Journal of Anxiety Disorders 64 (2019) 45–54

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

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

A randomized controlled trial of prolonged exposure therapy versus relaxation training for older veterans with military-related PTSD☆

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ARTICLE INFO

Keywords:
Aging
Geriatric
Combat veterans
Psychotherapy
Cognitive-behavioral therapy

ABSTRACT

Objective: Although prolonged exposure (PE) has strong support for treating posttraumatic stress disorder (PTSD), there is little research on PE for older adults. Likewise, Relaxation Training (RT) has shown some benefit for PTSD, but has not been adequately tested in this population.

Method: This study represents the first randomized controlled trial of two active psychotherapies for PTSD among older adults. Male combat veterans (N = 87; *mean age* = 65 years) were randomly assigned to 12 sessions of PE (n = 41) or RT (n = 46). Clinician-administered and self-report assessments were conducted at pre-treatment, post-treatment, and six-month follow-up; self-reported symptoms were also measured at each treatment session.

Results: Multi-level modeling indicated that Clinician-Administered PTSD Scale scores significantly decreased from pre-treatment to follow-up, but the time by treatment condition interaction was not significant. Pre- to post-treatment change was large in PE and moderate in RT, but many gains were lost at follow-up. For self-reported PTSD symptoms, a significant time by treatment condition interaction emerged, suggesting that participants who received PE had both greater decreases in symptoms and a greater rebound in self-reported PTSD symptoms than those who received RT. Unlike PTSD symptoms, depression symptoms neither changed nor were moderated by treatment condition from pre-treatment to follow-up. For self-reported PTSD and depression symptoms assessed at each session, time significantly predicted symptom reductions across psychotherapy sessions.

Conclusions: PE and RT are well-tolerated, feasible, and effective for older adults, though treatment gains were not maintained at follow-up.

Trial registration: clinicaltrials.gov Identifier: NCT00539279.

☆ All views and opinions expressed herein are those of the authors and do not necessarily reflect those of our respective institutions or the U.S. Department of Veterans Affairs.

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https://doi.org/10.1016/j.janxdis.2019.02.003
Received 7 August 2018; Received in revised form 21 December 2018; Accepted 20 February 2019
Available online 21 February 2019
0887-6185/ Published by Elsevier Ltd.

1. Introduction

Posttraumatic stress disorder (PTSD) is a major public health problem in the United States (U.S.), with lifetime prevalence estimates ranging from 8 to 10% in the general population (Kilpatrick et al., 2013; Miller et al., 2013) and 1.6–4.5% among older adults (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012; Pietrzak, Goldstein, Southwick, & Grant, 2012). Combat veterans report particularly high levels of PTSD, with lifetime estimates ranging from 6 to 31% (e.g., Fulton et al., 2015; Richardson, Frueh, & Acierno, 2010). The personal and societal costs of PTSD are high, and include early mortality, attempted suicide, functional impairment, and psychiatric and physical comorbidity (Goldberg et al., 2014; Kilpatrick et al., 2013; Lohr et al., 2015; Oquendo et al., 2003). Although the effects of PTSD are well studied in a general adult population, there is minimal research examining PTSD in older adults, particularly regarding treatment.

Because PTSD typically has a chronic course (Chopra et al., 2014), psychological, social, and occupational dysfunctions may persist throughout the lifespan. The older adult population is large, multigenerational, and heterogeneous, but older individuals are often grouped together despite differences in their historical and cultural experiences (e.g., Great Depression; Cook & Niederehe, 2007; Norris, Kaniasty, Conrad, Inman, & Murphy, 2002). This has limited our understanding of the dynamics and treatment of PTSD in this population.

Limited research examines differences in PTSD symptomatology between older and younger adults (Bottche, Kuwert, & Knaevelsrud, 2012). Some studies have found no differences in PTSD severity or symptom expression, while others have found older adults have lower severity (Bottche et al., 2012). Older adults may also experience greater PTSD symptoms and express PTSD differently than younger adults (Bottche et al., 2012). One study found that older adults have more hyperarousal and fewer intrusive symptoms following a traumatic event when compared to younger groups (Goenjian et al., 1994).

PTSD presentation may also change throughout the lifespan. Research suggests that avoidance increases while re-experiencing and hyperarousal decrease across time (Trappler, Braunstein, Moskowitz, & Friedman, 2002; Yehuda et al., 2009). Thus, explicitly targeting avoidance in older adults with PTSD may be particularly important. PTSD symptoms may reemerge later in life, perhaps due to health problems, stressful events (e.g., retirement), or decreased social support (Hiskey, Luckie, Davies, & Brewin, 2008; Lantz & Buchalter, 2001). This highlights the importance of examining PTSD among older adults as a distinctive cohort.

The number of older veterans is rising, and they are increasingly requesting mental health care (Wiechers, Karel, Hoff, & Karlin, 2015). Thus, there is a need to determine how to best treat PTSD in older veterans. Individuals with military-related PTSD have high nonresponse rates and residual symptoms following evidence-based PTSD treatment. Approximately two-thirds of individuals with military-related PTSD retain their diagnosis following evidence-based interventions, and one-third drop out of treatment prior to receiving an adequate "dose" (Steenkamp, Litz, Hoge, & Marmar, 2015). Furthermore, combat veterans are less responsive to treatment when compared to other types of trauma; one meta-analysis reported that individuals with combat trauma report half as much improvement as those who experienced an assault and two-thirds as much as those who experienced other trauma types (Bradley, Greene, Russ, Dutra, & Westen, 2005).

Three randomized controlled trials (RCTs) have been conducted with older adults with trauma histories, though none focused on veterans or compared active psychotherapies. Bichescu, Neuner, Schauer, and Elbert, (2007) compared narrative exposure therapy (NET; $n = 9$) to a single session of psychoeducation ($n = 9$) for former political prisoners with PTSD ($M_{age} = 70$ years). NET, but not psychoeducation, resulted in a reduction in PTSD and depression symptoms. Bowland, Edmond, and Fallot, (2012) administered a spiritually-based group intervention to women who experienced interpersonal trauma (e.g., domestic violence). Participants were over 55 years old, and a PTSD diagnosis was not required. Nonetheless, participants in the treatment condition ($n = 21$) reported decreases in physical complaints, PTSD, depression, and anxiety compared to the delayed treatment group ($n = 22$). Finally, Knaevelsrud, Böttche, Pietrzak, Freyberger, and Kuwert, (2017) conducted a comparison of a therapist-assisted, Internet-based writing therapy ($n = 47$) to a delayed treatment group ($n = 47$) for older adults (primarily women; $M_{age} = 71$ years) with subsyndromal or full PTSD. Writing therapy was superior to delayed treatment in reducing PTSD symptoms. These studies suggest that older adults can benefit from PTSD treatments, but RCTs examining evidence-based interventions (e.g., prolonged exposure [PE], cognitive processing therapy [CPT]) among older adults are lacking.

