

The Efficacy of 90-Min Versus 60-Min Sessions of Prolonged Exposure for PTSD: A Randomized Controlled Trial in Active-Duty Military Personnel

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Objective: Prolonged exposure (PE) therapy is a first-line posttraumatic stress disorder (PTSD) treatment, but the manualized 90-min session format constitutes a barrier to adopting PE in most settings because they use 60-min sessions for scheduling and billing. We examined whether 60-min PE sessions were as effective and efficient as 90-min PE sessions. **Method:** In total, 160 active-duty military personnel with PTSD were randomized to 8–15 sessions of 60- or 90-min PE sessions and assessed pre- and posttreatment, and 3- and 6-month posttreatment, using the Clinician Administered PTSD Scale for *Diagnostic and Statistical Manual for Mental Disorders*, 5th edition [DSM-5] (CAPS-5). Participants were also assessed weekly during treatment using the PTSD Checklist for DSM-5 (PCL-5). A 60-min PE was hypothesized to be noninferior to 90-min PE based on preliminary studies. **Results:** Using intent-to-treat analyses, the 95% CI for the difference between 60- and 90-min PE was less than the noninferiority margin (4.69 for the CAPS-5 and 7.38 for the PCL-5) at all three endpoints, suggesting that the efficacy of 60-min PE was noninferior to that of 90-min PE. Similarly, the rate of improvement per session for 60-min PE was noninferior to the rate for 90-min sessions for the PCL-5. Sensitivity analyses and Bayes factors were consistent with these results. **Conclusions:** 60-min sessions of PE are noninferior to 90-min sessions with regard to both efficacy and efficiency. Thus, PE can be effectively delivered in shorter sessions, making it easier for behavioral health providers to implement within the military health system and in other mental health systems that use 60-min session appointments.

What is the public health significance of this article?

The 60- and 90-min sessions of PE had comparable efficacy and efficiency in reducing PTSD symptoms. The implementation of shorter sessions of PE may increase access to evidence-based PTSD care.

Keywords: PTSD, prolonged exposure therapy, military, trauma, non-inferiority

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Posttraumatic stress disorder (PTSD) affects an estimated 7% of the population (Kessler et al., 2017), with higher rates among certain groups, including active-duty military personnel and veterans (Judkins et al., 2020). As PTSD severely impacts functioning (Asnaani et al., 2018; Creamer et al., 2011; Forbes et al., 2019), access to evidence-based treatment is imperative. Prolonged exposure (PE) therapy (Foa et al., 2007, 2019) is an evidence-based treatment for PTSD with demonstrated efficacy across numerous populations, including military personnel (Foa et al., 2018; Peterson et al., 2019). Based on emotional processing theory (Foa et al., 2006; Foa & Kozak, 1986), PE involves 8–15 90-min sessions, with 40–45 min of imaginal exposure (revisiting, recounting, and processing the most upsetting trauma memory) in order to achieve within-session extinction or reduction of distress. Emotional processing theory originally hypothesized that within-session extinction to be an important indicator of therapeutic recovery. However, subsequent research suggested within-session extinction is not related to outcomes and thus is not clinically necessary (Harned et al., 2015; Jaycox et al., 1998; Sripatha & Rauch, 2015).

The 90-min PE session length constitutes a scheduling, productivity, and reimbursement barrier to implementation in many mental health systems, including the military health care system. Specifically, these systems typically operate within a 60-min session framework for scheduling and billing of psychotherapy. A strong emphasis on productivity metrics, large provider caseloads, high patient demand relative to provider availability, and a greater opportunity cost for missed appointments can all work to deter behavioral health providers from implementing 90-min PE sessions (McLean et al., 2022). Thus, reducing PE sessions to 60 min while maintaining the magnitude and speed of therapeutic effect would remove a major barrier to using PE. Consistent with findings from the broader literature showing that shortening session length is an

effective adaptation (e.g., Bryant et al., 2019; Cigrang et al., 2017), one nonrandomized PE study (van Minnen & Foa, 2006) and one pilot randomized controlled trial of PE (Nacasch et al., 2015) found that 60-min PE sessions, each with a shorter duration of imaginal exposure, were similar in effectiveness as 90-min sessions. However, design and power limitations of these studies prevented conclusion about noninferiority.

To address this gap, we conducted a randomized noninferiority trial treating active-duty military personnel seeking treatment for PTSD. We hypothesized that (a) 60-min PE sessions would be noninferior to 90-min sessions with respect to treatment efficacy, as measured by clinician-rated and self-reported PTSD symptom severity at posttreatment and at 3- and 6-month posttreatment and (b) 60-min sessions of PE would be noninferior to 90-min sessions with respect to treatment efficiency, as measured by average decrease in PTSD symptom severity per treatment session. We chose to test whether 60-min PE was noninferior to 90-min PE rather than testing for equivalence between the two treatments because 60-min PE would be advantageous for all parties involved (patients, therapists, the military, and/or insurance providers) as long as therapeutic outcomes from 60-min PE were not inferior to outcomes from 90-min PE.

