Studies have found that certain demographic factors increase risk for suicidal thoughts and behaviors. Specifically, gender, ethnicity, employment status, marital status, and age have been associated with risk for suicide (e.g., Milner et al., 2012; Straud et al., 2020; Wilmoth et al., 2015). Additionally, PTSD is associated with increased suicidal ideation and suicide attempts (Bell & Nye, 2007; Farberow et al., 1990; Freeman et al., 2000; Gradus et al., 2015; Jakupcak et al., 2009; Lemaire & Graham, 2010; May & Klonsky, 2016; Wisco et al., 2014) and is a particularly strong predictor for those with combat exposure, which heightens risk for suicidal thoughts and behavior (Bullman & Kang, 1994; Pompili et al., 2013). Furthermore, a recent diagnosis of PTSD or depression was associated with an increased risk for a suicide attempt (Schoenbaum et al., 2014). Explanations for the relationship between PTSD and suicidal thoughts and behaviors may include witnessing or perpetrating harm or death onto others, witnessing the death of fellow soldiers, chronic hypervigilance, and the uncertainty of danger from combat exposure over extended periods of time. Additionally, within the framework of the interpersonal psychological theory of suicide, acquired capability for suicide is heightened in those with exposure to frequent death and dying due to a potentially lower threshold for fear of death (Van Orden et al., 2010).

Military sexual trauma is also highly correlated with suicidal thoughts and behaviors in veterans with PTSD and is among the most common type of trauma that women veterans experience. Studies of veterans with MST identified negative self-beliefs (i.e., unbearability and unlovability) as primary drivers of suicidal beliefs (Holliday et al., 2018). Research on MST has traditionally been explored among women; however, a meta-analysis revealed estimates in men at 3.9% (Wilson, 2016), and even higher rates were found when relying on self-report measures instead of medical chart reviews.

A TBI is one of the signature injuries of soldiers from the OEF/OIF conflicts. History of a TBI has been associated with several psychological sequelae, including PTSD, suicidal ideation and attempts, difficulties with mood regulation, and cognitive rigidity in veteran samples (cites for

PTSD and SI; Bryan & Rozek, 2018; Joseph et al., 2015). One early study on the topic of TBI, PTSD, and suicide found that the association between TBI and suicide was explained by comorbid PTSD (Barnes et al., 2012). Other studies have found that a history of a TBI, after adjusting for psychiatric comorbidities, was predictive of death by suicide (Brenner et al., 2011). In a study of 824 male and 825 female OEF/OIF veterans who deployed to Iraq or Afghanistan, PTSD, current depression, and history of TBI were all associated with current SI, and after accounting for comorbidity, TBI history was associated with current SI in only the male combat veterans (Wisco et al., 2014). Given the number of factors that can influence risk for suicidal thoughts and behaviors in veterans with PTSD, it is important to understand how PTSD treatment may differentially affect this risk for veterans with varying demographic factors (i.e., combat history, sex, and TBI status).

PTSD treatment and its impact on suicidal thoughts and behaviors

There is limited research on evidence-based treatment for PTSD and its impact on suicidal thoughts and behaviors. A national study examined the prevalence and correlates of SI in a national sample of veterans in residential PTSD treatment and found an absence of SI among the majority of participants, although 43% still endorsed some level of suicidal ideation (Smith et al., 2020). Other studies found that treatment of PTSD in veterans could be associated with reductions in suicidal ideation (e.g., Stayton et al., 2019) in residential treatment. There is limited research on the association of PTSD treatment and suicidal thoughts and behaviors in veteran samples of women and those with histories of a TBI; however, studies of women veterans with MST who have attempted suicide identified negative self-beliefs as a primary driver of reasons for attempting suicide (Holliday et al., 2018). Certain EBPs for PTSD, such as cognitive processing therapy (CPT), target cognitions, and beliefs about the self, others and the world following the experience of a traumatic event and have proven effective interventions in treating negative self-beliefs and self-blame following trauma. Cognitive processing theory would theoretically be an effective intervention for veterans who had experienced MST, and subsequently developed negative views of self and internalized beliefs that they could have prevented the trauma.

