Title

The Effect of PTSD Symptom Change on Suicidal Ideation in a Combined Military and Civilian Sample Engaged in Cognitive Processing Therapy.

Journal

Behavior Therapy, 52(3)

Authors

Shields, Norman

Lane, Jeanine

Sijercic, Iris

et al.

Publication Date

2021-05-01

DOI

10.1016/j.beth.2020.10.001

Peer reviewed

HHS Public Access

Author manuscript

Behav Ther. Author manuscript; available in PMC 2024 March 27.

Published in final edited form as:

Behav Ther. 2021 May ; 52(3): 774–784. doi:10.1016/j.beth.2020.10.001.

The Effect of PTSD Symptom Change on Suicidal Ideation in a Combined Military and Civilian Sample Engaged in Cognitive Processing Therapy

Clara M. Johnson[a], **Samantha C. Holmes**[b], **Michael K. Suvak**[c], **Jiyoung Song**[a], **Norman Shields**[d], **Jeanine E. M. Lane**[e], **Iris Sijercic**[e], **Zachary D. Cohen**[f], **Shannon Wiltsey Stirman**[a,g,*], **Candice M. Monson**[e,*]

[a]Dissemination and Training Division, National Center for PTSD, 795 Willow Road, Menlo Park, CA, 94025, USA

[b]Department of Psychiatry, Yale School of Medicine , 300 George St #901, New Haven, CT 06511, USA

[c]Suffolk University, Department of Psychology, 41 Temple Street, Donahue D609, Boston, MA, 02114, USA

[d]Royal Canadian Mounted Police, 4225 Boulevard Dorchester Ouest, Westmount, QC H3Z 1V5, CAN

[e]Department of Psychology, Ryerson University, 350 Victoria AvenueToronto, ON M5B 2K3, CAN

[f]Department of Psychiatry, University of California, Los Angeles, 757 Westwood Plaza, Los Angeles, CA, 90095, USA

[g]Department of Psychiatry and Behavioral Sciences at Stanford University, 401 Quarry Rd, Stanford, CA, 94305, USA

Abstract

In light of the well-established relationship between posttraumatic stress disorder (PTSD) and suicidal ideation (SI), there has been a push for treatments that simultaneously improve symptoms of PTSD and decrease SI. Using data from a randomized controlled hybrid implementation-effectiveness trial, the current study investigated the effectiveness of Cognitive Processing Therapy (CPT; Resick, Monson, & Chard, 2016) on PTSD and SI. The patient sample (N = 188) was diverse in military and veteran status, gender, and comorbidity, and 73% of the sample endorsed SI at one or more points during CPT. Participants demonstrated significant improvement in SI over the course of CPT. Multilevel growth curve modeling revealed a significant association between PTSD symptom change and change in SI. Results from cross-lagged multilevel regressions indicated that PTSD symptoms predicted SI in the next session, yet SI in a given session did not predict PTSD symptoms in the next session. Potentially relevant clinical factors (i.e., military status, gender, depression diagnosis, baseline SI, study consultation condition) were not associated

Corresponding Author: Shannon Wiltsey Stirman, National Center for PTSD, VA Palo Alto Healthcare System, 795 Willow Rd., Menlo Park, CA 94025; sws1@stanford.edu.

*Co-senior authors

with the relationship between PTSD symptoms and SI. These results add to the burgeoning literature suggesting that evidence-based treatments for PTSD, like CPT, reduce suicidality in a range of individuals with PTSD, and that this reduction is predicted by improvements in PTSD symptoms.

Keywords

PTSD; Suicidality; Cognitive Processing Therapy; Treatment Process and Outcome Measures

Within the United States, approximately 123 individuals die by suicide each day (Drapeau & McIntosh, 2017). As such, mental healthcare systems prioritize suicide prevention. Although the United States has made strides in increasing awareness for suicide prevention, and a body of literature has developed to identify effective treatments to reduce suicide risk and suicidal ideation (SI), emphasis on posttraumatic stress disorder (PTSD), a key risk factor, is often neglected. Thus, the current study aims to expand on previous literature by analyzing the overall and temporal relationship between PTSD symptomatology and SI throughout an evidence-based psychotherapy (EBP) for PTSD.

Extensive research indicates that PTSD is a risk factor for SI and suicide attempts among veteran (Arenson et al., 2018; Guerra & Calhoun, 2011; Pompili et al., 2013), active duty (Bryan & Corso, 2011; McLean et al., 2017) and civilian samples (Boffa et al., 2017; Gradus et al., 2010; Kratovic, Smith, & Vujanovic, 2020; Wilcox, Storr, & Breslau, 2009). A possible explanation for the elevated suicide risk is the high prevalence of comorbid depression among individuals diagnosed with PTSD (Arenson et al., 2018; Kimbrel, Meyer, DeBeer, Gulliver, & Morissette, 2016; O'Donnell, Creamer, & Pattison, 2004). Comorbid depression and PTSD can result in an increased risk for SI versus PTSD alone (Brown, Zang, et al., 2019; Bryan & Corso, 2011; Calabrese et al., 2011; Ramsawh et al., 2014). However, Guerra and Calhoun (2011) and Wilcox et al. (2009) found that PTSD symptoms and SI remain significantly correlated even when controlling for symptoms of major depressive disorder. Although the specific mechanisms that explain the relationship between PTSD and SI remain unclear, the well-established link between PTSD and SI presents an opportunity to identify strategies to address highly comorbid symptoms within a single treatment (Krysinska & Lester, 2010).