Method

Transparency and Openness

We report how we determined our sample size, all manipulations, and all measures in the study, and we follow Journal Article Reporting Standards (Kazak, 2018). There were no data exclusions. Requests for deidentified data, analysis code, and research materials should be made to Drs. Edna Foa and Carmen McLean. Data were analyzed using SPSS Version 26. This study's design and its analysis were preregistered at <https://clinicaltrials.gov/ct2/show/NCT01911585>.

Trial Design

The study used a parallel group randomized controlled trial. Participants were assigned to either 60- or 90-min PE using permuted block randomization (1:1 ratio). The randomization sequence was computer-generated using variable-sized permuted blocks. Block sizes of 2, 4, and 8 were used to ensure that study therapists treated an equal number of participants in both study conditions while reducing the chance that study personnel could determine the allocation of the final participant in the block based on the prior allocations within that block. Randomization information was received by the study coordinators at the time of randomization.

Participants

Participants were 160 active-duty military personnel seeking treatment for PTSD recruited from military installations in the Southeastern United States. Inclusion criteria were: ages 18–65; either a diagnosis of PTSD as determined by a Clinician-Administered PTSD Scale for *Diagnostic and Statistical Manual for Mental Disorders*, 5th edition [DSM-5] (CAPS-5; Weathers, Blake, et al., 2013) or a CAPS-5 severity score ≥ 25 and a PTSD-Checklist for DSM-5 (PCL-5; Weathers, Litz, et al., 2013) score of ≥ 25 ; and the ability to speak, read, and write English. Exclusion criteria were: current manic or psychotic symptoms requiring immediate stabilization or hospitalization (determined using the Mini-International Neuropsychiatric Interview [MINI]; Sheehan et al., 1998); current severe alcohol use (operationalized as a score of ≥ 4 on Items 4–6 and a total score of ≥ 20 on the Alcohol Use Disorders Identification Test; Babor et al., 2001); evidence of severe traumatic brain injury (based on marked impairment in communication or comprehension during baseline assessments); or current suicidal ideation severe enough to warrant immediate crisis intervention (assessed by the Depressive Symptom Index-Suicidality Subscale and corroborated by a clinical risk assessment).

Measures

Screening Measures

The MINI (Sheehan et al., 1998) is a short-structured diagnostic interview for *Diagnostic and Statistical Manual for Mental Disorders*, 4th edition (DSM-IV) and International Classification of Diseases, 10th revision (ICD-10) psychiatric disorders. Two sections of the MINI were administered to screen potential participants for current manic or psychotic symptoms requiring immediate stabilization or hospitalization. The Alcohol Use Disorders Identification Test (Babor et al., 2001) is a 10-item measure, administered via self-report, which assesses hazardous drinking and was used to screen potential participants for current severe alcohol use.

Primary Outcome: Clinician-Administered PTSD Scale for DSM-5

The CAPS-5 (Weathers, Blake, et al., 2013) is a structured clinical interview to determine PTSD diagnoses according to the DSM-5. Scores on 20 items (scored from 0 to 4; 0 = *not at all* to 4 = *extremely*) are added to form a total severity rating (maximum score = 80). The CAPS-5 has strong test–retest and interrater reliability, as well as high internal consistency (Weathers et al., 2018).

Secondary Outcome: PTSD-Checklist for DSM-5

The PCL-5 (Weathers, Litz, et al., 2013) is a 20-item self-report measure of PTSD. Items are scored from 0 to 4 (0 = *not at all* to 4 = *extremely*) with a maximum possible score of 80. Higher scores indicate greater PTSD symptom severity. The PCL-5 has demonstrated good internal consistency, test–retest reliability, convergent and discriminant validity (Blevins et al., 2015; Bovin et al., 2016), and correlates highly with the CAPS-5 (Weathers et al., 2018) and other clinician-administered measures of PTSD (Wortmann et al., 2016).

Additional Measure: Adverse Events

Clinically significant untoward changes in physical or mental health were recorded by study staff as possible adverse events (AEs) for safety evaluation.

Interventions

90-Min Prolonged Exposure Therapy (90-Min PE)

Ninety minutes PE followed the published PE manual (Foa et al., 2007), consisting of psychoeducation about PTSD, in vivo exposure (approaching trauma-related distressing situations), and 40 min of imaginal exposure (repeated recounting of the most distressing traumatic memory) followed by processing thoughts and feelings related to the imaginal experience. In vivo exposure began in Session 2 and imaginal exposure began in Session 3. Between sessions, participants were instructed to listen to audio recordings daily of the imaginal recounting and to complete in vivo exercises.