Exposure-based therapy is effective for younger samples, and it is included in nationally recognized guidelines for treating PTSD (*Veterans Affairs [VA]/Department of Defense [DoD] PTSD Guideline*, 2017). Three small studies testing exposure in older combat veterans suggest that exposure-based treatments are effective (Gamito et al., 2010; Thorp, Stein, Jeste, Patterson, & Wetherell, 2012; Yoder et al., 2013). Two of these studies (Thorp et al., 2012; Yoder et al., 2013) examined PE, one type of trauma-focused exposure therapy that has been successfully and extensively used to treat PTSD (Thorp, Wells, & Cook, 2017). PE is a manualized intervention (Foa, Hembree, & Rothbaum, 2007) that treats PTSD by exposing clients to feared, but safe, situations (in vivo exposure) and memories (imaginal exposure). Yoder et al. (2013) presented data from 65 combat veterans who received PE at a VA clinic, while Thorp et al. (2012) reported outcomes for 11 veterans with military traumas. Although these studies reported improvements in PTSD in older adults following PE, neither study used a randomized design or included follow-up assessments. As such, these findings are preliminary.

A recent review examined potential mechanisms of change in PE and found that between-session habituation and changes in trauma-related beliefs strongly influence treatment-related change (Cooper, Clifton, & Feeny, 2017). PE is well suited to change negative post-traumatic beliefs. Through repeated imaginal exposure, individuals learn that they can tolerate trauma related memories and emotions, which may improve self-perception and self-efficacy (Cooper et al., 2017). Through in-vivo exposures, individuals disconfirm negative beliefs by gathering evidence for what they are able to do successfully and safely. Lau, Edelstein, and Larkin, (2001) proposed that exposure may actually work more efficiently among older adults with anxiety, based on findings that this cohort experiences a quicker rate of physiological extinction to feared stimuli when compared to younger adults. Differences in rates of habituation to exposure between younger and older adults may influence PE treatment outcomes between cohorts. This hypothesis warrants more research.

Relaxation training (RT) reduces anxiety in older samples (Thorp et al., 2009), and has been used as a control condition for trauma-focused studies because it is relatively easy to learn, is well-accepted by patients, and has been shown to improve PTSD (Bernstein, Borkovec, & Hazlett-Stevens, 2000). Taylor et al. (2003) compared RT to PE in an RCT for younger adults ($M_{age} = 37$ years) and found that individuals who received RT had a significant reduction in symptoms; however, those in the PE condition experienced significantly greater reductions and a quicker treatment response. Taylor et al. (2003) did not report outcomes for older adults.

Relaxation is proposed to work by reducing anxiety and physiological arousal, enhancing self-efficacy, developing a sense of control, increasing decentering (i.e., the ability to observe thoughts and feelings objectively and not personalize them; Hayes-Skelton, Calloway, Roemer, & Orsillo, 2015), and improving anxiety awareness (Conrad & Roth, 2007; Hayes-Skelton et al., 2015; Siev & Chambless, 2007). Because older adults with PTSD tend to have high levels of hyperarousal (Goenjian et al., 1994), this intervention may be particularly effective among this cohort. Decreasing arousal through relaxation may reduce

startle responses and improve sleep, irritability, and anger. Decentering may help older adults with PTSD to distinguish intrusive memories from the actual traumatic event, lowering their distress.

The current study is the first RCT to compare the efficacy of two active psychotherapies for older adults with PTSD. U.S. combat veterans over the age of 60 with military-related PTSD were recruited; eligible participants were randomized to receive either PE or RT. Unlike PE, where the mechanism of action centers on the excitation of the stress response system and habituation over time, RT focuses on using relaxation techniques to counteract anxiety and stress. Using RT as a comparison condition allows for inferences about the utility and efficacy of exposure therapy in this population. We hypothesized that older male combat veterans randomized to PE would have significantly greater decreases in PTSD and depression symptom severity over the study duration in comparison to those randomized to RT.

2. Method

2.1. Participants

Eighty-seven male combat veterans recruited from a southwestern VA medical center between 2009–2013 participated in this study (see Fig. 1 for CONSORT diagram). Veterans had a mean age of 65.54 (range = 60–89; *SD* = 5.69 years). On average, participants reported 13.99 years of education (*SD* = 2.63), and a yearly median income of $30,000 to $45,000. The majority of the sample was married (76%), White (72%), and served in Vietnam (83%; See Table 1 for demographic information).

Study inclusion criteria included: (a) male U.S. veterans; (b) age 60 or older; (c) English literacy; and (d) primary diagnosis of PTSD due to a military criterion A event with a clear memory of their worst trauma. Exclusion criteria were: (a) unmanaged psychosis or manic episodes in the past year; (b) concurrent psychotherapies targeting PTSD or depression (veterans engaged in non-exposure treatment for disorders other than PTSD [e.g., general couples therapy] were eligible); (c) severe cardiovascular or respiratory disease that made it difficult to