Suicidal thoughts and behaviors have also been examined in the literature in association with changes in PTSD symptomatology over the course of PTSD treatment. For example, in a recent study examining changes in PTSD and suicidal ideation, changes in PTSD symptoms preceded changes in suicidal ideation over the course of CPT

(Johnson et al., 2021). Furthermore, studies examining the role of risk factors for suicide (e.g., previous suicide attempts) in PTSD treatment have found that veterans at increased suicide risk have benefitted as well from CPT as those with fewer risk factors (e.g., Roberge et al., 2021). It is important to examine similar relationships between PTSD and suicide in larger and more diverse samples of veterans in PTSD treatment.

Research aims

Given the established correlates of suicidal thoughts and behaviors in the literature and the recent literature showing CPT to be effective in reducing SI, this study sought to explore potential within-group differences on suicide-related dimensions for veterans engaged in PTSD treatment. If more is understood about specific predictors of suicidal thoughts and behaviors in different groups of veterans, treatment can be tailored to better meet their needs. Additionally, most of the recent literature has examined SI following PTSD treatment; however, not as much is known about the impact of suicide attempts on PTSD treatment outcomes. Therefore, this study has one exploratory aim and two hypotheses, the first of which is exploratory: (1) to determine the baseline and posttreatment differences in suicidal ideation among veterans in three residential PTSD treatment programs (Women's, Men's, and PTSD/TBI), (2) there will be differential predictors of suicidal ideation among the three residential programs, and (3) those with histories of suicide attempts will exhibit similar trajectories of PTSD symptoms over CPT treatment as those without histories of suicide attempts (when controlling for program type and depression), given findings from the current literature in group differences in suicidal ideation.

METHODS

Participants

This sample included 365 veterans participating in residential PTSD treatment at a midwestern Veterans Administration Medical Center between August 2017 and March 2020. Most participants identified as White (67.2%), followed by Black (28.7%) and other (4.2%). Participants were divided among the Men's residential program (39.5%), Women's program (27.9%), and the TBI program (32.6%). The mean age for the full sample was 45.90 ($SD = 11.65$). Most participants were unmarried (64.1%), and 80.7% of participants identified their employment status as disabled, unemployed, retired, student,

or other. The most common branch of service was the army (57.1%), while service era representation included OEF/OIF (47.8%), Vietnam (5.5%), and other service eras (46.7%). All participants included in this sample completed the residential program. For more detailed demographic information, see [Table 1](#).

Procedures

Data were from veterans engaged in residential PTSD treatment at a VA facility in the Midwest. Data were collected as part of an ongoing VA Office of Research and Development and affiliated university IRB-approved archival research study as part of standard care. Through the residential program, all participants completed a combined course of group and individual CPT. PTSD treatment is supplemented by additional groups, such as distress tolerance, psychoeducation, anger management, and goal-setting groups. Veterans in the Men's and Women's programs are in residential treatment for 7 weeks, while the TBI program has an additional week for neuropsychological testing, TBI psychoeducation, and speech therapy.

As part of the admission process, participants completed diagnostic clinical interviews and a battery of self-report assessments. The Clinician-Administered PTSD Scale for DSM-5 (CAPS-5; Weathers et al., 2013) was administered to assess program eligibility which required a PTSD or subthreshold PTSD diagnosis. Subthreshold PTSD was defined as meeting three of four symptom clusters. The Structured Clinical Interview for DSM-5 Disorders (SCID-5 for DSM-5; First et al., 2015) was also administered as part of the intake process to assess for comorbid diagnoses. These interviews were then re-administered at a posttreatment assessment.

Self-report measures included the PTSD Check List-5 (PCL-5; administered weekly), the Patient Health Questionnaire-9 (PHQ 9), and the Beck Scale for Suicidal Ideation (BSI). All self-report measures were administered as part of the pre-, mid-, and posttreatment assessments.