SI has been shown to decrease after engagement in EBPs for PTSD, including individual and group Cognitive Processing Therapy (CPT; Resick, Monson, & Chard, 2016; Gradus et al., 2013; Stayton, Martin, Pease, & Chard, 2019; Horwitz, Miron, & Maieritsch, 2019; Resick et al., 2017) and Prolonged Exposure (PE; Foa, Hembree, & Rothbaum, 2007; Brown, Belli, Suzuki, Capaldi, & Foa, 2019; Brown, McLean et al., 2019; Cox et al., 2016; Norr, Smolenski, & Reger, 2018). Moreover, previous studies demonstrate that declines in PTSD symptoms are correlated with reductions in SI during CPT (Gradus et al., 2013) and PE (Brown, Belli, et al., 2019; Brown, McLean, et al., 2019; Cox et al., 2016). Gradus et al. (2013) studied female rape survivors' endorsement of PTSD symptoms and SI before, after, and at various time points during CPT and PE in a randomized controlled trial (RCT) that compared the two treatments. Although reductions in PTSD symptoms were correlated with

reductions of SI in both PE and CPT, patients enrolled in CPT saw greater reductions in SI. However, PTSD and SI were only measured every other session in the study, limiting the ability to understand potential session-to-session changes and the temporal precedence of changes in each. In another study, of predominately male veterans who received PE in three US Veterans' Health Administration centers, Cox et al. (2016) found that PTSD symptoms in one session predicted SI in the next session of PE, as measured by a single item on the Depression Inventory (Beck, Steer, & Carbin, 1988), in routine care. They did not, however, find the reverse relationship to be true. That is to say, SI in a particular session did not predict PTSD symptoms in the next session. Norr et al. (2018) similarly looked at the relationships between PTSD symptoms and SI in a RCT among active duty military members enrolled in PE, Virtual Reality Exposure, and waitlist control using cross-lagged panel models. In contrast to prior findings, SI measured at mid-treatment predicted the PTSD symptom change in the subsequent session. These findings suggest that EBPs for PTSD result in a decrease of SI and that there may be a reciprocal relationship among SI and PTSD symptoms.

Although the extant literature has established an association and potential temporal relationships between reductions in PTSD symptoms and SI in the course of EBPs for PTSD, this paper aims to address some of the existing gaps in the literature. First, much of the previous research has been in efficacy trials. To examine the feasibility and scalability of using EBPs in routine care, it is important to understand whether the same effects can be expected among therapists working in community settings and with patients who are more heterogeneous. Furthermore, clinical trials often examine PTSD treatment in specific populations in terms of gender, trauma type, or military status, decreasing the generalizability to the other trauma types and populations despite empirical evidence suggesting that these factors can be impactful. For example, Gradus et al. (2013) focused on female rape survivors, Brown, Belli et al. (2019) investigated adolescent females with a history of sexual assault, Cox et al. (2016) studied mostly middle-aged male veterans, and Norr et al. (2018) analyzed data from largely male active duty military members. Zimmerman et al. (2015) found gender to moderate the relationship between PTSD and SI such that women were more likely to experience SI as PTSD symptoms increased, emphasizing the need to study mixed-gender samples. Because research has indicated that certain types of traumatic events have stronger associations with suicidal thoughts and behaviors than others (Stein et al., 2010), it is also critical to explore whether these findings regarding changes in PTSD symptoms and SI during treatment remain constant within a broad range of individuals, including active military personnel, veterans, and civilians.

To our knowledge, no previous research has investigated if PTSD symptoms predict SI (along with the converse relationship) within a community-based sample of individuals engaged in CPT for PTSD. Gradus et al. (2013) examined the relative efficacy of CPT versus PE in improving suicidality, but did not examine the directionality of changes in PTSD and suicidality. Cox et al. (2016) and Nor et al. (2019) explored the directionality of associations between PTSD and SI among patients in PE. As CPT is another first-line treatment for individuals with PTSD and may reduce SI more than PE (Gradus et al., 2013), it is critical to determine whether results from PE trials (e.g., Cox et al., 2016; Norr et al., 2018) translate to CPT. Another limitation to existing literature is infrequent assessment.

For example, Norr et al. (2018) measured PTSD symptoms and SI at baseline, session five, post-treatment, and 3- and 6-month follow up. To better examine the relationship between PTSD and SI at a session-to-session level, it is important to consistently collect and analyze symptom measurements at each session.

The current study used data from an implementation trial of CPT (Monson et al., 2018) to explore the relationship between PTSD symptom change and SI change over the course of CPT within a mixed active duty, veteran, and civilian sample with varied trauma types that were served in diverse routine care settings across Canada. We first sought to replicate previous findings by analyzing change in PTSD symptoms and SI over the course of CPT. Consistent with previous literature (Gradus et al., 2013; Stayton et al., 2019; Horwitz et al., 2019; Resick et al., 2017), we hypothesized that patients would experience reductions in both PTSD and SI over the course of CPT (Hypothesis 1). We also assessed the relationship between changes in PTSD symptoms and SI during treatment. We hypothesized that changes in SI would be positively correlated with changes in PTSD during treatment (Hypothesis 2) based on existing research (Brown, Belli, et al., 2019; Brown, McLean, et al., 2019; Cox et al., 2016; Gradus et al., 2013). To better understand the temporal relationship, we examined whether PTSD symptoms predicted SI and vice versa at a session-to-session level. We hypothesized that changes in PTSD symptoms would predict changes in SI in future sessions, but, based on previous findings (Cox et al., 2016), that the reverse relationship would not be significant (Hypothesis 3). As an exploratory aim, we examined whether clinical depression diagnosis, baseline SI, military/veteran status, gender, and type of consultation received in the implementation trial moderated the relationships described in our third hypothesis (Exploratory Aim 1).

Method

For detailed procedural and demographic information, please refer to the parent study (Monson et al., 2018). To briefly summarize the procedure, the study enrolled therapists (N = 134) with varying levels of education and experience with EBPs, from Veterans Affairs Canada Operational Stress Injury Clinics, Canadian Forces mental health services and the broader Canadian community. They were randomly assigned to one of three consultation conditions following a 2-day CPT training workshop: 1) Standard CPT consultation by expert CPT Consultants without session audio review (Standard Consultation); 2) CPT consultation by expert CPT Consultants that included review of session audio segments (Consultation Including Audio Review); and 3) No Consultation, with delayed feedback on fidelity (i.e., adherence to, and competence in, CPT). All procedures were approved by university Research Ethics Boards (REB) and Institutional Review Boards along with REBs from each site involved in the study.