60-Min Prolonged Exposure Therapy (60-Min PE)

Sixty minutes PE also followed the standard PE protocol, except imaginal exposure was reduced from 40 to 20 min and total session length was reduced from 90 to 60 min. Content for Sessions 1 and 2 was abridged, but no content was omitted. Rather, the level of detail was decreased to accommodate the shorter time frame. In vivo exposure began in Session 2 and imaginal exposure began in Session 3.

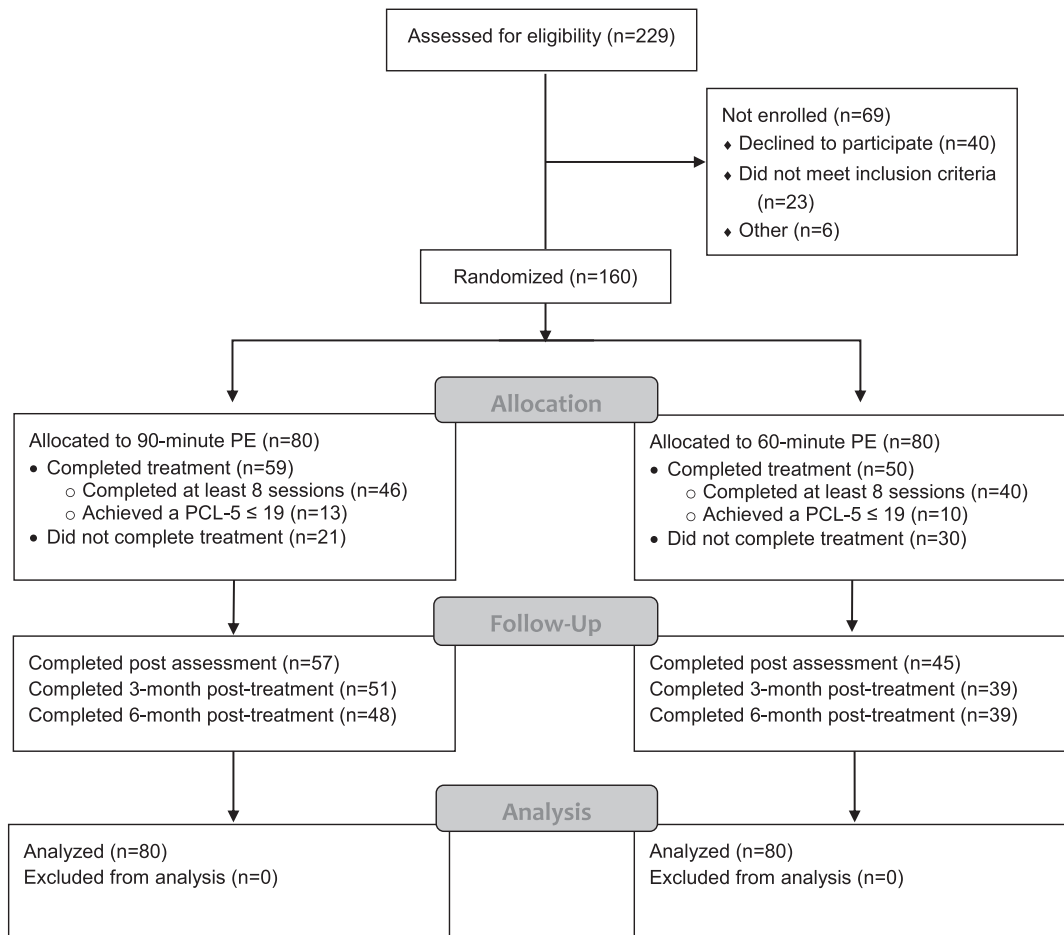
Providers

All five providers were master's-level licensed professional counselors who attended the standard PE training offered by the University of Pennsylvania Center for the Treatment and Study of Anxiety. Each provider completed approximately equal proportions of 60- and 90-min PE.

Procedure

Study procedures were approved by the institutional review boards of the Medical University of South Carolina, the University of Pennsylvania, and the U.S. Army Medical Research and Development Command Human Research Protection Office. Figure 1 shows the Consolidated Standards of Reporting Trials (CONSORT) diagram. Treatment was up to 15 sessions; participants could end treatment earlier if they scored ≤ 19 on the PCL-5. Data were collected from December 2017 through February 2021, when target enrollment was met, and the final data point was

Figure 1
Consolidated Standards of Reporting Trials (CONSORT) Flow Diagram



collected. Before the COVID-19 pandemic began, study activities were completed in-person in community-based offices near selected military bases in Hinesville, GA, Savannah, GA, Beaufort, SC and Charleston, SC. After March 2020, procedures were completed remotely via videoconferencing (therapy sessions) or telephone (interview assessments).