Measures

The Beck Scale for Suicidal Ideation is a 21-item scale to assess for suicidal ideation and is a widely used self-report measure for suicidal ideation (Range & Knott, 1997). The measure is scored by totaling the responses to the first 19 items. Question 20 asks about previous suicide attempts, and question 21 asks about the participant's wish to die during the suicide attempt. The BSI has strong internal consistency ($\alpha = 0.93$) and good construct validity and is

TABLE 1 Description of sample demographic characteristics

Characteristic	M (SD) or N (%)
History of suicide attempt	
Yes	168 (51.5%)
No	158 (48.5%)
History of SA with current SI	105 (62.9%)
Index trauma	
Combat	127 (39.0%)
Sexual assault	125 (38.3%)
Childhood abuse	27 (8.3%)
All other traumas	47 (14.4%)
Program type	
Men	144 (39.5%)
Women	102 (27.9%)
TBI	119 (32.6%)
Sex	
Men	256 (72.1%)
Women	99 (27.9%)
Age	45.90 (11.65)
Race/ethnicity	
African American or Black	96 (28.7%)
White	225 (67.2%)
Other	14 (4.2%)
Marital status	
Married	125 (35.9%)
Unmarried	223 (64.1%)
Service era	
Vietnam	19 (5.5%)
OEF/OIF	166 (47.8%)
Other	162 (46.7%)
Branch of service	
Army	198 (57.1%)
Navy	46 (13.3%)
Air Force	40 (11.5%)
Marine Corps	51 (14.7%)
National Guard	2 (0.6%)
More than one branch	9 (2.6%)
Other	1 (0.3%)
Employment	
Full-time or part time	67 (19.3%)
Disabled, unemployed, retired, student, and other	281 (80.7%)

highly correlated with the Clinician-Administered Scale for Suicidal Ideation ($r = 0.90$) (Beck et al., 1988).

The Clinician-Administered PTSD Scale for the DSM-5 (CAPS-5) (Weathers et al., 2013) is a clinical interview

designed to assess DMS-5 PTSD diagnostic criteria: re-experiencing (Cluster B), avoidance (Cluster C), negative mood and cognition (Cluster D), and arousal (Cluster E) symptoms. The scale is 30 items, and symptoms are rated on a scale of 0 (absent) to 4 (extreme). The scale has good interrater reliability ($k = 0.79$), strong internal consistency ($\alpha = 0.88$), and good test-retest reliability ($k = 0.83$) (Weathers et al., 2019). The scale has been shown to have good convergent validity with the CAPS-IV ($r = 0.83$) and the PCL-5 ($r = 0.66$) (Weathers et al., 2019). The CAPS-5 was used in regression analyses, as it showed a similar pattern of results to the PCL-5.

The PCL-5 (Weathers et al., 2013) is a 20-item self-report measure assessing symptoms of PTSD. This study uses the PCL-5: monthly at the pretreatment assessment and the PCL-5: weekly at treatment sessions and posttreatment assessment. This measure asks respondents to rate how much they are bothered by each symptom on a scale of 0 (not at all) to 4 (extremely). The range of the measure is 0–80. The PCL-5 has good internal consistency ($\alpha = 0.96$; Bovin et al., 2016) and a strong correlation to the PCL-S ($r = 0.87$; Wortmann et al., 2016). The PCL-5 was only used in the multilevel modeling (MLM) analyses, given that we had session-level data for this measure as opposed to the CAPS-5 with two time points.

The PHQ-9 is a 9-item measure of depression based on the DSM-IV criterion for depression (Kroenke et al., 2001). This instrument assesses how much an individual has been bothered by depression symptoms over the past 2 weeks. The PHQ-9 is measured on a scale of 0 (not at all) to 3 (nearly every day) and has a range of 0–27. The measure has been found to have good internal consistency in a sample of adults in primary care ($\alpha = 0.89$ and 0.86 ; Kroenke et al., 2001) and good internal consistency at pretreatment and posttreatment in a sample of individuals with depression ($\alpha = 0.74$ and 0.81 ; Titov et al., 2011).