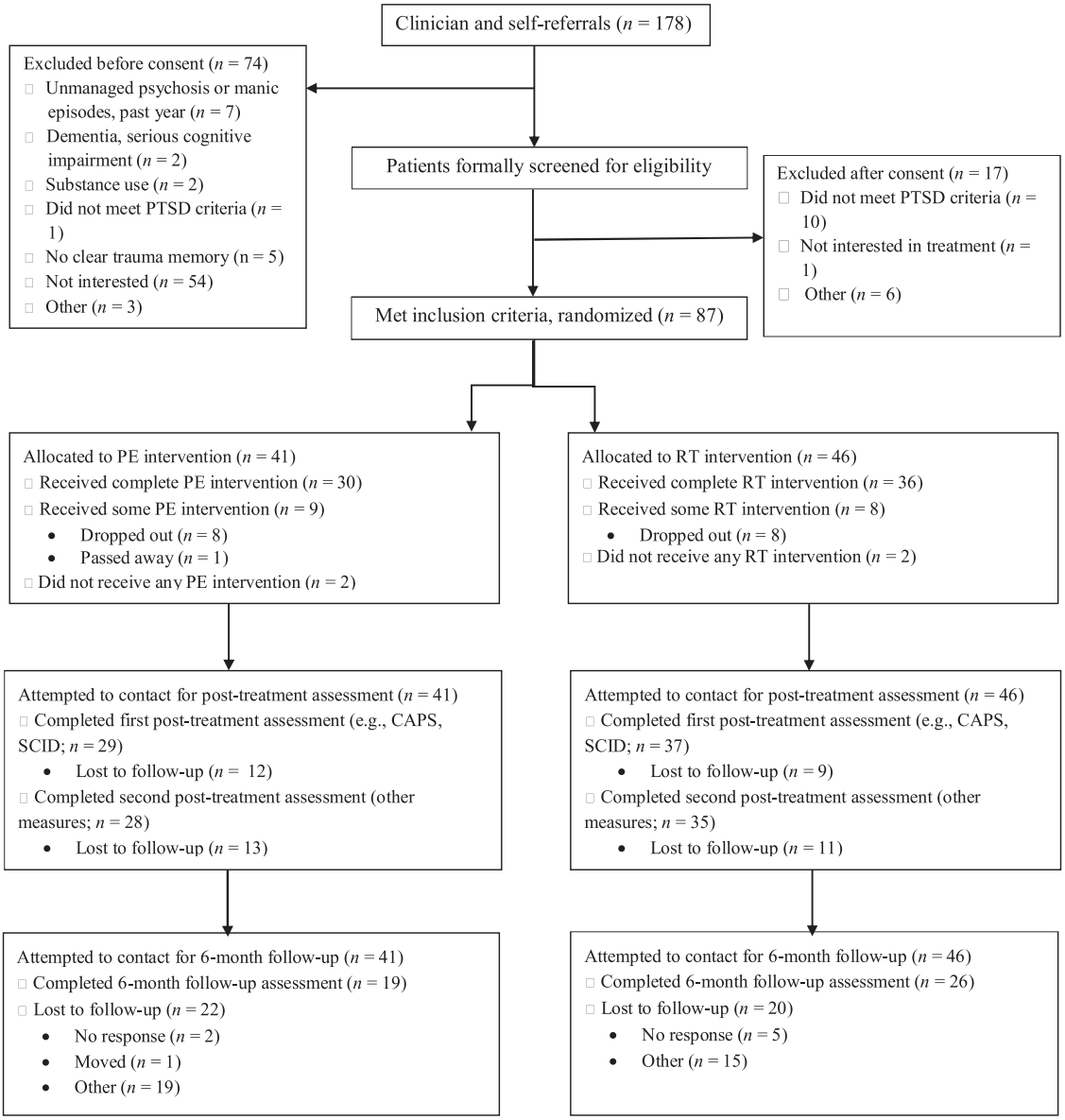

Fig. 1. CONSORT Flow Diagram of Participant Study Progress.
Note. CONSORT = consolidated standards of reporting trials; PE = prolonged exposure therapy. RT = relaxation training.

Table 1
Participant Characteristics.

Characteristic	Total Sample (N = 87)[a]		PE		RT		p
	M	*SD*	*M*	*SD*	*M*	*SD*	
Age (years)	65.41	5.44	66.51	6.21	64.43	4.49	.07[b]
Time since trauma (years)	43.12	5.80	44.00	6.17	42.24	5.39	.47[b]
Education (years)	13.99	2.63	13.95	2.49	14.02	2.78	.31[b]
Combat Exposure Scale Total	14.88	9.83	14.88	9.84	14.67	10.02	.93[b]
Years of military service	8.01	8.13	10.20	9.83	5.98	5.51	.02 [b]
	n (%)		*n (%)*		*n (%)*		*p*
Sex							–
Male	87 (100%)		41 (100%)		46 (100%)		
Female	0 (0%)		0 (0%)		0 (0%)		
Index Trauma Type							.56[c]
Combat-related	82 (88%)		35 (92%)		39 (87%)		
Sexual assault	0 (0%)		0 (0%)		0 (0%)		
Natural disaster	2 (2%)		2 (4%)		0 (0%)		
Sudden, accidental death	3 (4%)		1 (3%)		2 (4%)		
Other	4 (5%)		2 (5%)		2 (4%)		
Marital Status							.07[d]
Married/committed relationship	66 (77%)		35 (85%)		31 (69%)		
Single/divorced/widowed	20 (23%)		6 (15%)		14 (31%)		
Employed							.84[d]
Employed (part time or full time)	9 (11%)		5 (12%)		5 (11%)		
Unemployed or retired and looking for work	24 (28%)		11 (27%)		13 (30%)		
Retired, not looking for work	45 (53%)		23 (56%)		22 (50%)		
Comorbidity[e]							.80[d]
Major depressive disorder	18 (21%)		7 (17%)		11(24%)		.43[d]
Any anxiety disorder	40 (46%)		19 (47%)		21 (46%)		.95[d]
History of psychotherapy	63 (73%)		30 (73%)		33 (71%)		.62[d]

Note. PE = prolonged exposure therapy. RT = relaxation training.
[a] Some participants did not report demographic information, individuals with missing data points were excluded by analysis.
[b] *t*-tests were used for statistical comparisons between conditions.
[c] Fischer's Exact test was used for statistical comparisons between conditions.
[d] Chi-square was used for statistical comparisons between conditions.
[e] Comorbidity determined by the Structured Clinical Interview for DSM-IV-TR, research version (SCID-IV-TR).

ensure regular therapy attendance; (d) positive screen for substance dependence in the prior two months; or (e) lifetime history of a head trauma resulting in loss of consciousness longer than 20 min. Prior PTSD treatment (e.g., supportive therapy, CPT) was not exclusionary.

