Journal of Psychiatric Research 80 (2016) 59–63

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/psychires

Reducing suicidal ideation through evidence-based treatment for posttraumatic stress disorder

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ARTICLE INFO

Article history:
Received 28 December 2015
Received in revised form
9 May 2016
Accepted 23 May 2016

Keywords:
Suicide
Suicidal ideation
Suicide prevention
Posttraumatic stress disorder (PTSD)
Evidence-based treatments (EBTs)
Effectiveness research

ABSTRACT

Background: Suicide is a major public health concern in military and civilian contexts. Veteran populations are at increased risk for suicide, especially veterans with mental health disorders such as Posttraumatic Stress Disorder (PTSD). Suicidal ideation (SI) is a primary risk factor for suicide.
Methods: We investigated changes in SI in a multi-site sample of treatment seeking veterans from three separate Veterans Health Administration (VA) medical centers (n = 289) who received Prolonged Exposure (PE) therapy, an evidence-based treatment (EBT) for PTSD. SI and PTSD symptoms were assessed, using self-report instruments, throughout routine clinical care.
Results: Both PTSD and SI symptoms reduced over the course of treatment (d-type effect sizes of 1.47 and 0.27, respectively). While SI was associated with PTSD symptoms at all time points, appropriately specified, time lagged models indicated that changes in PTSD symptoms were predictive of future declines in SI, while the converse was not true.
Conclusions: Results indicate that treating PTSD symptoms with an EBT for PTSD can be an effective way to reduce SI, at least partially, and for some patients. These data are significant in light of the resources and programming devoted to addressing SI in the VA relative to available empirical evidence regarding the effectiveness of developed strategies. The findings demonstrate the importance of facilitating EBT referrals for specific disorders as a component of broad-based suicide outreach and preventions strategies.

Suicide is a major public health concern. In the United States, suicide is a leading cause of death (Xu et al., 2016; CDC, 2013). Suicide rates among U.S. military and veteran populations are especially concerning. Recent estimates suggest veterans constitute 9% of the U.S. population (Texas Workforce Investment Council, 2012) but 22% of known suicides (Kemp and Bossarte, 2012). A recent study examining Veterans Health Administration (VA) service users found that the standardized mortality ratio of suicide fatalities was 1.42 to 1.66 times higher among veterans than the general population (Blow et al., 2012). Some evidence suggests that Afghanistan and Iraq veterans, compared to other veterans, are at particular risk for suicide, although data are limited (Kang and Bullman, 2008). In response, a number of major federal initiatives have attempted to address suicide prevention within active duty

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http://dx.doi.org/10.1016/j.jpsychires.2016.05.011
0022-3956/

and veteran populations (Department of Veterans Affairs, 2008), and the U.S. population as a whole (U.S. Public Health Service, 1999).

Even with focused suicide prevention efforts, predicting and effectively treating suicidality remains difficult (Klonsky and Muehlenkamp, 2007). The low base rate of suicide is a major barrier to research, as low base rate behaviors are difficult to predict (Murphy, 1983). Still, risk factors for suicidality have been identified, including suicidal ideation (SI) (Borges et al., 2008) and psychiatric diagnoses, such as Posttraumatic Stress Disorder (PTSD) (Haney et al., 2012). SI has been shown to predict specific behaviors such as making a suicide plan, suicide gestures, and suicide attempts (Gradus et al., 2010). The association between SI and suicide attempts is important as having a suicide attempt is one of the most robust predictors of completed suicide (Joiner, 2005). Among psychiatric diagnoses, PTSD is a salient risk factor for SI, suicide attempts, and completions in general (Gradus et al., 2010; Tarrier and Gregg, 2004) and military populations (Ilgen et al., 2010; Jakupcak et al., 2009) (but see Conner et al., 2014). Thus, populations with SI *and* PTSD are especially relevant targets for suicide prevention efforts.

VA mental health clinics that provide evidence-based treatments (EBTs) for PTSD are important, though under-identified, contexts to study suicide prevention. EBTs for PTSD, such as Prolonged Exposure (PE), have been found to reduce PTSD symptoms with consistently large effect-sizes (Nacasch et al., 2011; Eftekhari et al., 2013). PTSD symptom reduction might be a key element in reducing SI.