Data analysis

Statistical analyses were performed using SPSS Statistics Version 22 (IBM SPSS, 2013). Descriptive statistics were conducted on demographic and study variables for both the overall sample and each cohort. A one-way ANOVA was conducted to compare suicidal ideation at baseline among the three programs. Paired-sample *t*-tests were performed to assess changes in SI from pretreatment to posttreatment. Regression analyses for each program were conducted to assess for pretreatment predictors of SI at posttreatment. To determine whether a history of a suicide attempt (yes/no) impacted treatment outcome, MLM was conducted in IBM SPSS Statistics Version 22

(IBM SPSS, 2013). Due to the nature of an archival clinical dataset, a portion of data was missing due to dropout or not initiating treatment. Maximum likelihood estimation was utilized for the entire treatment-seeking sample to address this missing data. PTSD symptoms, as measured by the PCL-5 at each session, was entered as the dependent variable. History of a suicide attempt (yes/no) was entered as a categorical covariate to determine whether those with and without a previous suicide attempt at pretreatment experienced differences in PTSD symptomatology at posttreatment. To explore the influence of variables associated with suicidal ideation, program type (Women's, Men's, and PTSD/TBI) and pretreatment depression were included as covariates in a final model.

RESULTS

Descriptive analyses

Demographic study variables are found in Table 1. Most of the sample (50.3%) reported suicidal ideation prior to treatment, while 51.5% reported a history of at least one suicide attempt prior to treatment. Of participants who reported a history of at least one suicide attempt, 62.9% also reported current suicidal ideation at pretreatment. Means and standard deviations for the main study variables in the full sample, as well as paired-sample *t*-tests of study variables from pre- to posttreatment, are found in Table 2. All study variables significantly decreased for the full sample from pre- to posttreatment. In taking a closer look among program differences, the Men's program exhibited significant decreases in suicidal ideation from pre- to posttreatment ($t[124] = 4.03, p < 0.001$), while the Women's and TBI programs did not have significant changes in suicidal ideation.

Regarding significant demographic differences among the programs, veterans in the TBI program were younger ($p < 0.001$), had more veterans who identified as White ($p < 0.001$), had more combat-related index events than childhood abuse or sexual assault ($p > 0.001$), and were from the OEF/OIF service era ($p > 0.001$) than those in the Women's or Men's programs.

Regression analyses

In the hierarchical linear regression predicting change in BSI items 1–19 (suicidal ideation) for the full sample, employment status ($\beta = -0.13, p = 0.018$), change in CAPS-5 total score ($\beta = 0.17, p = 0.007$), change in PHQ-9 total score ($\beta = -0.17, p = 0.009$), and a history of suicide

TABLE 2 Contrast of study variables at pretreatment and posttreatment

Full sample								
Variable	Pretreatment		Posttreatment		<i>t</i> (323) ^a	95% CI		Cohen's <i>d</i>
	M	SD	M	SD		LL	UL	
CAPS-5	42.61	9.65	24.66	11.89	26.86	16.63	19.26	1.64
PCL-5	57.10	12.50	36.79	17.59	21.69	18.47	22.16	1.35
BSI (1–19)	4.37	6.44	3.00	5.70	4.38	0.76	1.99	0.23
PHQ-9	17.45	5.40	11.44	6.05	16.66	5.29	6.71	1.02
Men's program								
Variable	Pretreatment		Posttreatment		<i>t</i> (128) ^a	95% CI		Cohen's <i>d</i>
	M	SD	M	SD		LL	UL	
CAPS-5	43.59	9.26	25.83	12.66	15.02	15.42	20.10	1.60
PCL-5	57.97	11.84	36.87	17.47	13.57	18.02	24.18	1.41
BSI (1–19)	5.25	7.36	3.05	5.81	4.03	1.12	3.28	0.33
PHQ-9	17.67	5.30	11.00	6.15	11.74	5.55	7.80	1.16
Women's program								
Variable	Pretreatment		Posttreatment		<i>t</i> (90) ^a	95% CI		Cohen's <i>d</i>
	M	SD	M	SD		LL	UL	
CAPS-5	42.42	9.23	23.90	11.73	14.84	16.04	21.00	1.75
PCL-5	57.00	13.36	34.52	17.59	12.10	18.78	26.17	1.44
BSI (1–19)	4.23	6.48	3.11	6.28	4.17	−0.20	2.42	0.18
PHQ-9	17.23	5.64	11.67	5.90	7.90	4.17	6.97	0.96
PTSD/TBI program								
Variable	Pretreatment		Posttreatment		<i>t</i> (111) ^a	95% CI		Cohen's <i>d</i>
	M	SD	M	SD		LL	UL	
CAPS-5	41.63	10.38	23.93	10.38	17.23	15.67	19.74	1.71
PCL-5	56.18	12.58	38.49	17.68	12.01	14.78	20.61	1.15
BSI (1–19)	3.50	5.07	2.86	5.13	1.52	−0.20	1.50	0.13
PHQ-9	17.36	5.36	11.78	6.09	9.00	4.35	6.80	0.97