We recruited males because they represent the majority of combat veterans in this cohort and our study would be underpowered to detect gender differences. Veterans as young as 60 were permitted to enter the study to ensure the inclusion of most Vietnam era veterans. Comorbid mood and anxiety disorders were expected and permitted to maximize generalizability. Individuals taking psychotropic medications were allowed to participate, but those who had made changes to type or dosage level within 60 days were asked to delay their start until their medication regimen had stabilized for two months. As recommended by Bradley et al. (2005), individuals with suicidal ideation were not excluded, and suicidal urges and plans were assessed throughout the study and addressed by the study therapists as needed.

2.2. Assessments

Participants were assessed at pre-treatment, post-treatment, and six months post-treatment (M = 5.5 months). Diagnostic assessments were conducted by an independent clinical evaluator (ICE); a clinical psychology doctoral student and a medical student served as ICEs. When possible, the same ICE administered all assessments for a given participant. Although ICEs may have known the stage of assessment (i.e., post-treatment), this optimized comfort for participants and allowed ICEs to better assess change over time. The ICEs were masked to condition, were trained to administer the assessments by a doctoral-level psychologist and masters-level clinician, and received weekly supervision/consultation.

2.2.1. Measures

The Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995) is a semi-structured interview assessing PTSD status and severity. A list of potentially traumatic events (the Life Events Checklist) was included, and the event chosen as the "worst" (i.e., the military-related criterion A event that was most distressing in the past month) was used as the basis of CAPS assessment. The CAPS addresses each of the 17 symptoms from the Diagnostic and Statistical Manual for Mental Disorders – 4th Edition Text Revision (DSM-IV-TR; American Psychiatric Association, 2000), and it has high levels of internal consistency, good inter-rater reliability, and excellent convergent validity (Weathers, Keane, & Davidson, 2001). We used the F1/I2 method of diagnosis (Weathers, Ruscio, & Keane, 1999). Frequency and intensity ratings for items were summed to determine a severity score (possible range: 17–136; α = .84); a 15-point change in this score indicates clinically significant change (Weathers et al., 2001). All eligible participants met the DSM-IV-TR criteria for PTSD using the CAPS at pre-treatment, as the 5th Edition (DSM-V; American Psychiatric Association, 2013) had not yet been published at the start of the study. The traumatic event reported at pre-treatment was used as the index trauma at later assessments for consistency in assessing change.

The Structured Clinical Interview for DSM-IV-TR (SCID-IV-TR, research version; First, Gibbon, Spitzer, & Williams, 1997) is a widely used clinician-administered structured diagnostic interview. The SCID-IV-TR follows DSM-IV-TR diagnostic criteria, and has demonstrated good-to-excellent diagnostic reliability across the most common conditions (First et al., 1997). The SCID determined the presence and severity of comorbid conditions (e.g., major depressive disorder); it is used in this study to characterize the sample.

Self-report questionnaires were printed in 16-point font for ease of reading (see Thorp, Sones, & Cook, 2011). The demographics questionnaire was developed by the research team and collected information such as age, race/ethnicity, and military service (see Table 1). The Combat Exposure Scale (CES; Keane et al., 1989) describes and quantifies combat exposure. The CES was given at pre-treatment and used to characterize the sample; seven items are scored on a five-point scale (possible range: 0–41), with higher scores representing more combat exposure. The CES has excellent internal consistency and test-retest reliability (Keane et al., 1989). The PTSD Checklist, stressor-specific version (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993) was administered at the beginning of each therapy session and at all three assessment points to assess self-reported PTSD symptoms. The PCL-S has excellent internal consistency (α = .89 for this sample), test-retest reliability, and convergent and discriminant validity (Wilkins, Lang, & Norman, 2011). The nine-item Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) is a widely used self-report assessment of depression symptoms. The PHQ-9 was administered at the beginning of each therapy session and at all assessment points to evaluate depression symptom severity. The PHQ-9 has excellent internal reliability (α = .87 for this sample), test-retest reliability, and construct validity (Kroenke et al., 2001).

2.3. Treatment

All diagnostic assessment interviews and treatment sessions were audiotaped and videotaped.

2.3.1. Relaxation training

Participants in the RT condition were given up to 12, 90-minute individual sessions. RT was administered according to the Taylor et al.

(2003) protocol. Treatment focused on teaching systematic steps to relax through tensing and releasing 16 muscle groups (i.e., progressive muscle relaxation) with pleasant imagery and calming words. Over time, participants reduce the number of muscle groups that they focus on for practice, and the training is generalized to other environments (e.g., while driving).

2.3.2. Prolonged exposure

PE is a manualized trauma-focused treatment developed by Foa et al. (2007). Participants who received PE completed up to 12, 90-minute individual sessions. Per the PE protocol, clients were taught breathing retraining skills, conducted imaginal exposure (i.e., narrating their worst trauma memory out loud, repeatedly) and in-vivo exposures (i.e., engaging in feared but safe situations), and completed homework (e.g., conducting exposures).

2.4. Therapists

Therapists were licensed clinical psychologists or social workers who were trained in PE and RT. Therapists attended weekly consultation with [redacted for blind review] that included didactic training, discussion, and review of videotapes.

2.5. Treatment fidelity

Two clinicians trained in each treatment rated all session recordings for 20% of randomly selected participants, divided equally between treatment conditions. PE fidelity raters used a structured adherence measure developed by Dr. Foa's research group. RT raters used an adherence measure based on that developed by Taylor et al. (2003). Therapists were adherent to both protocols, as measured by average percentage of required elements successfully administered during each session (PE = 91.73%; RT = 88.00%; $t(24) = 2.41$, $p = .20$).

2.6. Assessment fidelity

Experts in the diagnosis of PTSD and administration of the CAPS served as assessment fidelity raters. Fifteen percent of participants were randomly selected for assessment fidelity, and the rater listened to CAPS recordings at all time points for each participant selected. Inter-rater reliability between the ICE and the fidelity assessor for PTSD diagnoses was excellent ($k = .83$).

2.7. Procedure

2.7.1. Recruitment, randomization, and consent

The study was approved by the [redacted] IRB, and informed consent was obtained by each participant prior to engaging in any study activity. Participants were recruited via flyers and VA clinic provider referral. If deemed eligible by telephone screening, potential participants were scheduled for an in-person assessment. Participants were compensated $40 for each of three in-person assessments.

2.7.2. Pre-treatment assessment

At the pre-treatment session, participants completed the CAPS and SCID-IV-TR. Veterans who did not meet criteria for PTSD were compensated but excluded. Participants who met inclusion criteria were randomly assigned and proceeded with the study. Eligible participants were given a questionnaire packet that contained self-report questionnaires to complete at home.