Limited data specifically addresses suicidality and SI in the context of EBTs for PTSD (Panagiotti et al., 2009). Two studies have linked EBTs for PTSD to reductions in SI. One trial demonstrated that in a civilian, female sample at high risk for suicide, a treatment package, which included PE, reduced SI (Harned et al., 2014). A randomized clinical trial (RCT) with a civilian, female sample showed that two EBTs for PTSD (PE and Cognitive Processing Therapy) reduced SI. In this trial, SI reduction was associated with reductions in PTSD symptoms, even when depression or hopelessness were accounted for (Gradus et al., 2013). The generalizability of these findings is limited as both trials were completed in an efficacy context, and employed civilian, female samples with an average age near 30 years old.

The current study investigates SI during routine care in three PTSD specialty clinics at three VA medical centers. The current study extends research on SI in the context of EBTs for PTSD by investigating a predominately male, veteran sample, with an average age of 50, in an effectiveness context. We predicted PE for PTSD would be associated with reduction in SI. We also predicted that, throughout treatment, SI would be related to PTSD symptoms. In addition to hypothesis testing, exploratory analyses investigated the dynamic relationship of SI and PTSD symptoms over time.

1. Method

1.1. Sample and treatment setting

The current sample consisted of 289 veterans engaged in PE for PTSD, between January 1, 2006 and August 22, 2013, in three outpatient PTSD specialty clinics using similar clinical procedures, housed at VA medical centers in distinct geographical regions. 144 (of 289) veterans were drawn from site 1, while 101 and 44 were drawn from site 2 and 3, respectively. After a standardized intake assessment, including the Clinician Administered PTSD Scale (Blake et al., 1995) or the Posttraumatic Symptom Interview (Foa et al., 1993), patients were assigned to a clinic therapist for PE and symptoms were tracked at multiple time points through treatment. Providers were clinical psychologists, social workers, psychology postdoctoral residents, or predoctoral psychology interns. Across the three sites, more than fifty providers are represented in the data set. Standard clinic practices included weekly PE peer-group supervision.

Inclusion criteria required: (i) The use of PE throughout treatment, and (ii) the collection of at least 2 points of SI measurement: at baseline and at least 28 days from the baseline measurement. This minimum time frame was selected as it corresponds to the time typically required to initiate all active exposure elements of PE. Notably, this is a conservative time frame for the current hypotheses because it is not typically considered a sufficient minimum dose of PE. Participant gender (female/male), age, and race/ethnicity (White/Black/Hispanic/Asian/Native Hawaiian and Other Pacific Islander), were obtained from an intake demographic questionnaire. Demographic data were obtained via the VA's Computerized Patient Record System for a minority of participants whose data were missing from intake questionnaires. The final sample ($n = 289$) was 89% male, 13% African-American, 1.5% Hispanic, 0.5% Native Hawaiian or other Pacific Island, and 85% White. The average age of study participants was 50.4 years ($SD = 15.10$). Service era included 0.3% World War II, 0.8% Korea, 37.7% Vietnam, 16.9% Desert Storm/Desert Shield, 30.4% OEF/OIF, and 11.5% Other.

The study was conducted as part of a PTSD archival data initiative approved by a VA institutional review board. Study data were collected during routine care. There were no research related exclusion criteria, and no incentives were given as part of study participation.

1.2. Procedure

1.2.1. Prolonged Exposure therapy

PE (Foa et al., 2007) is a manualized treatment protocol typically administered over 8 to 13 weekly 90-minute sessions. The primary elements include: a) psychoeducation, b) detailed rationale for treatment procedures, c) repeated in-vivo exposures to safe situations avoided due to distress, d) repeated and prolonged imaginal exposure to traumatic memories, and e) discussion of traumatic memories and imaginal exposures. Between sessions, patients complete in vivo exposures and listen to audio recordings of imaginal exposures.

1.3. Measures

1.3.1. PTSD symptoms

The PTSD Checklist (PCL)-military version (Weathers et al., 1991) is a 17-item self-report measure of PTSD symptoms based on *Diagnostic and Statistical Manual for Mental Disorders—Fourth Edition* (*DSM—IV*) criteria (American Psychiatric Association, 2000). PCL scores range from 17 to 85 with higher scores indicating greater symptom severity. The PCL has good diagnostic efficiency (>0.70) and robust psychometric properties (Blanchard et al., 1996).