Therapists identified patients with a Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition diagnosis of PTSD (DSM-IV; American Psychiatric Association, 2000) with whom they intended to conduct CPT. The parent study began before the DSM 5 (American Psychiatric Association, 2013) was published, so the current study used measures of the DSM IV. As the therapists were recruited in routine care, the study team did not require a certain diagnostic approach, but rather asked therapists to use their organization’s routine

intake procedures to diagnose disorders including PTSD and depression. Intake may have varied across settings involved in the study, but some health systems use less structured intake procedures than is expected in a randomized clinical trial. Two participants without a clinical diagnosis of PTSD were included in the study because they experienced a trauma, scored higher than the cutoff (50) on the PTSD Checklist (Weathers, Litz, Herman, Huska, & Keane, 1993), and their therapists believed CPT to be potentially helpful. Patients (N = 188) were eligible for participation if they consented to audio recording of therapy sessions and were eligible for CPT based on the standards set by CPT developers (i.e., did not have current untreated symptoms of bipolar disorder or psychosis, substance dependence requiring detoxification, risk of imminent suicide or homicide or significant cognitive impairments; Resick et al., 2016). Therapists were instructed to use their organization's risk assessment protocols and their clinical judgement to determine whether there was a substantial risk of imminent suicide or homicide in determining patient eligibility.

Fifty-two percent of the sample identified as female, with a mean age of 39.4 years (SD = 11.3). The sample included 57.6% non-military/non-veteran patients, 23.3% veterans, and 19.2% patients on active duty. Patients were predominantly White, (88.0%), with the others identifying as Black (2%), Hispanic (1%), Asian/Pacific Islander (3%), Native Canadian (4%), and "other" (4%). Most participants were in committed relationships (59.0%), while the rest were single, widowed or divorced. Therapists reported that 50.5% of the patients experienced comorbid depressive disorders. For further demographic information, see the parent study (Monson et al., 2018).

Measures

The Posttraumatic Stress Disorder Checklist (PCL-IV) is a 17-item, self-report survey that measures DSM-IV PTSD symptom severity on a five-point Likert scale from "not at all" [1] to "extremely likely" [5] (Weathers et al., 1993). The cut-off score of 50 indicates probable PTSD. The PCL-IV has strong internal consistency in the current study (α = .94) and was completed at baseline, before each therapy session, and post-treatment. Therapists were trained by study staff to start each therapy session with symptom measures so that the therapist and patient could use the scores clinically during the session, particularly for the PCL-IV.

The Outcomes Questionnaire-45 (OQ-45) monitors functioning in routine care (Lambert et al., 1996). Only one of the 45 items, which assesses whether the respondent has thoughts of ending one's life, was used to measure SI in the current study on a five-point Likert scale from "never"[0] to "almost always" [4]. Patients completed the OQ-45 at baseline, before each session, and post-treatment.

Therapists reported each patient's clinical diagnosis of depression to the study team prior to the start of treatment.

Analytic Plan

Hypothesis 1: Change in PTSD and SI over time.—Using Mplus (Muthén & Muthen, 2017) we conducted multilevel growth curve models to examine overall change

in PTSD symptoms and SI during treatment. Prior to examining change, we evaluated two unconditional models (i.e., models with no predictors) to decompose the variance between three possible levels (Level 1: within patient participants/SI and PTSD symptoms across 12 therapy sessions; Level 2: between-patient participants; Level 3: between-therapist participants). Next, we evaluated separate unconditional change models (i.e., time included as the only predictor) to identify the best way to model time for PTSD symptoms and SI (linear versus log linear function of time). Table 2 includes the model comparisons based on change in deviance score (−2 log-likelihood value). The best fitting model for both PTSD symptoms and SI included the linear model of time, with time as the number of days since baseline assessment.

Hypothesis 2: Association between PTSD change and SI change.—We conducted a 2-level multivariate growth model producing initial status and slope estimates for both PTSD and SI in the same model.

Hypothesis 3: Temporal dynamics of the association between PTSD and SI.—We conducted cross-lagged multilevel regression analyses using the lmer and lmerTest statistical packages in R Statistical Software (R Core Team, 2018) to evaluate the directionality of the relationship of PTSD and SI. We retained the nesting structure from the analysis used to test Hypotheses 1 and 2. Our first model included SI, assessed at a single session, as the dependent variable and controlled for auto-correlated SI from the previous session. We compared model fit indices to examine which model of time to include in the current model (linear or linear plus quadratic). Our cross-lagged predictor of interest was PTSD symptoms from the previous session. We tested the reverse relationship in our second model. We included cross-lagged SI score as a predictor of PTSD symptoms from a particular session controlled by auto-correlated PTSD symptoms. Consistent with the parent study, we included the linear and quadratic model in the PTSD symptom predictor model.

Exploratory Aim 1: Potential moderators.—We then evaluated the cross-lagged models with each construct (baseline SI, clinical depression diagnosis, military/veteran status, gender, and type of consultation) added and included a variable by time interaction term. Missing demographic data were imputed using missForest r package (Stekhoven, 2013).[1]

Results

Hypothesis 1

Table 1 includes descriptive statistics of PTSD symptoms, SI, and days passed since baseline assessment for each session of CPT. As the parent study excluded patients who were at imminent risk for suicide, the levels of SI were relatively low ($M = 0.96$, $SD = 1.16$). However, only twenty-seven percent of patients consistently reported never having thoughts

[1]Given that the parent study found differences in PTSD symptom change across consultation conditions, we included type of consultation as a moderator in analyses for Hypotheses 2 and 3. There was no main effect of consultation type on the relationship between PTSD and SI, so we did not separate the analysis by consultation condition.

of ending their lives. Thirty-six percent of the patients consistently reported at least some level of SI, with the rest reporting SI at some weeks and no SI at others.