2.7.3. Weekly session self-report measures

Participants completed the PCL-S and PHQ-9 at the beginning of every therapy visit. Therapists scored each questionnaire in session and discussed changes from prior sessions and overall trajectories with the participant.

2.7.4. Post-treatment assessment

During the post-treatment session, participants completed the CAPS. The questionnaire packet was again completed at home.

2.7.5. Six-month follow-up

Participants were contacted to complete a one-session follow-up assessment approximately six months following the post-treatment assessment.

2.8. Data analysis

All participants randomized to treatment were included in intent-to-treat analyses. Preliminary analyses were conducted to compare pre-treatment data between veterans who received PE to those who received RT using *t*-tests and Pearson chi-squares. Among covariates, ethnicity, marital status, and employment status were examined as dichotomous variables; age and years of military service were examined as continuous variables. Analyses were also run comparing veterans who completed treatment with those who did not.

Longitudinal analyses of outcomes were analyzed using multilevel modeling (MLM) in PASW Statistics version 23. MLM models were used to (1) evaluate change in symptom measures across pre-treatment, post-treatment, and six-month follow-up and (2) examine change in self-reported PTSD and depression symptoms across all assessment time points (i.e., pre- and post-treatment, each psychotherapy session, six-month follow-up). In the primary outcome analyses, time was categorically coded for the three main assessment time points (intercept is pre-treatment). Both linear and quadratic time functions were included to evaluate change across the entire study period (i.e., including follow-up). In the session analyses, time was categorically coded for weekly assessments (i.e., pre-treatment, 12 sessions, and post-treatment; intercept is session 1) and a linear function was included in the model.

For each MLM model, the initial step determined the shape of the change trajectory and whether the intercept and random time slope varied across participants. After the initial step, a second step was conducted that included main effects of time and treatment condition, as well as time by treatment condition interactions to determine if treatment outcomes differed as a function of the type of treatment received. Since the treatment conditions differed on years of military service (noted below), MLM analyses were conducted both with and without this variable as covariate. Model specifications included an unstructured covariance structure, random intercept, and restricted maximum likelihood (REML) approach to handling missing data (a preferred method for longitudinal models; Graham, 2009). In addition to tests of statistical significance, effect size indices were calculated for longitudinal analyses (Cohen's *d* adjusted for repeated measures and based on complete data at assessment time points).

3. Results

3.1. Group comparisons

Demographic comparisons between treatment groups are located in Table 1. Veterans who received PE had served longer in the military than veterans who received RT ($t(57) = 2.53$, $p < 0.05$). There were pre-treatment differences between the treatment groups on the CAPS ($t(85) = -2.19$, $p < .05$, $d = .47$) and PHQ-9 ($t(79) = -2.28$, $p < .05$, $d = .40$), but not on the PCL-S ($t(80) = -1.00$, $p = .32$, $d = .22$); there were no other differences in pre-treatment demographics. Treatment completion rates did not significantly differ between the two conditions; 73% of individuals in the PE condition completed all 12 sessions of treatment ($M = 9.39$, SD = 4.51), while 78% of those who received RT completed all 12 sessions ($M = 9.89$, SD = 4.18; $t(85) = -0.49$, $p = 0.38$). Study attrition rates were 31% at post-treatment and 48% at follow-up; rates did not differ between treatment groups ($p > .05$).

As the number of years of military service differed between the two

Table 2
Means and Standard Deviations of Pre-treatment, Post-treatment, and Six-month Follow-up Outcome Variables.

Variable	Pre-treatment						Post-treatment						Six-month Follow-up					
	PE			RT			PE			RT			PE			RT		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
CAPS	41	66.07	14.84	46	73.00	14.66	29	48.48	24.59	38	62.79	17.80	20	52.10	21.67	26	61.58	17.29
PCL-S	39	57.46	12.66	43	60.16	11.90	27	47.00	18.91	35	58.13	12.20	19	58.37	13.77	26	58.31	10.88
PHQ-9	39	12.13	6.57	42	15.12	5.17	26	1088	7.67	35	14.80	5.75	18	13.22	5.99	25	13.92	6.42

Note. CAPS = The Clinically Administered PTSD Scale for DSM-IV-TR; PE = prolonged exposure; PHQ-9 = Patient Health Questionnaire, 9-Item; PCL-S = PTSD Checklist Stressor- specific version; RT = relaxation training.

treatment conditions, MLM analyses were run to determine if this variable was related to the symptom trajectory on the CAPS, PCL-S, or PHQ-9. The number of years of military service did not significantly predict the change in CAPS ($p = .93$), PCL-S ($p = .26$), or PHQ-9 ($p = .34$). There were no differences in the significance of predictors whether or not number of years of military service was included in the model; results from the parsimonious models without number of years of military service are presented.

3.2. Longitudinal effects

Means, standard deviations, and sample sizes for the CAPS, PCL-S, and PHQ-9 at each time point are available in Table 2 and Fig. 2. Figs. 2 and 3 display actual data collected, while MLM tables include estimates of missing data generated by the model. The initial step of the MLM models demonstrated that for longitudinal analyses (i.e., pre-treatment, post-treatment, six-month follow-up), the intercept showed significant variability for participants on the CAPS ($B = 92.59$, $p < .001$), PCL-S ($B = 74.98$, $p < .001$), and the PHQ-9 ($B = 15.62$, $p < .001$). Both the linear and quadratic time functions described the change trajectories for scores across time on the CAPS (linear, $B = -31.70$, $p < .001$; quadratic, $B = 6.26$, $p < .01$) and the PCL-S (linear, $B = -22.04$, $p \leq .001$; quadratic, $B = 5.44$, $p \leq .001$). More information can be found in Table 3. Taken together, these findings suggest that although PTSD symptoms decrease linearly over the course of the study, the rate of change slows over the follow-up period. For self-reported depression symptoms on the PHQ-9, neither linear nor quadratic time functions reflected the trajectory of scores (linear, $B = -2.99$, $p = .25$; quadratic, $B = 0.68$, $p = .31$). Although the PHQ-9 scores did not demonstrate significant change over time, model results are shown in Table 4 for consistency in presentation.