To assess the fidelity of the experimental manipulation, 10% of therapy session audio recordings were randomly sampled for analysis. The manipulation was successful; 60-min condition: $M = 60.27$ min, range = 50.48–66.53 (imaginal $M = 19.12$, range = 15.05–21.83); 90-min condition: $M = 89.21$ min, range = 72.90–105.02 (imaginal $M = 39.22$, range = 33.92–43.43). Therapists were five licensed, master's-level counselors who completed a 32-hr PE training and received weekly supervision from PE experts. Therapists were assigned approximately equal numbers of 60- and 90-min PE cases.

Clinical interviews were conducted at baseline, posttreatment, 3-month posttreatment, and targeted at 6-month posttreatment ($Mdn = 175$ days posttreatment) by master's-level clinicians blind to condition. Participants were not compensated. Therapists administered the PCL-5 at each treatment session.

More details on the study methods are available elsewhere (Foa et al., 2019).

Data Analytic Plan

Data Analysis

Noninferiority analyses tested: (a) whether the efficacy of 60-min PE was noninferior to that of 90-min PE on the CAPS-5 and PCL-5 at the primary endpoints: posttreatment, 3- and 6-month posttreatment (Hypothesis 1); and (b) whether reductions per session during treatment on PCL-5 during 60-min PE were noninferior to reductions during 90-min PE (Hypothesis 2). All superiority tests used a two-sided $p < .05$ criterion. Per protocol, our primary, intent-to-treat (ITT) analyses used multiple imputation (MI) for missing data at the primary endpoints. Variables used in the MI were: CAPS-5 and PCL-5 at all time points, linear and quadratic time, and recruitment site. Fifty data sets were imputed. For 60-min PE to be noninferior to 90-min, the upper bound of the one-sided 95% confidence interval of the difference between treatment groups had to be less than the noninferiority margin (Δ). Δ s were originally set for CAPS-IV and PCL-IV. However, the study ultimately used CAPS-5 and PCL-5 instead of these older versions. Thus, appropriate Δ s for these outcomes needed to be established. Fortunately, data from active-duty military samples were available from the STRONG STAR Consortium and from a recent report by Marx et al. (2022). These data were used to calculate appropriate noninferiority margins.

Across 11 CAPS-5 studies with military personnel with PTSD ($N = 1,442$), the baseline SD was 9.37 (Brett Litz, personal communication, November 6, 2021). In addition, the baseline SD s reported for CAPS-5 by Marx et al. (2022) were 9.63 for Study 1 ($n = 198$) and 9.11 for Study 2 ($n = 114$). Thus, the weighted average $SD = 9.38$. Setting Δ at $\frac{1}{2}SD$, our $\Delta = 4.69$ for CAPS-5. For the PCL-5, there is a large ($N = 912$) study of active-duty military (Wortmann et al., 2016) which found SD of the PCL-5 was 15.06. In addition, the baseline PCL-5 SD s reported by Marx et al. (2022) were 12.68 for Study 1 ($n = 198$) and 15.86 for Study 2 ($n = 114$). Thus, the weighted average $SD = 14.75$. Setting Δ at $\frac{1}{2}SD$ yields a $\Delta = 7.38$. We next compared these Δ s to those that could be derived from the weighted average reliable change indices (RCIs), which were available from Marx et al. (2022). The weighted average RCIs were 12.63 for CAPS-5 and 16.10 for PCL-5. Setting Δ at $\frac{1}{2}RCI$ resulted in a Δ (based on RCIs) of 6.32 for CAPS-5 and 8.05 for PCL-5. Given that the Δ s derived from the RCIs were higher than those derived from the SD s, we used the more conservative Δ s derived from the SD s for evaluating noninferiority in the present study ($\Delta = 4.69$ for CAPS-5 and $\Delta = 7.38$ for PCL-5).

In addition to noninferiority tests, we include Jeffreys, Zellner, and Siow (JZS) Bayes factors (BFs) for each test of treatment differences on both CAPS-5 and PCL-5 at each endpoint. BFs complement p values by quantifying the relative evidence for the null hypothesis versus the alternative hypothesis ($BF_{01} = \text{probability of the null hypothesis divided by probability of the alternative hypothesis}$; Quintana & Williams, 2018). $BF_{01} > 3.0$ indicates that the null is >3 times more likely than the alternative, providing support for the null hypothesis (Jeon & De Boeck, 2017; see Supplemental).

Two exploratory sensitivity analyses were performed for Hypothesis 1. As an alternative ITT analysis, multilevel modeling (MLM) was used to estimate means at primary endpoints. Second, noninferiority analyses were calculated using only those who completed each posttreatment assessment (“complete data”). For MLM analyses, we used piecewise growth models, modeling change over time separately for treatment versus posttreatment (see Figure 2). For CAPS-5, change from baseline to posttreatment was modeled as linear. For PCL-5, which was assessed at each session, change over sessions during treatment was modeled as quadratic because that model fit the data best, the lowest Akaike information criterion (AIC) and Bayesian information criterion (BIC). For both outcomes, change during posttreatment was modeled as linear since nonlinear trends were not significant. “Recruitment site” was included as a covariate in all analyses. Noninferiority tests used estimated means at each endpoint from MLM analyses.