Unconditional models.—Thirty-seven percent ($p < .001$) of the total variance in PTSD symptoms occurred at Level 1 (within participants), 62.27% ($p < .001$) was attributed to Level 2 (between-patient participants), and 0.69% ($p = .888$) of the variance was attributed to Level 3 (between therapists). Twenty-seven percent ($p < .001$) of the total SI variance was attributed to Level 1, 63.41% ($p < .001$) was attributed to Level 2, and 9.77% ($p = .127$) of the variance was attributed to Level 3. Since Level 3 variance was not statistically significant for either variable we evaluated two-level models for subsequent analyses.

Multilevel growth curve models.—SI decreased over time during CPT, $b = -0.01$, 95% CI [−0.02, −0.001], $p = .026$, $pr = -.12$. Consistent with findings from the parent study, PTSD symptoms also exhibited significant decreases during CPT, $b = -0.90$, 95% CI [−1.06, −0.74], $p < .001$, $pr = -.46$. Of those who completed CPT, 52.4% patients experienced reliable clinically significant improvement of PTSD symptoms (Holmes et al., 2019).

Hypothesis 2

PTSD symptoms and SI.—Consistent with Hypothesis 2, the slopes of PTSD symptoms and SI change were highly correlated, $r(188) = .64$, $p < .001$, 95% CI [.42, .81] (see Figure 1), indicating that individuals showing larger decreases in PTSD symptoms tended to exhibit larger decreases in SI relative to participants showing smaller decreases in PTSD.

Hypothesis 3

PTSD symptoms predicting SI.—We included only a linear time coefficient for the lagged analyses with SI as the outcome, as adding a quadratic time coefficient did not significantly improve model fit (ΔDEV = 1.10, ΔParms = 1, $p = .338$, $pr = .16$). When controlling for the prior session SI and the SI symptom trajectory, the PTSD symptoms predicted SI at the subsequent session, $b = 0.01$, $t(730) = 2.65$, $p = .008$, $pr = .10$ (see Table 3). The effect size of this cross-lagged PTSD symptom was small to medium. Cross-lagged models with each possible potential moderator (baseline SI, clinical depression diagnosis, military/veteran status, gender, and type of consultation) by time interaction term, included separately, revealed no significant interactions.

SI predicting PTSD symptoms.—We included linear and quadratic time coefficients in the cross-lagged models with PTSD symptoms as the outcome (ΔDEV = 44.15, ΔParms = 1, $p < .001$). When controlling for the auto-correlated PTSD symptom score and the symptom trajectory of PTSD symptoms, the cross-lagged path from SI to the PTSD score at the next session was not statistically significant, $b = 0.13$, $t(1389) = 0.66$, $p = .510$, $pr = .02$ (see Table 3). The effect size of this cross-lagged path was small. None of the interaction terms (time by baseline SI, clinical depression diagnosis, military/veteran status, gender, and type of consultation) were significant when included individually in the cross-lagged SI model.

Discussion

The current study expands on the existing literature that examines the relationship between PTSD symptom change and SI in EBPs for PTSD in two important ways. First, research that has explored the relationship between PTSD and SI, to date, has typically been in the context of efficacy trials and has utilized homogeneous samples (e.g., female rape survivors, male veterans). Consequently, researchers have called for additional inquiry to assess the generalizability of this effect (Gradus et al., 2013). The current study addressed this question by exploring the relationship between change in PTSD symptoms and SI over the course of CPT in routine care settings and by testing the effects of various potential moderators of the relationship in a heterogeneous sample. The results regarding the association between PTSD symptom change and changes in SI are consistent with our hypothesis, and with the results of previous studies (e.g., Gradus et al., 2013). These results, taken with the lack of significant moderators, support the robustness and generalizability of the relationship between PTSD and SI within the context of CPT.

The current study adds to the existing literature by examining the temporal dynamics of PTSD and SI over the course of CPT delivered in routine care settings. Previous studies that have employed cross-lagged models to examine the temporal relationship between PTSD symptom and SI changes involved PE efficacy trial data. The current study corroborates the unidirectional relationship found in PE (Cox et al., 2016) in CPT. Thus, PTSD symptom improvements appear to drive the change in SI, rather than the reverse.

Although specific mechanisms were not tested in the current study, there are several potential explanations for the association between PTSD symptom and SI reductions. Given that previous research has found greater reductions in both guilt and SI (Gradus et al., 2013; Nishith, Nixon, & Resick, 2005) in CPT than PE and that shame affects the relationship between PTSD and SI (e.g., Bryan, Morrow, Etienne, & Ray-Sannerud, 2012, Cunningham et al., 2019), it would be important to investigate the temporal relationship between shame, guilt and SI. Less frequent and intense re-experiencing and hyperarousal symptoms over the course of treatment may also result in less distress. Additionally, as avoidance resolves, and participants begin to re-engage in activities and reconnect with people, they may feel an increased sense of meaning and life satisfaction – all of which may be relevant to SI. Future research should assess these potential mechanisms.

The current study indicates that CPT can address factors associated with SI, and that decreases in PTSD symptoms result in SI reduction. This is an important message to highlight, given persistent apprehension regarding the administration of trauma-focused therapies with individuals who experience SI. Some have expressed concerns that processing traumatic events will result in PTSD symptom exacerbation (Becker, Zayfert, & Anderson, 2004; Larsen, Stirman, Smith, & Resick, 2016). It should be noted that imminent risk of suicide is a contraindication of CPT, though researchers are currently testing CPT with patients with imminent suicidality and with patients who endorse non-suicidal self-injury (Monson et al., 2018). Withholding CPT due to moderate levels of SI until SI has been reduced may mean delaying an intervention that could actually address this very important clinical concern. Consistent with previous research (e.g., Gradus et al., 2013), the results

of the current study suggest that PTSD and SI can be effectively treated simultaneously with CPT and other evidence-based, trauma-focused therapies for PTSD. Although SI significantly decreased over time, patients experienced a minor increase in SI at session 10. The increase in SI may indicate that as patients near the end of therapy, they begin to consider the idea of navigating life's challenges after leaving therapy and thus might experience a slight increase in SI. Further research should explore predictors of a spike in SI to help therapists prepare for SI increases later in therapy.