3.2.1. Clinician-administered PTSD symptoms model

Results from the final CAPS model indicate that there was not a significant main effect for treatment condition ($B = 14.06$, $p = .25$). The interactions between linear time and treatment condition ($B = -27.54$, $p = .06$) and quadratic time and treatment condition ($B = 6.56$, $p = .08$) indicate that clinician-assessed PTSD symptom severity significantly decreased for veterans who received either treatment in the study. Furthermore, the symptom scores between veterans in PE and RT did not generally differ across time points over the study period.

The within-group effect sizes for change in CAPS scores for veterans who received PE were $d = 0.89$ (large effect) for pre- to post-treatment changes and $d = -0.19$ for post-treatment to 6-month changes. For veterans in the RT condition, the effect sizes were $d = 0.68$ (moderate effect) from pre- to post-treatment and $d = 0.19$ from post-treatment to 6-month follow-up.

3.2.2. Self-reported PTSD symptoms model

Findings from the final PCL showed a slightly different pattern from those of the CAPS. Although the main effect of treatment was not significant in the CAPS model, the interactions between linear time and treatment condition ($B = -28.14$, $p = .03$) and quadratic time and treatment condition ($B = 7.19$, $p = .03$) were significant in the PCL-S model. These results indicate that scores for participants in the PE and RT conditions did not significantly differ at each time point, but participants in the PE condition experienced greater change in scores and also greater rates of slowing across time; whereas PCL-S scores for participants in the RT condition remained more stable across

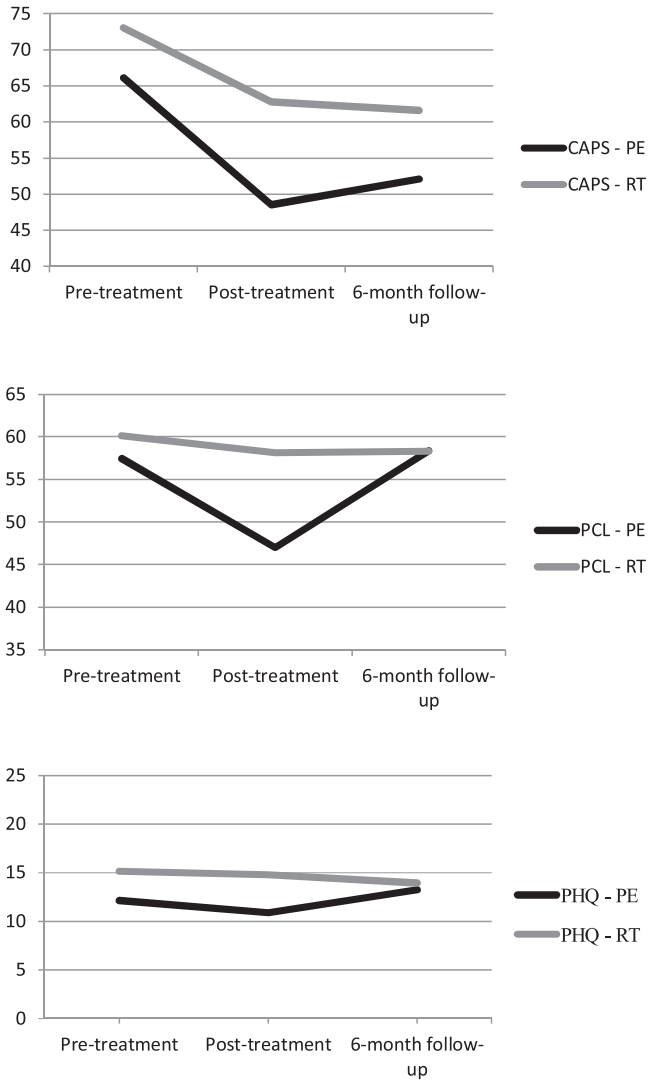

Fig. 2. Main outcome scores at pre-treatment, post-treatment, and six-month follow-up.
Note. CAPS = The Clinically Administered PTSD Scale for DSM-IV-TR; PE = prolonged exposure; PHQ-9 = Patient Health Questionnaire, 9-Item; PCL-S = PTSD Checklist Stressor- specific version; RT = relaxation training.

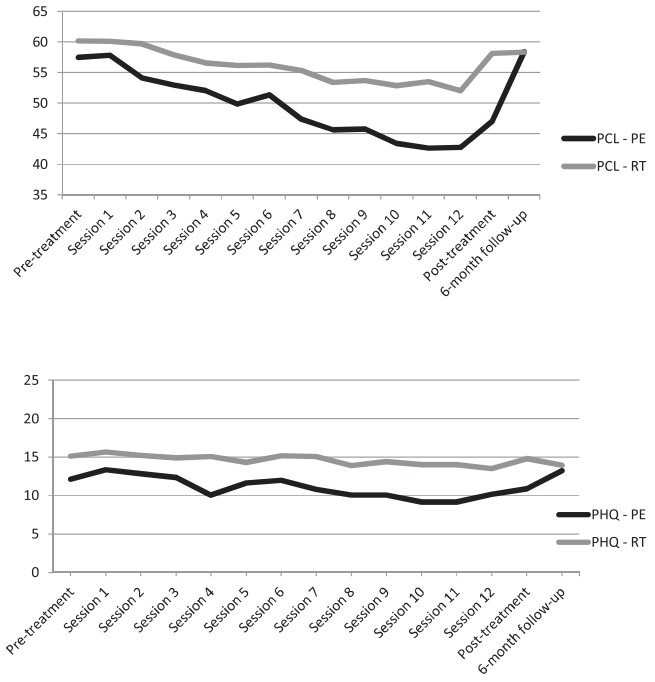

Fig. 3. Session by session scores for PCL-S and PHQ-9.
Note. CAPS = The Clinically Administered PTSD Scale for DSM-IV-TR; PE = prolonged exposure; PHQ-9 = Patient Health Questionnaire, 9-Item; PCL-S = PTSD Checklist Stressor- specific version; RT = relaxation training.

Table 3
Summary of Multilevel Analyses Examining Within- and Between-group Effects on Primary Outcomes.