1.3.2. Suicidal ideation

In line with prior research (Gradus et al., 2013; Joiner et al., 2005), the suicide item from the Beck Depression Inventory (item 9; BDI-II: Beck et al., 1996) was used to assess SI. Although this method involves a one-item assessment of SI, BDI item 9 has been shown to correlate with Beck's Scale for Suicidal Ideation (e.g., $r = 0.48$, $p < 0.001$), and thus is a valid measure of SI (Desseilles et al., 2012). Moreover, each of the sub-responses of BDI item 9 contain descriptions for self-identified and specific symptoms. The item is entitled "Suicidal Thoughts or Wishes," and is presented on an ordinal scale from 0 to 3: "I don't have any thoughts of killing myself" (0), "I have thoughts of killing myself, but I would not carry

them out"(1), "I would like to kill myself"(2), and "I would kill myself if I had the chance"(3).

1.3.3. Weeks in treatment

Each measurement point of SI and PCL had an associated date. As PE is typically offered on a weekly basis, single-point dates were transformed into a Weeks in Treatment value.

1.4. Data analyses

Descriptive statistics and bivariate correlations for study variables were calculated using SPSS 23.0 software (IBM, 2014). Slope of SI between available measurements was tested using hierarchical linear modeling (HLM) with HLM 6 software (Raudenbush et al., 2004). *d*-type effect sizes and a Wilcoxon Ranked Sign Test were calculated to qualify differences in SI through treatment. Baseline differences between sub-samples with and without SI were investigated with one-way ANOVA and logistic regression. Mean levels of SI according to service era were investigated with one-way ANOVA and post hoc comparisons.

The temporal relationship between PTSD symptoms and SI was investigated with a modified Krull-MacKinnon Technique (Krull and MacKinnon, 2001) for longitudinal (time lagged) data. To account for assumed cross-sectional and longitudinal collinearity in these measures, separate models were used to regress: 1) SI on the previous session SI, 2) SI on the previous session SI and previous session PCL simultaneously, 3) PCL on the previous session SI and 4) PCL on the previous session SI and previous session PCL, simultaneously. These analyses were used to discern a "bi-directional" temporal effect from a "unidirectional" temporal effect while controlling for collinearity and avoiding violations of independence via fitting the data at level 1 (Bryk and Raudenbush, 1992). Statistically significant outcomes were qualified with effect sizes in a manner consistent with recommended guidelines for mixed/HLM models (Snijders and Bosker, 1994).

2. Results

Average number of weeks in treatment was 12.35 ($SD = 5.86$). First and final session PCL averages were 62.4 ($SD = 10.5$) and 47.0 ($SD = 15.7$), respectively. Overall treatment was associated with significant reduction in PCL-measured PTSD symptoms, $t(267) = 19.03$, $p < 0.001$ ($d = 1.47$) in the full intent-to-treat (ITT) sample. HLM models predicting SI were based on longitudinal points of measurement nested within 289 patients. An unconditional model estimated variance components for measurement-level and person-level units ($\sigma 2 = 0.149$, $\tau = 0.166$). The value of τ was significantly different from zero ($\chi 2 = 931.79$, df = 288, $p < 0.001$) with an intraclass correlation of 0.53, indicating that 53% of SI variance could be accounted for by factors associated with patient specification. Time of measurement predicted SI ($\beta = -0.15$, $p < 0.001$; 95% CI −0.21 to −0.09). The average SI scores at the first and final sessions were 0.48 ($SD = 0.60$) and 0.33 ($SD = 0.51$), respectively ($d = 0.27$). The nonparametric Wilcoxon Signed Rank test also indicated a significant decrease in SI ($z = -4.78$, $p < 0.001$), with 214 ties (response unchanged: unchanged response = 0, 50.2%; unchanged response = 1, 22.8%; unchanged response = 2, 0.7%; and unchanged response = 3, 0.3%), 58 decreases (response decrease: 1 to 0, 17.6%; 2 to 1, 1.7%; 3 to 0, 0.3%; 3 to 1, 0.3%), and 17 increases (response increase: 0 to 1, 5.9%). At first treatment session, 44% ($n = 127$) of the sample reported SI. Among this sub-sample, 41% ($n = 52$) reported no SI at final session, and 46% ($n = 58$) reported at least some reduction in SI by last session (See Fig. 1). In addition, when compared to the sub-sample reporting no baseline SI, the sub-sample reporting baseline SI was older ($M = 51.37$, $SD = 17.02$ vs. $M = 46.57$, $SD = 17.56$; $F(1, 259) = 4.89$, $p < 0.03$) and obtained higher PCL scores ($M = 65.76$, $SD = 9.57$ vs. $M = 59.78$, $SD = 10.40$; $F(1, 269) = 23.56$, $p < 0.001$). No differences were found between these sub-samples with respect to gender and race (only White and African-American groups were large enough to test race/ethnicity differences). When comparing baseline SI, differences were found between Vietnam, Desert Storm, and OEF/OIF service era veterans (Welch's $F(2, 218) = 9.25$, $p < 0.001$). (World War II and Korea service era veterans were excluded from this analysis due to small sample sizes, as were "Other" service era veterans due to interpretation limitations with this category.) Dunnett T3 post hoc comparisons revealed that Vietnam era veterans reported greater SI than OEF/OIF era veterans ($M = 0.64$, $SD = 0.65$ vs. $M = 0.28$, $SD = 0.48$; $p < 0.001$). No differences were found between those two groups and Desert Storm era veterans.