MI and MLM both assume data are missing at random (MAR), which is less restrictive than assumptions of the complete data analyses, which assume data are missing completely at random (MCAR). MAR can be met when there are differences between subjects who drop versus those who do not as long as missingness depends on covariates in the model and/or the observed dependent variable scores before dropout (Hedeker & Gibbons, 2006). Hedeker and Gibbons (2006) showed that when data are MAR, MLMs provide unbiased estimates of growth curve parameters, even when dropout exceeds 80% and dropout is uneven between groups. Because one cannot prove MAR, we ran sensitivity analyses that did not assume MAR (i.e., we ran missing not at random models). These exploratory models are reported in the Supplemental.

For Hypothesis 2 (noninferiority in efficiency), we used MLMs to estimate PCL-5 change during treatment, with “session” as an independent variable and site as a covariate. Change was modeled as quadratic because that fit the data best. Average change per session by condition was calculated and used in the noninferiority analysis for Hypothesis 2.

Sample Size Determination

Sample size was determined a priori to provide .90 power to detect noninferiority using a one-sided 95% CI for 3-month posttreatment in the “complete data” analysis. Given information on the CAPS-IV at the time, we assumed a $SD = 18$, $\Delta = 10$, Δ has since been updated (made more restrictive) with information on CAPS-5, and 30% dropout. Power analysis required $N = 160$ participants.

Post Hoc Power Analysis

Missing data were imputed using MI for ITT analyses for Hypothesis 1, $N = 160$ at all three primary endpoints. Thus, power was $\geq .95$ to detect noninferiority using a one-sided 95% CI, for both outcomes. For complete data analyses, power was $>.90$ for CAPS-5 and $>.80$ for PCL-5. For Hypothesis 2, our prespecified noninferiority margin for differences in slopes between groups was 1.1, our $SD = 2.37$, and power was $>.90$ to detect noninferiority with a 95% one-sided confidence interval.