The findings of the current study are particularly salient given the prioritization of suicide prevention by healthcare systems. The Department of Veterans Affairs published the "National Strategy for Preventing Veteran Suicide 2018–2028" which includes guidelines for therapists to follow when working with veterans with SI. While the creation and proliferation of policy and resources is necessary, the discussion of the role of PTSD treatments in addressing SI is missing, which has serious clinical implications. PTSD is a well-established risk factor for suicide attempts (e.g., Calabrese et al., 2011) and treatment for PTSD can result in decreases in SI regardless of gender, military/veteran status, depression diagnosis, and extent of suicidality. Consequently, discussion of PTSD should be explicitly integrated into psychoeducational resources targeting suicide risk, PTSD screening should be considered in conjunction with suicide risk assessments, and CPT and PE might be highlighted as potentially effective suicide prevention strategies for individuals with comorbid PTSD who are not at imminent risk of suicide. Further research should examine whether PTSD treatment is as effective as other strategies for suicide prevention in this population. The current study exhibits a number of strengths including its heterogeneous sample, longitudinal design, and collection of data at each session. Additionally, CPT occurred in routine care settings by newly trained CPT therapists, which allowed for greater generalization than previous randomized controlled trials with more restricted sample characteristics. There are, however, some limitations. First, SI was assessed using a single item. Although this approach has been used by similar studies (e.g., Gradus et al., 2013; Norr et al., 2018; Horwitz et al., 2018), it does not allow for a comprehensive assessment of suicidality (e.g., plan, intent, means). It is also possible that the variation in the single item measure of SI overtime may have influenced the overall effect of CPT on SI that was found. Nonetheless, psychotherapy assessments with one-item and treatment measures with fewer items reduce survey burden (Hornsey, Olsen, Barlow, & Oei, 2012). Additionally, the current sample endorsed relatively low levels of SI. Replication in samples with higher levels of SI will be important in terms of generalizability and power. SI was also collected at the beginning of each session, which may indicate that the SI may have been tied to anxiety towards starting a new session. If SI were collected upon completion of a therapy session, this relationship between SI and PTSD may be different. Nonetheless, as this study was within a routine care sample, the procedures aligned with the way in which therapists commonly collect symptom measures in order to assist clinically in the session. As the current study did not systematically collect index traumas from each patient, it would be important to look at index trauma as a moderator of the relationship between PTSD and SI in future research. Finally, while the sample was diverse in several ways (i.e., gender, military/veteran status), it lacked racial, ethnic, and sexual diversity. Consequently, future research should assess EBPs for PTSD as a means of addressing SI with more comprehensive

measures of suicidality among a more diverse sample. Additionally, future research should explore mechanisms that may explain the association between PTSD symptom and SI reductions.

Conclusions

The current study demonstrates that, 1) during a course of CPT, PTSD symptoms and SI decrease, 2) reductions in PTSD symptoms were associated with reductions in SI, 3) PTSD symptom improvement in a particular session predicts SI in the next session, and 4) gender, military/veteran status, consultation condition, and depression diagnosis do not affect the relationship between PTSD and SI. These results provide invaluable information for the ongoing large-scale efforts in healthcare systems to prevent suicide. Specifically, suicide awareness and prevention resources should make explicit the link between PTSD and SI, PTSD screens should be incorporated into suicide risk assessments, and CPT should be considered as a potential strategy to address suicide risk for patients with PTSD.

Acknowledgments:

This work was supported by a Canadian Institutes for Health Research operating grant [259353] to the senior authors. Work on this paper by the second author was supported by NIH grant T32.DA019426. This material is also the result of work supported with resources and the use of facilities at the Palo Alto VA Healthcare System, Menlo Park Division in Menlo Park, CA. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs, the United States government, Stanford University, Ryerson University, or other affiliates.

Declaration of Interests:

Dr. Monson receives book royalties from Guilford Press related to authoring the treatment manual of interest to this publication. There are no other interests to disclose.

References

American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders (4th ed., Text Revision). Washington, DC: Author.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders *(5th ed.).* Washington, DC: Author.

Arenson MB, Whooley MA, Neylan TC, Maguen S, Metzler TJ, & Cohen BE. (2018). Posttraumatic stress disorder, depression, and suicidal ideation in veterans: Results from the mind your heart study. Psychiatry Research, 265, 224–230. doi:10.1016/j.psychres.2018.04.046 [PubMed: 29753254]

Beck AT, Steer RA, & Carbin MG. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. Clinical Psychology Review, 8, 77–100. doi:10.1016/0272-7358(88)90050-5

Becker CB, Zayfert C, & Anderson E. (2004). A survey of psychologists' attitudes towards and utilization of exposure therapy for PTSD. Behaviour Research and Therapy, 42, 277–292. doi:10.1016/S0005-7967(03)00138-4 [PubMed: 14975770]

Boffa JW, Stanley IH, Hom MA, Norr AM, Joiner TE, & Schmidt NB. (2017). PTSD symptoms and suicidal thoughts and behaviors among firefighters. Journal of Psychiatric Research, 84, 277–283. doi:10.1016/j.jpsychires.2016.10.014 [PubMed: 27810667]

Brown LA, Belli G, Suzuki N, Capaldi S, & Foa EB. (2019). Reduction in suicidal ideation from prolonged exposure therapy for adolescents. Journal of Clinical Child & Adolescent Psychology, 1–9. doi:10.1080/15374416.2019.1614003

Brown LA, McLean CP, Zang Y, Zandberg L, Mintz J, Yarvis JS, ... & Petersen J. (2019). Does prolonged exposure increase suicide risk? Results from an active duty military sample. Behaviour Research and Therapy, 118, 87–93. doi:10.1016/j.brat.2019.04.003 [PubMed: 31022593]

Brown LA, Zang Y, Benhamou K, Taylor DJ, Bryan CJ, Yarvis JS, ... & Pruiksma KE. (2019). Mediation of suicide ideation in prolonged exposure therapy for posttraumatic stress disorder. Behaviour Research and Therapy, 119, 103409. doi:10.1016/j.brat.2019.103409 [PubMed: 31176888]