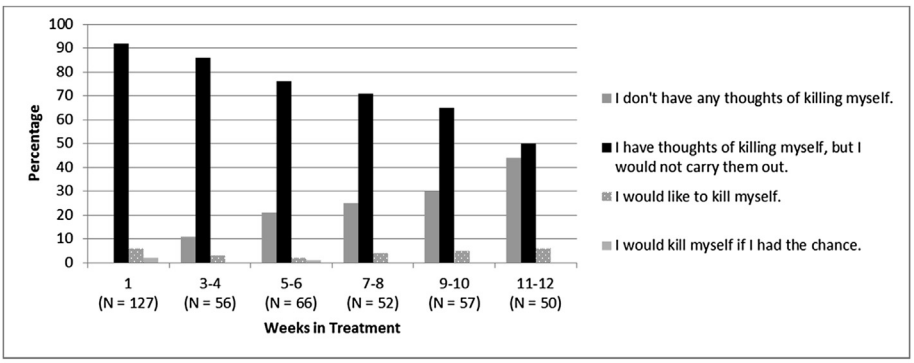
SI and PTSD symptoms were correlated across all points of measurement ($r = 0.42$, $p < 0.001$), including first ($r = 0.33$, $p < 0.001$) and last sessions ($r = 0.46$, $p < 0.001$). An HLM predicting SI from the previous session SI indicated a significant effect ($\beta = 0.35$, $p < 0.001$), accounting for 16% of the variance in SI. Adding previous session PTSD symptoms in the model resulted in significant predictive coefficients for both previous session SI and previous session PTSD symptoms ($\beta = 0.007$, $p < 0.003$), and accounted for an additional 3% of variance in SI outcomes. Thus, previous session PTSD symptoms predicted SI, over and above previous session SI. The converse analyses were run with PTSD symptoms predicted by previous session PTSD symptoms ($p < 0.001$) and previous session SI ($p < 0.566$), with no significant finding for SI.

3. Discussion

This multi-site study investigated if PE for PTSD was associated with a reduction in SI among veterans receiving standard outpatient treatment at three VA medical centers. PE for PTSD was associated with significant reductions in PTSD symptoms and SI. PTSD symptoms predicted SI at the following visit, over and above previous SI, though the converse was not true. Although PTSD symptoms and SI were correlated across all treatment time points, it appears that reductions in PTSD symptoms came prior to, and partially explained reductions in SI.

The current results, obtained in naturalistic settings, are similar to findings from two RCTs, as all three investigations found that EBTs for PTSD are associated with reductions in SI (Gradus et al., 2013; Harned et al., 2014). The current results provide novel evidence that, during the course of an EBT, PTSD symptom reductions come prior to and predict declines in SI. This effect is not attributable to collinearity between the measures. Moreover, the current study sample includes important criteria for generalizability: large sample size, multiple sites, naturalistic settings, and highly-standardized treatment. In addition, the current study extends research on EBTs for PTSD and SI, by employing a predominately male, veteran sample.

In the current sample, about half of those initially reporting SI experienced decreases in SI throughout treatment, with 41% of this sub-sample reporting no SI by the final session. These findings suggest that PE is salutary for the reduction of SI. Still, 59% of those who started treatment with SI still reported at least some SI in their last available session, even if step-wise reductions occurred. Moreover, for the entire sample, the SI reduction effect size was small ($d = 0.27$). Given the study's ITT sample, including premature treatment terminators, and also given the robust relationship between SI reduction and weeks in treatment, it is likely that early termination played a significant role in non-reduction of SI, but this is speculation. Regardless, these results suggest that PE may only be



Note: Data is not available, at each week, for all 127 participants in sub-sample after week 1.