Abbreviations: CI, confidence interval for mean change from pretreatment to posttreatment. *LL*, lower limit. *UL*, upper limit. CAPS-5, Clinician-Administered PTSD Scale for DSM-5. PCL-5, PTSD Checklist for DSM-5. BSI (1–19), Beck Scale for Suicide Ideation, Suicidal Ideation Score. Total scores for BSI items 1–19 at pretreatment and posttreatment were positively skewed, so log transformations were used to improve normality.

^aAll *t*-values were significant at $p < 0.001$.

attempt ($\beta = 0.20$, $p < 0.001$) were significant in the final step, beyond the effects of marital status and service era. In the regression predicting BSI suicidal ideation change score for the Men's residential program, only history of suicide attempt ($\beta = 0.21$, $p = 0.022$) was significant in the final step. In the Women's residential program, change in CAPS-5 total score ($\beta = 0.28$, $p = 0.038$) was significant in the final step. Finally, in the TBI residential program, employment status ($\beta = -0.20$, $p = 0.035$) and history of suicide attempt ($\beta = 0.25$, $p = 0.009$) were significant in the final step.

Multilevel modeling analyses

We conducted a preliminary model to assess the impact of treatment alone on PCL-5 total score. In this model, PCL-5 was entered as the dependent variable, and time was entered as a covariate. The results of this initial linear model suggested a main effect of time on PCL-5 score ($B = -1.58$, $SE = 0.071$, $95\% \text{ CI} = [-1.72, -1.45]$, $t(3001) = -22.43$, $p < 0.001$). A second model was conducted to test the effect of quadratic time. In this model, PCL-5 was entered as the dependent variable, time, and quadratic time were

added as covariates. The main effect of time remained significant ($B = -3.45$, $SE = 0.33$, $95\% \text{ CI} = [-4.09, -2.81]$, $t(2450) = -10.60$, $p < 0.001$), while quadratic time was also significant ($B = 0.11$, $SE = 0.019$, $95\% \text{ CI} = [0.07, 0.148]$, $t(2446) = 5.918$, $p < 0.001$). Therefore, quadratic time was included in future models.

Next, we added random intercept and random effects of time and tested the model using different covariance structures for random effects. Based on the nature of the data, we expected an autoregressive (AR1) covariance structure to demonstrate best fit; however, we conducted a nested, chi-squared difference test using the negative two log likelihood ($-2LL$) values obtained from the model with an AR1 structure ($-2LL = 25324.299$, $df = 5$), and model with unstructured covariance ($-2LL = 25324.299$, $df = 5$). There was no significant difference between these structures, suggesting that the autoregressive structure (AR1) provided the best fit.