Bryan CJ & Corso KA. (2011). Depression, PTSD, and suicidal ideation among active duty veterans in an integrated primary care clinic. Psychological Services, 8, 94–103. doi:10.1037/a0023451

Bryan CJ, Morrow CE, Etienne N and Ray-Sannerud B. (2013), Guilt, shame, and suicidal ideation in a military outpatient clinical sample. Depression and Anxiety, 30, 55–60. doi:10.1002/da.22002 [PubMed: 23077111]

Calabrese JR, Prescott M, Tamburrino M, Liberzon I, Slembarski R, Goldmann E, . . . Wilson K. (2011). PTSD comorbidity and suicidal ideation associated with PTSD within the Ohio Army National Guard. Journal of Clinical Psychiatry, 72, 1072–1078. doi:10.4088/JCP.11m06956 [PubMed: 21899816]

Cohen J. (1977). Statistical power analysis for the behavioral sciences. New York, NY: Academic Press.

Cox KS, Mouilso ER, Venners MR, Defever ME, Duvivier L, Rauch SA, . . . Tuerk PW. (2016). Reducing suicidal ideation through evidence-based treatment for posttraumatic stress disorder. Journal of Psychiatric Research, 80, 59–63. doi:10.1016/j.jpsychires.2016.05.011 [PubMed: 27295122]

Cunningham KC, LoSavio ST, Dennis PA, Farmer C, Clancy CP, Hertzberg MA, ... & Beckham JC. (2019). Shame as a mediator between posttraumatic stress disorder symptoms and suicidal ideation among veterans. Journal of Affective Disorders, 243, 216–219. doi:10.1016/j.jad.2018.09.040 [PubMed: 30248631]

Drapeau CW, & McIntosh JL (for the American Association of Suicidology). (2016). U.S.A. suicide 2015: Official final data. Washington, DC: American Association of Suicidology. Retrieved August 2, 2017, from http://www.suicidology.org

Foa EB, Hembree EA, & Rothbaum BO. (2007). Treatments that work. Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences: Therapist guide. New York, NY, US: Oxford University Press.doi:10.1093/med:psych/9780195308501.001.0001

Gradus JL, Qin P, Lincoln AK, Miller M, Lawler E, Sørensen HT, & Lash TL. (2010). Posttraumatic stress disorder and completed suicide. American Journal of Epidemiology, 171, 721–727. doi:10.1093/aje/kwp456 [PubMed: 20160171]

Gradus JL, Suvak MK, Wisco BE, Marx BP, & Resick PA. (2013). Treatment of posttraumatic stress disorder reduces suicidal ideation. Depression and Anxiety, 30, 1046–1053. doi:10.1002/da.22117| [PubMed: 23636925]

Guerra VS & Calhoun PS. (2011). Examining the relation between posttraumatic stress disorder and suicidal ideation in an OEF/OIF veteran sample. Journal of Anxiety Disorders, 25, 12–18. doi:10.1016/j.janxdis.2010.06.025 [PubMed: 20709493]

Hornsey MJ, Olsen S, Barlow FK, & Oei TP. (2012). Testing a single-item visual analogue scale as a proxy for cohesiveness in group psychotherapy. Group Dynamics: Theory, Research, and Practice, 16, 80–90. doi:10.1037/a0024545

Horwitz AG, Held P, Klassen BJ, Karnik NS, Pollack MH, & Zalta AK. (2018). Posttraumatic cognitions and suicidal ideation among veterans receiving PTSD treatment. Cognitive Therapy and Research, 42, 711–719. doi:10.1007/s10608-018-9925-6 [PubMed: 30505042]

Horwitz AG, Miron L, & Maieritsch KP. (2019). Prospective associations between DSM–5 PTSD symptom clusters and suicidal ideation in treatment-seeking veterans. Psychological Services, 16, 321–328. doi:10.1037/ser0000215 [PubMed: 30359075]

Kimbrel NA, Meyer EC, DeBeer BB, Gulliver SB, & Morissette SB. (2016). A 12-Month prospective study of the effects of PTSD-depression comorbidity on suicidal behavior in Iraq/Afghanistan-era veterans. Psychiatry Research, 243, 97–99. doi:10.1016/j.psychres.2016.06.011 [PubMed: 27376669]

Kratovic L, Smith LJ, & Vujanovic AA. (2020). PTSD symptoms, suicidal ideation, and suicide risk in university students: The role of distress tolerance. Journal of Aggression, Maltreatment & Trauma, 1–19. doi:10.1080/10926771.2019.1709594

Krysinska K & Lester D. (2010). Post-traumatic stress disorder and suicide risk: A systematic review. Archives of Suicide Research, 14, 1–23. doi:10.1080/13811110903478997 [PubMed: 20112140]

Lambert MJ, Burlingame GM, Umphress VJ, Hansen NB, Vermeersch D, Clouse G, & Yanchar S. (1996). The reliability and validity of the Outcome Questionnaire. Clinical Psychology and Psychotherapy, 3, 106–116.

Larsen SE, Stirman SW, Smith BN, & Resick PA. (2016). Symptom exacerbations in trauma-focused treatments: Associations with treatment outcome and non completion. Behaviour Research and Therapy, 77, 68–77. doi:10.1016/j.brat.2015.12.009 [PubMed: 26731171]

McLean CP, Zang Y, Zandberg L, Bryan CJ, Gay N, Yarvis JS, ... & STRONG STAR Consortium. (2017). Predictors of suicidal ideation among active duty military personnel with posttraumatic stress disorder. Journal of Affective Disorders, 208, 392–398. doi:10.1016/j.jad.2016.08.061 [PubMed: 27810723]

Monson CM, Shields N, Suvak MK, Lane JE, Shnaider P, Landy MS, ... & Stirman SW. (2018). A randomized controlled effectiveness trial of training strategies in cognitive processing therapy for posttraumatic stress disorder: Impact on patient outcomes. Behaviour Research and Therapy, 110, 31–40. doi:10.1016/j.brat.2018.08.007 [PubMed: 30218837]

Muthén L, & Muthen B. (2017). Mplus. Los Angeles: Muthen & Muthen.