Fig. 1. Sub-sample of Veterans Endorsing Baseline Suicidal Ideation (SI) (N = 127), Percent Endorsing SI through Weeks of Treatment. *Note:* Data is not available, at each week, for all 127 participants in sub-sample after week 1.

a part of the necessary clinical services for treating SI in PTSD, albeit a seemingly critical and efficient service.

Why is a dose of PE associated with reductions in SI? One possibility is that measures of SI and PTSD reflect a latent construct of generalized distress. Although this likely plays a role, the current data also suggest something more specific, as PTSD symptoms predicted future SI, but the converse was not true. Thus, the current results suggest that PE reduces PTSD symptoms, which leads to reductions in SI. This finding, however, needs to be qualified by limitations of the current data.

3.1. Limitations and conclusion

There are several limitations of the current study. Although the SI measure used is non-intrusive, easily administered, and has high utility in clinical settings (Luoma et al., 2002), it is a limited measure. Measurement points in this study were associated with ecologically-valid treatment in naturalistic settings and so were not always equally spaced in time. Although not violating statistical assumptions, this limits interpretation. Moreover, it is possible that the temporal results presented here would be attenuated if the SI and PTSD symptom measures were equally dynamic. It is likely that the SI measure primarily captures substantial changes in SI, while the PTSD symptom measure likely captures more subtle changes in PTSD symptoms. Even so, the descriptive individual response choices on the SI measure has real-world meaning and are face valid. Regardless of dynamic psychometric nuances, the SI responses and changes in those responses, are meaningful. Other study limitations exist that are typical of research in naturalistic settings: no randomization or comparison groups, no a priori definition of treatment completion, no data on dropout rate, variable number of measurement points across participants, missing data, and clinicians not blind to assessment procedures and outcomes. Moreover, in contrast to previous research on EBTs for PTSD and SI, the current sample was veteran and predominately White males. Thus, generalizing the results of this study, especially the novel findings of PTSD symptom reduction predicting SI reductions, should be done with caution. Recognizing these limitations, the current study still provides relevant data on the reduction of SI in EBT effectiveness settings.

Suicide is a major mental health issue that is difficult to predict due to low base rates. Thus, highly generalizable practices to address suicide are needed. The results of this study, in concert with the findings from well-controlled clinical trials (Gradus et al., 2013; Harned et al., 2014), support the notion that for individuals with PTSD, an EBT should be part of a generalized plan of care and suicide risk-management. As such, we put forth that broad-based suicide prevention efforts should promote widespread availability of EBTs for PTSD. Moreover, suicide prevention programming should include specific and efficient mechanisms to link individuals with SI and PTSD to clinics in which EBTs for PTSD are provided. Building up suicide prevention infrastructures to promote access to EBTs for PTSD and targeted referrals will involve high levels of collaboration and might challenge existing mores in healthcare institutions. This approach, though, will have the additional benefit of encouraging broader adoption of EBTs for PTSD in standard mental health infrastructures, which aligns with current initiatives and values in and outside of the VA.

Conflict of interest

The authors of this manuscript have no conflict of interests, and therefore have no conflicts to report.

Author contributions

Keith S. Cox: Study design, data collection and preparation, statistical analyses, manuscript preparation.

Emily R. Mouilso: Data collection and preparation, manuscript preparation.

Margaret R. Venners: Data collection and manuscript preparation. Mahrie E. Defever: Data collection and manuscript preparation.

Leticia Duvivier: Manuscript preparation.

Sheila A.M. Rauch: Data collection and manuscript preparation.

Thad Q. Strom: Data collection and manuscript preparation.

Thomas E. Joiner: Study design and manuscript preparation.

Peter W. Tuerk: Study design, data collection and preparation, statistical analyses, manuscript preparation.

Dr. Keith Cox and Dr. Peter Tuerk were responsible for all data analyses.

Role of funding source

Dr. Tuerk's contribution to this work was supported by a Career Development Award (CDA-2) from the Department of Veteran Affairs, Veterans Health Administration, Office of Research and Development, Clinical Sciences Research and Development (PI: Peter W. Tuerk).

The Office of Research and Development had no direct role or knowledge of the current manuscript. This Office awarded Dr. Tuerk a career development award, which included general time for

manuscript preparation related to Dr. Tuerk's PTSD research interests. Dr. Tuerk used some of this time to work on this manuscript.

Acknowledgments

Dr. Cox had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Dr. Tuerk's contribution to this work was supported by a Career Development Award (CDA-2-013-09F) from the Department of Veteran Affairs, Veterans Health Administration, Office of Research and Development, Clinical Sciences Research and Development (PI: Peter W. Tuerk).

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