To determine whether a reported history of suicide attempt at pretreatment influenced treatment outcome, suicide attempt (BSI item 20) at pretreatment and the Suicide Attempt \times Time interaction term were added to the model. Time was entered as a covariate while suicide attempt was entered as a factor. PCL-5 was entered as the dependent variable, and random intercept and random effects of time were entered using an autoregressive covariance matrix. Results indicated a main effect of time remained significant, ($B = -2.61$, $SE = 0.35$, $95\% \text{ CI} = [-3.29, -1.93]$, $t(2455.95) = -7.50$, $p < 0.001$). There was no significant main effect of suicide attempt ($B = -0.37$, $SE = 1.98$, $95\% \text{ CI} = [-4.26, 3.51]$, $t(908.19) = -0.187$, $p = 0.851$); however, the Suicide Attempt \times Time interaction was significant ($B = -0.39$, $SE = 0.18$, $95\% \text{ CI} = [-0.74, 0.03]$, $t(2447.116) = -2.14$, $p = 0.033$). This suggests that those

with a history of a suicide attempt displayed different rates of change in PCL-5 scores across treatment as compared to those without a history of suicide attempt at pretreatment. Upon plotting marginal means over time, those with a history of a suicide attempt exhibited higher PCL-5 scores over treatment than those without a history of a suicide attempt.

To determine whether this final model evidenced better fit than our baseline model described above, we conducted a nested, chi-squared difference test using the $-2LL$ values obtained from the baseline model (i.e., time, history of a suicide attempt, and their interaction term as predictors, random intercept, and random effect of time) and our final model (i.e., containing program type and pretreatment PHQ-9 score). The $-2LL$ values for these models were 25721.50 ($df = 6$) and 23652.78 ($df = 10$), respectively. This difference of 2068.72 was significantly greater than the critical value for chi-square at p -value of 0.05 of 5.99, suggesting that our final model evidenced better model fit (see Figure 1).

DISCUSSION

This study has one exploratory aim and two hypotheses: (1) to determine the baseline and posttreatment differences in suicidal ideation among veterans in three residential PTSD treatment programs (Women's, Men's, and PTSD/TBI), (2) there will be differential predictors of suicidal ideation among the three residential programs, and (3) those with histories of suicide attempts will exhibit similar trajectories of PTSD symptoms over CPT treatment as those without histories of suicide attempts (when controlling for program type and depression).

Change in PCL-5 scores across CPT

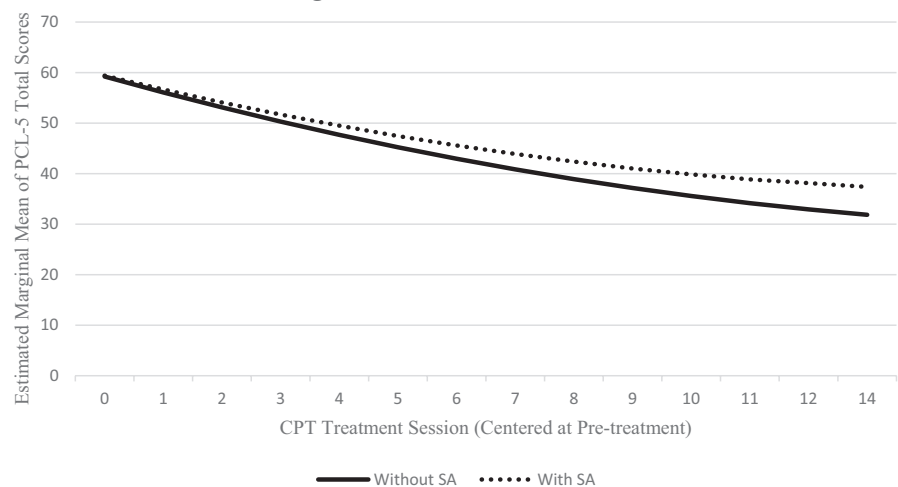


FIGURE 1 Changes in PTSD symptoms across sessions of cognitive processing therapy in residential PTSD treatment in veterans with and without histories of suicide attempts at pretreatment. *Note: PCL-5 = PTSD Checklist for DSM-5. Session 0 = pretreatment; Session 14 = posttreatment.