Nishith P, Nixon RD, & Resick PA. (2005). Resolution of trauma-related guilt following treatment of PTSD in female rape victims: A result of cognitive processing therapy targeting comorbid depression? Journal of Affective Disorders, 86(2–3), 259–265. doi:10.1016/j.jad.2005.02.013 [PubMed: 15935245]

Norr AM, Smolenski DJ, & Reger GM. (2018). Effects of prolonged exposure and virtual reality exposure on suicidal ideation in active duty soldiers: An examination of potential mechanisms. Journal of Psychiatric Research, 103, 69–74. doi:10.1016/j.jpsychires.2018.05.009 [PubMed: 29783077]

O'Donnell ML, Creamer M, & Pattison P. (2004). Posttraumatic stress disorder and depression following trauma: Understanding comorbidity. American Journal of Psychiatry, 161, 1390–1396. doi:10.1176/appi.ajp.161.8.1390 [PubMed: 15285964]

Pompili M, Sher L, Serafini G, Forte A, Innamorati M, Dominici G, ... & Girardi P. (2013). Posttraumatic stress disorder and suicide risk among veterans: a literature review. The Journal of Nervous and Mental Disease, 201(9), 802–812. doi:10.1097/NMD.0b013e3182a21458 [PubMed: 23995037]

R Core Team (2018). R: A Language and Environment for Statistical Computing [Computer software]. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Ramsawh HJ, Fullerton CS, Mash HBH, Ng THH, Kessler RC, Stein MB, & Ursano RJ. (2014). Risk for suicidal behaviors associated with PTSD, depression, and their comorbidity in the US Army. Journal of Affective Disorders, 161, 116–122. doi:10.1016/j.jad.2014.03.016 [PubMed: 24751318]

Resick PA, Monson CM, & Chard KM. (2016). Cognitive processing therapy for PTSD: A comprehensive manual. New York, NY: Guilford Publications.

Resick PA, Wachen JS, Dondanville KA, Pruiksma KE, Yarvis JS, Peterson AL, ... & Litz BT. (2017). Effect of group vs individual cognitive processing therapy in active-duty military seeking treatment for posttraumatic stress disorder: A randomized clinical trial. JAMA Psychiatry, 74, 28–36. doi:10.1001/jamapsychiatry.2016.2729 [PubMed: 27893032]

Stayton LE, Martin CE, Pease JL, & Chard KM. (2019). Changes in suicidal ideation following cognitive processing therapy in a VA residential treatment program. Military Psychology, 31, 326–334. doi:10.1080/08995605.2019.1630230

Stein DJ, Chiu WT, Hwang I, Kessler RC, Sampson N, Alonso J, . . . De Girolamo G. (2010). Cross-national analysis of the associations between traumatic events and suicidal behavior: Findings from the WHO World Mental Health Surveys. PloS One, 5(5), e10574. doi:10.1371/journal.pone.0010574 [PubMed: 20485530]

Stekhoven DJ. (2013). missForest: Nonparametric Missing Value Imputation using Random Forest. R package version 1.4.

Weathers FW, Litz BT, Herman JA, Huska JA, & Keane TM. (1993). The PTSD checklist (PCL): Reliability, validity and diagnostic utility. Paper presented at the 9th annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.

Wilcox HC, Storr CL, & Breslau N. (2009). Posttraumatic stress disorder and suicide attempts in a community sample of urban American young adults. Archives of General Psychiatry, 66, 305–311. doi:10.1001/archgenpsychiatry.2008.557 [PubMed: 19255380]

Zimmerman L, Villatte JL, Kerbrat AH, Atkins DC, Flaster A, & Comtois KA. (2015). Current suicidal ideation among treatment-engaged active-duty soldiers and marines. Military Behavioral Health, 3, 296–305. doi:10.1080/21635781.2015.1093980 [PubMed: 27170848]