Parameter	CAPS	PCL-S	PHQ-9
Intercept	91.90 (8.15)***	68.60 (6.99)***	16.64 (2.92)***
Linear Time	−23.12 (9.60)*	−10.84 (8.21)	−1.92 (3.43)
Quadratic Time	4.22 (2.44)†	2.55 (2.08)	0.39 (0.87)
Treatment condition	14.06 (12.24)	17.95 (10.48)†	−0.13 (4.38)
Linear Time x Treatment condition	−27.54 (14.52)†	−28.14 (12.44)*	−3.86 (5.21)
Quadratic Time x Treatment condition	6.56 (3.70)†	7.19 (3.16)*	1.02 (1.32)

Note. Standard errors are in parentheses. CAPS = Clinician-administered PTSD Scale; PCL-S = PTSD Checklist Stressor-specific version; PHQ-9 = Patient Health Questionnaire. Treatment condition includes prolonged exposure (coded as 1) and relaxation (coded as 0).
† $p < 0.09$.
* $p < 0.05$.
*** $p < .001$.

Table 4
Summary of Multilevel Analyses Examining Within- and Between-group Session Effects on Symptom Outcomes.

Parameter	PCL-S	PHQ-9
Intercept	56.54 (4.35)***	10.46 (1.95)***
Session	−1.82 (0.45)***	−0.38 (0.17)*
Treatment condition	1.77 (2.71)	2.48 (1.21)*
Session x Treatment condition	0.61 (0.27)*	0.12 (0.11)

Note. Standard errors are in parentheses. PCL-S = PTSD Checklist Stressor-specific version; PHQ-9 = Patient Health Questionnaire. Treatment condition includes prolonged exposure (coded as 1) and relaxation (coded as 0).
* $p < 0.05$.
*** $p < .001$.

assessment time points.

The within-group effect sizes for change in PCL-S scores for veterans in the PE condition were $d = 0.54$ (moderate effect) for pre- to post-treatment changes and $d = -0.58$ (moderate effect) for post-treatment to 6-month changes. For veterans who received RT, the effect sizes were $d = 0.50$ (moderate effect) from pre- to post-treatment and $d = -0.20$ (small effect) from post-treatment to 6-month follow-up.

3.3. Session effects

Results from the initial step of the MLM session models (i.e., pre-treatment, each of 12 sessions, post-treatment) showed significant variability in the intercept ($B = 58.82$, $p < .001$) and ($B = 13.78$, $p < .001$) for the PCL-S and PHQ-9 models, respectively. The linear time function reflected the change trajectories for scores across weekly assessments on the PCL-S ($B = -0.88$, $p < .001$) and the PHQ-9 ($B = -0.18$, $p = .001$). For self-reported PTSD symptoms, findings indicated a significant main effect of session (time) and a session by treatment condition interaction (see Table 4 and Fig. 3). The results specify that veterans' self-reported PTSD symptom severity decreased across time for both conditions; however, veterans who received PE reported significantly greater improvements than those who received RT. For self-reported depression symptoms, main effects of session and treatment condition emerged as significant predictors of change. In other words, depression symptoms improved across time for veterans in the study, although veterans randomized to RT reported more elevated depression symptoms at each time point. The session by treatment condition interaction was not significant, suggesting that the trajectory of symptom improvement did not vary as a function of treatment condition.

4. Discussion

This is the first RCT to compare the efficacy of two active PTSD therapies for older adults, the fastest growing age group in the U.S. (U.S. Census Bureau, 2010). Consistent with previous studies (Thorp et al., 2012; Yoder et al., 2013), this study demonstrated that it is feasible to recruit older veterans with PTSD and provide them with psychotherapy. PE and RT were both well tolerated.

Clinician-rated PTSD symptoms significantly improved for veterans in both conditions, and this change was linear. The trajectory of PTSD symptom improvement did not significantly differ between the two treatments, although effect sizes were greater in PE. Pre-to-post effect sizes were large for PE and moderate for RT. The significant response to PE from pre-treatment to post-treatment confirms that older adults can experience a positive and meaningful response to exposure-based therapy.

For self-reported PTSD symptoms, a significant time (linear and quadratic) by treatment interaction emerged. Participants who received PE experienced a greater rate of change in self-reported PTSD symptoms; they also reported a greater slowing of change, or rebound effect, than those who received RT. Although the rate of change over time also decreased for clinician-reported PTSD symptoms, CAPS scores did not rebound to the same degree as self-reported PTSD scores during the follow-up period; these findings are encouraging regarding the ability to experience lasting change following PE in this population. Clinician-rated scores are a more objective measure of symptom change, but self-report scores are important and reflect increasing levels of distress following treatment. Continued distress after treatment suggests that it may be beneficial to add "booster" sessions of psychotherapy or extend treatment.

Although the research on RT effect sizes is inconsistent, our effects were smaller than those cited in younger samples (e.g., $d = 1.29$; Taylor et al., 2003). This may be due, in part, to recruiting individuals with military-related PTSD who do not respond as well to PTSD treatments (Carlson, Chemtob, Rusnak, Hedlund, & Muraoka, 1998). RT is a low-cost treatment that can be easily implemented; therefore, it is important

to better understand why older combat veterans with PTSD may not respond as well to RT as younger individuals.

Participants in both conditions experienced significant improvements in their self-reported depression and PTSD; however, the clinical implications of these differences are less compelling. Of those who received PE and had follow up data, 58% still met criteria for PTSD based on the CAPS and only half experienced clinically significant change. Although the percent of veterans retaining their diagnosis was similar to results reported in Steenkamp's 2015 review on military-related PTSD, fewer older adults reported clinically meaningful change in our study compared to those in Steenkamp's manuscript (70–91%; Steenkamp et al., 2015). Among those who received RT and had follow-up data, 77% still met criteria for PTSD on the CAPS and only 35% met the threshold for clinically significant change.

Across conditions, depression scores did not significantly change from pre-treatment to follow-up. Individuals who received PE experienced a +/− 3-point change in their PHQ-9 scores over the course of the study, while those in the RT condition reported a +/− 2-point change. These findings do not represent statistically significant or clinically meaningful changes, especially considering that the average participant reported moderate depression. This is concerning, as about two-thirds of veterans with PTSD report depression symptoms (Rytwinski, Scur, Feeny, & Youngstrom, 2013). Although evidence-based PTSD treatments often improve depression (Ronconi, Shiner, & Watts, 2015), our results suggest that PE and RT may not adequately address these symptoms in older cohorts. Older adults with PTSD may have depression due to different etiologies or maintaining factors compared to younger adults, such as decreased social support due to the loss of loved ones, declines in physical health, and end of life concerns. Combination treatments that include evidence-based PTSD and MDD components (e.g. Strachan, Gros, Ruggiero, Lejuez, & Acierno, 2012) may be helpful to better address depression symptoms among those with PTSD. Additional research specifically examining these treatments in the older adult population is needed.