*Note: PCL-5=PTSD Checklist for DSM-5. Session 0=pre-treatment; Session 14=post-treatment.

Exploratory aim 1

Just over half (50.3%) of the overall sample reported SI at admission, and 51.5% reported a prior suicide attempt. Of those who reported a prior suicide attempt, 62.9% endorsed suicidal ideation at pretreatment. These findings suggest that veterans admitted to a residential PTSD treatment program are among the most acute and chronic risk populations for suicide, given that rates of SI among veterans enrolled in any mental health services are around 15% (Annual Report: VA Mental Health Programs and Suicide Prevention Services Independent Evaluation, 2018). The TBI program and the Women's program showed non-significant decreases in suicidal ideation from pre- to posttreatment, while the Men's program experienced a significant decrease. This suggests that having a diagnosed TBI may provide an additional and persistent risk for active suicidal ideation beyond PTSD, which is consistent with previous research (Brenner et al., 2011; Wisco et al., 2014). For this group of veterans, certain aspects of having a TBI (e.g., concentration and memory issues) may contribute to negative beliefs about the self, thus heightening the potential suicide risk. Additionally, this particular sample of veterans in the TBI program had significant demographic differences from the other programs. Specifically, this group of male veterans was more likely to be White and have combat events as the index trauma, both of which are known risk factors in OEF/OIF veterans (Kaplan et al., 2007; Maguen et al., 2011). Regarding the nonsignificant findings for changes in suicidal ideation in the Women's program, suicide rates have been increasing in recent years for women veterans (e.g., Department of Veterans Affairs, 2020), even though male veterans have historically died by suicide at higher rates (Hedegaard et al., 2018). Additionally, certain types of traumas (i.e., childhood and current sexual and/or physical violence) have been more strongly associated with suicidal ideation and behaviors in women (Benda, 2005). Although suicidal ideation decreased at a nonsignificant level for women across treatment, certain trauma-related factors and psychiatric comorbidities in the diagnostic presentation may have contributed to nonsignificant changes in SI.

Hypothesis 1

The first exploratory hypothesis that there would be differential predictors of SI among the three residential programs was supported. In the full sample, employment status, change in clinician-rated PTSD symptoms, change in depression symptoms, and history of suicide attempt were all predictors of change in SI at different levels of significance for each residential program. In the TBI

program, employment and history of a suicide attempt were significant predictors of SI. Having gainful employment could contribute to increased hope in the future, especially for veterans with comorbid TBI symptoms, given the association between unemployment and history of TBI (Caplan et al., 2016).

This is also consistent with longitudinal data in veteran samples, which found that employment status was significantly associated with lower suicidal ideation 1 year later (Elbogen et al., 2020). Additionally, history of a suicide attempt was a significant predictor for the Men's program and the TBI program, and it is a well-known predictor of future suicidal thoughts and/or behaviors (e.g., Schafer et al., 2021). Finally, change in PTSD symptoms was the only significant predictor of suicidal ideation in the Women's program, most of whom have an index trauma of MST. Evidence suggests that MST survivors are at higher risk for suicidal ideation than other types of trauma (Holliday et al., 2018). PTSD symptoms are highly correlated with suicidal thoughts and behaviors in other veteran samples (e.g., Johnson et al., 2021). In fact, Johnson et al. (2021) found that changes in PTSD symptoms preceded changes in SI over the course of CPT. The current findings regarding predictors of SI are consistent with other samples of veterans, such that certain demographic factors, mental health symptoms, and previous suicide attempts incur greater risk for SI in veterans in residential PTSD treatment.