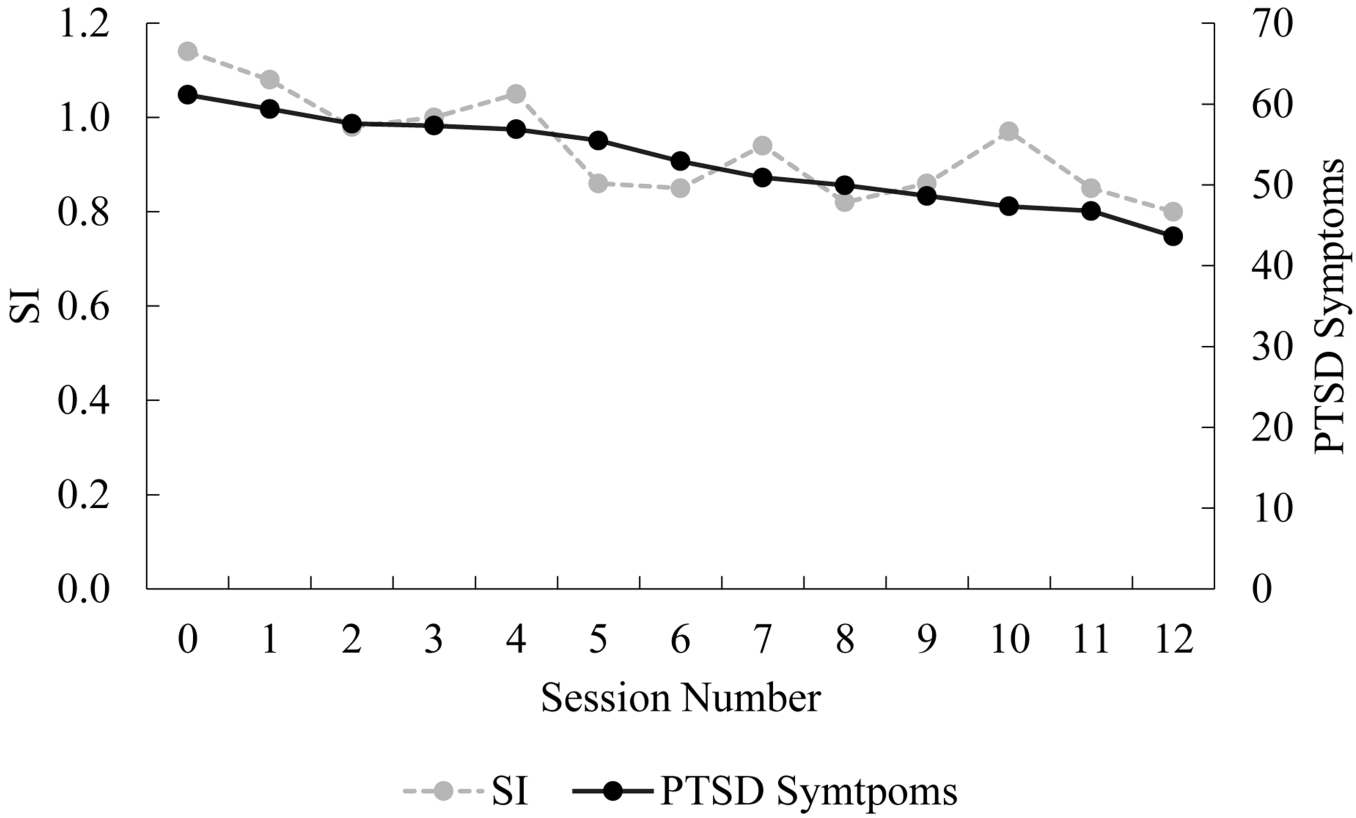

Figure 1.

Comparison of the 2-level growth curves (PTSD symptom trajectory vs. SI trajectory). We depicted this graph using an index chart to show relative change since baseline of PTSD symptoms and SI. The slopes are highly correlated $r(188) = .64$, $p < .001$. SI = suicidal ideation; PTSD = posttraumatic stress disorder

Table 1

Descriptive Statistics for Number of Days Since Baseline Assessment, PTSD Symptoms, and SI

	Number of Days Since Baseline		PTSD Symptoms			SI		
Session	***M***	***SD***	***n***	***M***	***SD***	***n***	***M***	***SD***
0	0.00	0.00	149	61.12	11.26	143	1.14	1.21
1	13.68	15.94	167	59.37	12.02	158	1.08	1.18
2	22.61	17.75	168	57.56	13.15	161	0.98	1.14
3	35.20	37.30	155	57.31	12.49	146	1.00	1.20
4	45.78	42.72	141	56.87	13.83	134	1.05	1.18
5	54.70	42.87	127	55.47	14.66	123	0.86	1.08
6	64.56	45.48	126	52.92	15.69	118	0.85	1.13
7	77.13	49.71	121	50.90	14.57	115	0.94	1.14
8	86.36	51.05	120	49.93	15.99	120	0.82	1.17
9	95.97	53.16	115	48.62	16.32	113	0.86	1.13
10	109.5	59.58	113	47.32	15.33	112	0.97	1.19
11	118.3	61.19	107	46.77	15.69	101	0.85	1.15
12	122.3	48.32	108	43.64	16.18	105	0.80	1.12

Note. The data comes from the sample that has completed the PTSD symptom and SI measures from a given session. *n* = sample; *M* = mean; *SD* = standard deviation; SI = suicidal ideation; PTSD = posttraumatic stress disorder; Session 0 = pre-session baseline.

Table 2

Growth Curve Estimates for Each Model of Time and Baseline to Session 12 Changes for PTSD Symptoms and SI

Parameter	Condition	*b*	*95% CI*	*p*
Intercept/Baseline				
	PTSD	61.12	[51.27, 70.97]	<.001
	SI	1.14	[0.96, 1.32]	<.001
Linear Time (Days/30)				
	PTSD	−0.90	[−1.06, −0.74]	<.001
	SI	−0.01	[−.021, −0.001]	.026
Log function of time [Ln(time+1)]				
	PTSD	−1.81	[−3.31, −2.33]	<.001
	SI	−0.05	[−0.08, −0.02]	.003
Baseline - S12 Change		Est	*d*	
	PTSD	−17.35	−1.56	
	SI	−0.33	−0.27	

Note. Initial estimates from PTSD and SI symptom growth curve models did not fully display in the Mplus output due to program limitations. We divided the temporal variable in all models by a constant (30) to change timing from daily to monthly. Dividing both variables by a constant does not change the results other than altering the coefficient metric. *B* = unstandardized regression coefficient; *95% CI* = 95 percent confidence interval; *p* = *p*-value; Est = estimate; *d* = Cohen's d effect size (0.20 small, 0.50 medium, 0.80; (Cohen, 1977); S12 = session 12; Days = days since baseline therapy session; SI = suicidal ideation; PTSD = posttraumatic stress disorder.

Table 3

Fixed-Effect Estimates for the Multilevel Cross-Lagged Analyses of PTSD Symptoms and SI

Parameter	*b*	*SE*	*p*	*pr*
SI				
Intercept	0.24	0.12	.057	.09
Auto-Correlated SI	0.45	0.03	< .001	.55
Cross-Lagged PTSD Symptoms	0.01	0.00	.008	.10
Time (Linear)	0.00	0.00	.208	−.03
PTSD Symptoms				
Intercept	5.74	0.98	< .001	.15
Auto-Correlated PTSD Symptoms	0.88	0.02	< .001	.84
Cross-Lagged SI	0.13	0.19	.510	.01
Time (Linear)	−0.01	0.01	.220	−.03
Time (Quadratic)	0.00	0.00	.443	.02

Note. *b* = unstandardized coefficient; *SE* = standard error; *p* = p-value; *pr* = partial regression coefficient (small = .10, medium = .24, large = .37); PTSD = posttraumatic stress disorder; SI = suicidal ideation