Results

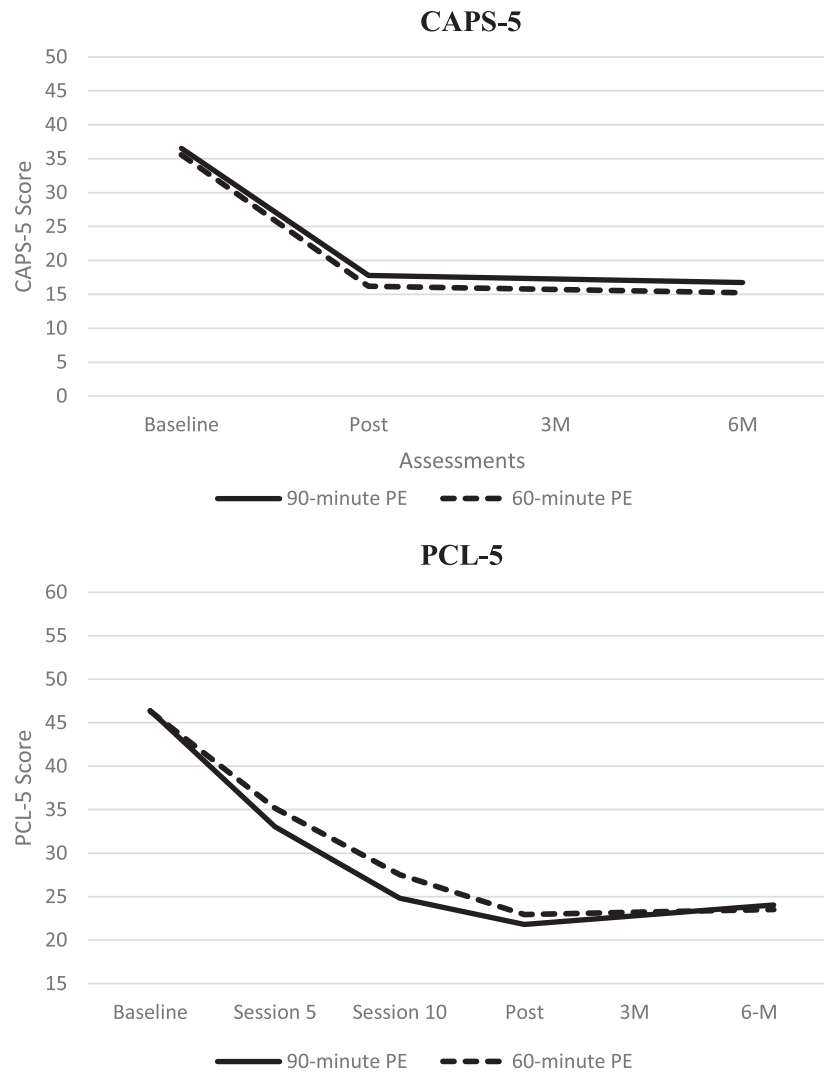
Preliminary Analyses

Participants were predominately enlisted service members, men, and in their early 30s; a slight majority were White. Detailed participant characteristics appear in Table 1. Eighty participants were randomized to each treatment group. A total of 109 participants (68.1%) completed an adequate dose (Foa et al., 2007) of at least eight sessions ($n = 86$) or achieved a $PCL-5 \leq 19$ ($n = 23$), with a similar proportion of participants completing treatment in each condition, $n = 59$ (74%) in 90-min PE, $n = 50$ (63%) in 60-min, Fisher’s exact test $p = .17$. Eighty-seven (54.5%) completed the 6-month assessment, $n = 48$ in 90-min (60%), $n = 39$ in 60-min (49%), Fisher’s exact test $p = .204$. The average number of sessions completed was 8.84 ($SD = 4.01$) for 90-min and 8.34 ($SD = 4.17$) for 60-min PE, $t(150) = 0.76$, $p = .45$. Participants with missing data did not differ from participants without missing data on any baseline demographic or psychological variables. Exploratory analyses found that treatment modality (in-person vs. telemental health) did not moderate any study effects.

Prespecified Intent-to-Treat Analyses

Results of the MI are shown in Table 2. T tests showed that scores on the CAPS-5 and PCL-5 at the three endpoints (posttreatment, 3- and 6-month posttreatment) were not significantly different for 60-min PE ($n = 80$) compared to 90-min PE ($n = 80$). For Hypothesis 1 (noninferiority of efficacy), noninferiority tests required that the one-sided 95% CI for the difference between the two treatments be less than the noninferiority margin (4.69 for CAPS-5; 7.38 for PCL-5). Table 2 shows that the 95% CI for the difference between 60- and 90-min PE was less than the noninferiority margin at all three endpoints for both outcomes, suggesting that 60-min PE was noninferior to 90-min PE. This conclusion is supported by the

Figure 2
MLM Model of the Growth Curve of CAPS-5 and PCL-5 Over Time



Note. MLM = multilevel modeling; CAPS-5 = Clinician Administered PTSD Scale for DSM-5; PCL-5 = PTSD Checklist for DSM-5; PE = prolonged exposure; PTSD = posttraumatic stress disorder.

BFs, which ranged from 3.39 to 5.56 (Table 2), indicating that the probability of the null hypothesis is 3.39–5.56 times the probability of the alternative hypothesis ($BF_{01} > 3.0$ supports the null hypothesis that the M of 60-min PE equals the M of 90-min PE).

Hypothesis 2 (noninferiority in efficiency) examined whether the decrease per session on PCL-5 in 60-min PE was noninferior to that in 90-min PE (Figure 2). This hypothesis involved only the PCL-5 because it was assessed every session. The intent-to-treat quadratic MLM model showed that the difference between the average decrease per session for 60-min PE (average decrease in 60-min PE = -1.89 , $n = 80$) was not significantly different from 90-min PE (average decrease in 90-min PE = -2.05 , $n = 80$), and, relevant to the noninferiority hypothesis, that the 95% CI for this difference between treatments was less than the noninferiority margin ($\Delta = 1.1$; see Table 2).

Exploratory Sensitivity Analyses

Intent-to-Treat Analysis Using MLM

MLM is an intent-to-treat analysis that can provide ITT estimates of the means and standard errors at any time point along its growth curve. Hence, it was used as a sensitivity analysis for the primary MI analysis. The estimated means from these MLM piecewise growth models (Figure 2) are displayed in Table 2. Confirming the results from the MI analysis, there were no significant differences between treatment groups at any of the three endpoints for either outcome. Similarly, noninferiority tests showed that the 95% CI for the difference between 60-min PE ($n = 80$) and 90-min PE ($n = 80$) was less than the noninferiority margin at all endpoints for both outcomes, consistent with noninferiority. These conclusions were supported by the BFs all being >3.0 (Table 2).