Hypothesis 2

The second hypothesis of this study was that veterans with or without a history of suicide attempt would benefit equally well from CPT, given that other studies have found no significant differences in PTSD symptoms at the completion of CPT for those with and without SI in residential settings (e.g., Stayton et al., 2019). This hypothesis was not supported in the current sample, as significant differences were found between veterans with and without a history of suicide attempt(s). Participants with a history of a suicide attempt began and ended treatment with higher PTSD symptoms than those without a history of suicide attempt. Importantly, both groups experienced significant decreases in PTSD symptoms over treatment (p 's < 0.001); however, those without a history of a suicide attempt endorsed a greater amount of reduction in PCL-5 scores at posttreatment. As mentioned, the psychiatric severity of a residential PTSD treatment sample likely contributed to the high rates of both suicidal thoughts and behaviors; therefore, it is not surprising to also see elevated PTSD symptoms in this subset of our sample. Additionally, self-reported

PTSD symptoms were measured over time, as they were assessed using the weekly PCL-5; however, the inherent subjectivity of self-report measures could impact the degree of measured change in the PTSD symptoms assessed. With these potential explanations in mind, it is warranted to highlight that regardless of suicide attempt history, both groups made significant decreases in PTSD symptoms over the course of CPT.

Clinical implications

The findings of the current study provide insight into the role of suicidal thoughts and behaviors during PTSD treatment. Although this study was not causal in nature, findings could aid clinicians in helping veterans receive the most benefit during PTSD treatment. The established comorbidities among PTSD symptoms and suicidal thoughts and behaviors underscore the potential for PTSD treatment to be associated with suicide-related outcomes as well. First, veterans with PTSD and comorbid TBI are at higher risk for suicide, and this is consistent with the current findings. When using CPT for PTSD, it may be beneficial to target negative self-evaluations about what it means to have a TBI (e.g., stuck points of feeling like a burden and feeling incompetent). Second, it would benefit clinicians to be mindful of how certain risk factors may be more prominent for different veterans. For example, employment status was a significant predictor of suicidal ideation for veterans with PTSD and comorbid TBI. Having opportunities to engage in vocational rehabilitation services and/or occupational therapy in addition to PTSD treatment would also target this risk factor throughout treatment. Additionally, veterans could work on setting employment goals in the residential treatment plan so that they could actively work with Vocational Rehabilitation to secure gainful employment after graduation. The effectiveness of this vocational rehabilitation intervention, however, is based on the assumption that the veterans have reasonable vocational or occupational aspirations. Additionally, veterans with a history of suicide attempt(s) may also require more focus on stuck points related to trust in self and esteem-related stuck points in CPT.

Limitations

This study has several limitations to bear in mind when interpreting the current findings. First, this study relied on self-reported suicidal ideation at pre- and posttreatment, as well as PTSD symptoms through the weekly PCL-5 measurements. With self-report measures, it is difficult to ascertain an accurate measure of symptoms at

times, given the subjectivity of reporting on instrument items. Additionally, most participants identified as White veterans of the Army; therefore, the results may not generalize to other samples with more diverse compositions. Of note, this study did have more women in the sample than prior studies that only examined male veterans, and there was a focus on specific factors of the Women's program.

Future research

Given what is understood about the inherent instability and fluidity of suicidal thoughts and behaviors, there are several future directions in working with veterans at risk for suicide that could help lower the risk. Research using numerous time points (i.e., weekly) to assess suicidal thoughts and behaviors instead of pre- and post-treatment data points could provide a clearer picture of the overall trend, as well as specific time points of risk. This would provide more granular data on how CPT impacts risk week to week and would also be more in line with the recent understanding of the fluid nature of suicide risk over time, particularly in individuals with PTSD (Rugo-Cook et al., 2021). Analysis of weekly sessions may have important associations with risk. For instance, do suicidal thoughts and behaviors increase after the veteran reads their Impact Statement detailing the effects of the trauma in their life and identifies stuck points? In the same way, it is important to understand what happens to suicide risk when one begins to investigate and discard erroneous, hurtful beliefs about themselves due to the impact of trauma. A real-time weekly assessment of suicidal thoughts and behaviors could improve understanding of how different weekly interventions impact risk in real time in addition to the overall course of treatment from beginning to end.

CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are the property of the Department of Veterans Affairs. Restrictions apply to the availability of these data, which were used under license for this study.

ETHICAL STATEMENT

This material is the authors' own original work, which has not been previously published elsewhere. The paper is not currently being considered for publication elsewhere.

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