These results indicate that older adults can experience decreases in PTSD (across sessions and follow-up) and depression (across sessions) if they engage in PE or RT. Because our study did not recruit both younger and older cohorts, a direct comparison between ages is not possible. However, the PTSD and depression treatment outcomes seen in this study do not appear to be as strong as those reported in other studies for younger cohorts. This theme has also been reported in treatment outcome research for other conditions. Gould, Coulson, and Howard, (2012) conducted a meta-analysis on CBT for older adults across anxiety disorders and found moderate effect sizes for CBT when compared to treatment-as-usual and wait-list conditions, and small effect sizes among RCTs with an active control group (e.g., pharmacotherapy). In contrast, meta-analyses with predominantly younger populations have found large effects after CBT for anxiety (e.g., Mitte, 2005), suggesting that older adults with anxiety may not respond as well to CBT. Examinations of CBT for older adults with depression have resulted in moderate-to-large effects (e.g., Krishna et al., 2011), comparable to those reported in broader adult populations (see Butler, Chapman, Forman, & Beck, 2006 for a review). In another study, no differences were found when comparing effect sizes for CBT in older adults with younger populations (Cuijpers, van Straten, Smit, & Andersson, 2009). These findings suggest that CBT can effectively reduce depression in older adults, with more tenuous effects for anxiety. However, these studies did not explore depression symptoms in individuals with a PTSD diagnosis, which may partially account for why the current study diverges from prior findings.

Furthermore, elements unique to our sample may have impacted treatment outcome. The average duration of time since the index trauma in our sample was 43 years; older trauma memories may be more difficult to recall, impairing imaginal exposures or memory processing. Furthermore, negative beliefs about oneself and the world may become more ingrained with time, making beliefs less likely to change. Prior research has neglected to find a relationship between time since an index trauma and PTSD treatment outcomes (e.g., Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). However, the average time between the index trauma and treatment initiation across these studies was reported to be less than 12 years, a much shorter duration than in our sample. Older adults who experienced a trauma at a younger age (e.g., during their time in the military) may be more likely to have a chronic course of PTSD or a complex symptom presentation (Averill & Beck, 2000). Additionally, older adults with PTSD may experience worsening symptoms due to impairments in social support, financial stability, coping skills, physical health, and cognitive functioning (Averill & Beck, 2000). Finally, we experienced high rates of attrition in our sample at follow-up (48%). Findings during the follow-up period should be interpreted with caution; we were unable to determine why the majority of individuals ended participation. Although attrition rates did not differ between treatment groups, it is possible that there were components of treatment or specific characteristics in this population (e.g., worsening health) that led to high rates of attrition in this study. These factors may all contribute, in part, to the relatively poorer outcomes exhibited by the older adults in this study.

Finally, our sample was comprised entirely of veterans with high rates of combat exposure. Recent meta-analyses suggest that combat veterans have high nonresponse rates to evidence-based PTSD treatments, with approximately two-thirds of participants retaining their PTSD diagnosis (Steenkamp et al., 2015); our nonresponse rates were similar to these findings. Similar results have been found for RT in military-related PTSD (e.g., Carlson et al., 1998). However, the percentage of participants who experienced clinically meaningful change following treatment was less than the percentage reported by Steenkamp et al. Although the link between combat trauma and poorer treatment outcome is understudied, the prolonged, recurrent, and extreme nature of combat trauma, which can involve moral injury and threats to multiple individuals, may partially explain the relationship (Litz et al., 2009). Many PTSD treatment outcome studies include mixed trauma samples (e.g., military non-combat trauma, civilian sexual assault); thus, our combat-only sample may be more treatment-resistant than those included in other studies.

The study has several strengths. The sample consisted of older combat veterans – two groups that are under-researched in treatment studies and who may be particularly treatment recalcitrant. Validated assessments; manualized, empirically based treatment protocols; and a six-month follow-up were used in the current study, adding to the methodological rigor. Finally, participants with concurrent mood and anxiety disorders and suicidal ideation were not excluded, improving generalizability and clinical impact. Given the high rate of suicide among veterans (e.g., Kang et al., 2015), it is imperative that studies include those with ongoing suicidality.

There are also important limitations. First, diagnostic criteria and assessments were based on the DSM-IV-TR. Second, even though we used estimation methods to account for missing data, high rates of attrition were found at follow-up. Third, our sample was limited to male combat veterans, so findings cannot be generalized to all older adults. Fourth, the mean and median age of our participants were in the mid-60 s, suggesting that we still may not know much about "old-old" adults (i.e., over 70). Future studies should explore differences in treatment response among different groups of older veterans. Finally, our results rely on self-report data for depression symptoms. These results should be interpreted in light of these issues.

This study addresses critically important gaps in our understanding of the efficacy of psychological interventions among older male combat veterans with PTSD. Future studies should recruit a more diverse sample of older adults to ensure generalizability of study findings, examine the efficacy of other PTSD treatments (e.g., CPT), and explore therapy modifications in this population. Examining duration of time since the traumatic event will also help researchers to better understand how this factor affects treatment response. Monitoring individuals for

longer follow-up periods and a closer examination of attrition may also be critical.

4.1. Conclusions

Our findings suggest that PE and RT are well-tolerated and feasible interventions for older male combat veterans. Participants experienced significant improvements in their PTSD, independent of which intervention they received, but clinically significant changes were less meaningful. Effect sizes for PE were comparable to those reported in younger populations (Steenkamp et al., 2015), but our findings also suggest that older adults may still experience high levels of symptom distress – both by self- and clinician-report – in comparison to younger cohorts. These results emphasize the importance of additional research on the treatment of PTSD among older cohorts to better serve this growing and underserved population.

Acknowledgements

The authors wish to thank the veterans who participated in this project. We also thank the research staff who worked on the project, including (in alphabetical order): Cara Eggers, Kelly Hughes-Berardi, Mary Linges, Mark West, and Tania Zamora. This work is partially supported by a Career Development Award (CDA-2-009-07S) that was awarded to Dr. Thorp by the Department of Veterans Affairs.

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