Table 1
Participant Characteristics

Characteristic	Participants, No. (%)		
	Entire sample (<i>n</i> = 160)	90-min PE (<i>n</i> = 80)	60-min PE (<i>n</i> = 80)
Age, <i>M</i> (<i>SD</i>), y	31.94 (7.90)	32.10 (7.75)	31.78 (8.10)
Post high school education ^a	116 (72.9)	55 (68.8)	61 (77.1)
Gender			
Male	115 (71.9)	61 (76.3)	54 (67.5)
Female	45 (28.1)	19 (23.8)	26 (32.5)
Race			
American Indian/Alaskan Native	5 (3.1)	1 (1.3)	4 (5.0)
Asian	1 (0.6)	1 (1.3)	0 (0.0)
Native Hawaiian/Other Pacific Islander	6 (3.8)	2 (2.5)	4 (5.0)
Black or African American	42 (26.3)	26 (32.5)	16 (20.0)
White	87 (54.4)	40 (50.0)	47 (58.8)
Other	19 (11.9)	10 (12.5)	9 (11.3)
Ethnicity ^a			
Hispanic or Latino	23 (14.5)	10 (12.5)	13 (16.5)
Non-Hispanic or Latino	136 (85.5)	70 (87.5)	66 (83.5)
Marital status ^a			
Never married, not in a relationship now	10 (6.3)	5 (6.3)	5 (6.3)
Not currently married	28 (17.6)	14 (17.6)	14 (17.7)
Currently married	98 (61.6)	51 (63.7)	47 (59.5)
Currently separated or divorced	23 (14.5)	10 (12.5)	13 (16.5)
Years in military, <i>M</i> (<i>SD</i>), y	11.53 (7.37)	11.71 (7.64)	11.35 (7.14)
Branch of service			
Army	35 (21.9)	22 (27.5)	13 (16.3)
Marines	67 (41.9)	32 (40.0)	35 (43.8)
Air Force	38 (23.8)	20 (25.0)	18 (22.5)
Navy	20 (12.5)	6 (7.5)	14 (17.5)
Military rank ^a			
Enlisted	152 (95.6)	78 (97.5)	74 (93.7)
Officer	7 (4.4)	2 (2.5)	5 (6.3)
Time from traumatic event, <i>M</i> (<i>SD</i>), y	8.34 (7.10)	8.42 (7.09)	8.25 (7.15)
Trauma type			
Combat	68 (42.5)	35 (43.8)	33 (41.3)
Sexual assault	41 (25.6)	17 (21.3)	24 (30.0)
Other	51 (31.9)	28 (35.0)	23 (28.7)

Note. *SD* = standard deviation; PE = prolonged exposure.

^aData regarding education, ethnicity, marital status, and military rank were available for 159 participants.

Analyses using models that did not assume that data were MAR (MNAR models), reported in the supplement, provided results that support the conclusions of our primary and sensitivity analyses.

Complete Data Analyses

The second sensitivity analysis used the raw data (no imputation) from participants who completed assessments at posttreatment, and 3- and 6-month posttreatment. *N*s at posttreatment, 3-, and 6-month posttreatment were 59, 49, and 48 for 90-min PE; and 50, 37, and 39 for 60-min PE. Again, there were no significant differences on CAPS-5 or PCL-5 between 60- and 90-min PE at any endpoint (Table 2). Also, the one-sided 95% CI for the difference between 60- and 90-min PE was less than the noninferiority margin at all three endpoints, except for the PCL-5 at posttreatment assessment. These conclusions were supported by the BFs all being >3.0 (Table 2).

Adverse Events

Two participants in the 60-min condition (2.5%) reported a total of two AEs; one was study related. Eight participants in the 90-min

condition (10.0%) reported a total of eight AEs; two were study related. Three additional participants experienced serious AEs (*n* = 3, 3.75% for 90-min PE). Two of these involved increased suicide risk, resulting in an emergency department visit or hospitalization, and one was a suicide; all of these serious AEs were unrelated to study participation.

Discussion

This is the first study to demonstrate that 60-min PE is noninferior to 90-min PE. Consistent with prior work (Nacasch et al., 2015; van Minnen & Foa, 2006) and as hypothesized, 60-min sessions were noninferior to 90-min sessions with respect to treatment efficacy among active-duty military personnel with PTSD. Using noninferiority margins of 4.69 on the CAPS-5 and 7.38 on the PCL-5, the 60-min condition was noninferior to the 90-min condition at posttreatment, 3-month posttreatment, and the final follow-up in intent-to-treat analyses. Results were supported by two sensitivity analyses and analyses that did not assume data were MAR and indicated that PE can be delivered in shorter (60 min) sessions than was originally specified, with comparable efficacy, by trained master's-level clinicians. Also, as hypothesized, 60-min sessions were noninferior to

Table 2
Noninferiority Tests

Time point	Mean 90-min PE	Mean 60-min PE	Difference between means ^a	Upper limit of the 95% CI ^b	Meets noninferiority hypothesis ^c	<i>p</i> for difference between means	BF ₀₁
CAPS-5							
Baseline	36.89	35.85	—	—	CI must be < 4.69 for CAPS-5 ^c	—	—
Multiple imputation							
Posttreatment	17.99	15.43	-2.56	1.29	Yes	0.278	3.39
3 months	16.07	15.26	-0.81	3.11	Yes	0.736	5.56
6 months	16.79	14.55	-2.24	1.86	Yes	0.368	4.03
MLM growth curve model							
Posttreatment	17.80	16.21	-1.59	2.07	Yes	0.478	4.64
3 months	17.25	15.71	-1.54	1.92	Yes	0.467	4.59
6 months	16.69	15.20	-1.49	2.50	Yes	0.543	4.93
Complete data analysis							
Posttreatment	17.48	15.22	-2.26	1.58	Yes	0.339	3.27
3 months	15.55	14.11	-1.44	2.92	Yes	0.596	4.25
6 months	16.31	14.13	-2.18	2.26	Yes	0.419	3.67
PCL-5							
Baseline	46.79	45.19	—	—	CI must be <7.38 for PCL-5 ^c	—	—
Multiple imputation							
Posttreatment	21.31	21.89	0.58	7.37	Yes	0.887	5.81
3 months	23.43	21.48	-1.95	5.38	Yes	0.665	5.38
6 months	23.72	20.71	-3.01	4.80	Yes	0.530	4.88
MLM growth curve model							
Posttreatment	21.77	22.95	1.18	6.48	Yes	0.717	5.51
3 months	22.89	23.23	0.34	5.40	Yes	0.914	5.83
6 months	24.01	23.51	-0.50	5.08	Yes	0.882	5.80
Complete data analysis							
Posttreatment	19.00	21.04	2.04	8.57	No	0.606	4.50
3 months	21.96	20.91	-1.05	6.22	Yes	0.816	4.30
6 months	21.80	20.31	-1.49	5.77	Yes	0.736	4.36
Improvement per treatment session							
Improvement	-2.05	-1.87	0.18	0.64	Slope CI must be <1.1 Yes	.530	

Note. CAPS-5 = Clinician Administered PTSD Scale for DSM-5; PCL-5 = PTSD Checklist for DSM-5; MLM = multilevel modeling; CI = confidence interval; PE = prolonged exposure; PTSD = posttraumatic stress disorder.

^a A difference that is negative indicates that 60-min PE has LOWER symptom severity than 90-min PE. ^b When the upper limit is below the noninferiority margin, the treatments are considered noninferior. ^c Meets noninferiority if upper limit of the 95% CI < 4.69 for CAPS and <7.38 for PCL-5.

90-min sessions with respect to treatment efficiency, operationalized as the average reduction in PCL-5 scores per session. This suggests that 60-min PE does not require more sessions to reduce PTSD symptoms to a similar degree as 90-min sessions.

Access to effective PTSD treatment is an important concern for the military and the general public. The 60-min PE protocol may significantly increase access to effective care while preserving limited resources by reducing patient burden, improving fit with behavioral health providers' typical practice schedules, and by matching many insurance reimbursement plans. Moreover, from a clinic operations perspective, the fiscal impact of a "no show" or missed appointment is reduced by 50% when a 60- versus 90-min session is missed. This is significant, given the high rate of missed psychotherapy appointments among patients with PTSD (Berke et al., 2019). Thus, the importance of the current findings for policy and implementation is substantial. Moreover, from a client's perspective, shorter sessions with shorter imaginal exposure and homework exercises may be more feasible and acceptable. Future research should directly test these potential hypothesized advantages of 60-min PE sessions (e.g., enhanced acceptability, reduced logistical burden, reduced lost revenue).

Study limitations must be noted. As DSM-5 measures of PTSD outcome were recently validated and lack consensus on noninferiority margins, we derived the noninferiority margins based on extant data. It would have been preferable to use well-established margins if they were available. The SDs for the CAPS-5 and PCL-5 in our sample were comparable to other studies (e.g., Marx et al., 2022) but larger than prior work using the DSM-IV versions of these measures (potentially due to the greater number of items required to capture the DSM-5 PTSD criteria). For the purposes of the present study, larger SDs served to make the noninferiority test more conservative. However, larger SDs for the DSM-5 versions of these PTSD measures may be an important psychometric issue for the field to contend with. Participants were active-duty military personnel and predominately men (71.9%). More research is needed to confirm the generalizability of these findings to other populations, including veterans, civilians, or women with PTSD and to ensure comparability of the treatment formats across other critical outcomes such as dropout rates. Additionally, reducing session length from 90 to 60 min while retaining all session components, albeit in abbreviated form, requires clinicians to be well versed in PE. Note, however, that this does not translate into requirements for advanced

degree (i.e., more costly) clinicians: All providers in this study were master's-level licensed professional counselors. Finally, as is common in treatment studies, many participants failed to complete all posttreatment assessments, requiring imputation of missing data.

These limitations notwithstanding, this study represents an important demonstration of shorter sessions for a leading PTSD therapy. More specifically, our findings provide evidence that administering PE in 60-min sessions does not reduce the efficacy or efficiency of this evidence-based treatment when compared to the traditional 90-min session format. Behavioral health providers and clinic administrators, particularly those who serve military populations, may consider these data when pursuing clinical training and structuring their clinic schedules, respectively.

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