Equine-Assisted Therapy for Posttraumatic Stress Disorder Among Military Veterans:
An Open Trial

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ABSTRACT

Objective: As veterans have high rates of posttraumatic stress disorder (PTSD) and historically poor treatment outcomes and high attrition, alternative treatments have gained much popularity despite lack of rigorous research. In this study, a recently developed and manualized 8-session group Equine-Assisted Therapy for PTSD (EAT-PTSD) was tested in an open trial to assess its preliminary feasibility, acceptability, and outcomes for military veterans.

Methods: The study was conducted from July 2016 to July 2019. Sixty-three treatment-seeking veterans with PTSD enrolled. PTSD diagnosis was ascertained using the Structured Clinical Interview for *DSM-5*, Research Version (SCID-5-RV) and confirmed using the Clinician-Administered PTSD Scale (CAPS-5). Mean age was 50 years, and 23 patients (37%) were women. Clinician and self-report measures of PTSD and depression were assessed at pretreatment, midtreatment, and posttreatment and at a 3-month follow-up. An intent-to-treat analysis and a secondary analysis of those who completed all 4 clinical assessments were utilized.

Results: Only 5 patients (8%) withdrew from treatment, 4 before midtreatment and 1 afterward. Posttreatment assessment revealed marked reductions in both clinician-rated and self-reported PTSD and depression symptoms, which persisted at 3-month follow-up. Specifically, mean (SD) CAPS-5 scores fell from 38.6 (8.1) to 26.9 (12.4) at termination. Thirty-two patients (50.8%) showed clinically significant change (≥ 30% decrease in CAPS-5 score) at posttreatment and 34 (54.0%) at follow-up.

Conclusions: Manualized EAT-PTSD shows promise as a potential new intervention for veterans with PTSD. It appears safe, feasible, and clinically viable. These preliminary results encourage examination of EAT-PTSD in larger, randomized controlled trials.

Trial Registration: ClinicalTrials.gov identifier: NCT03068325

Posttraumatic stress disorder (PTSD) is a prevalent and highly debilitating disorder, impairing social, occupational, and other important areas of functioning.[1] In the United States, PTSD has a lifetime prevalence of nearly 9% and a 12-month prevalence rate of about 3.5%.[1] As military personnel face increased risk for trauma exposure through combat, injury, captivity, and sexual assault,[2–4] PTSD rates are even higher for this population (10%–30%).

Despite the development of several psychotherapies and pharmacotherapies for PTSD,[5–8] research has consistently shown that more than one-third of treated PTSD patients never fully remit, demonstrating a median illness duration of 3 to 5 years despite treatment.[9,10] Many others avoid or reject treatment.[5,11] For example, while exposure-based therapy, the gold-standard PTSD treatment,[12] is often effective, about half of patients do not benefit, with many dropping out before treatment completion.[13–16] Military veterans have shown even weaker treatment effectiveness and higher dropout rates.[17–19] Moreover, veterans with PTSD often avoid seeking treatment due to mistrust, stigma, concerns about the treatment experience, low emotional readiness, and logistical barriers or simply because years of nonspecific or ineffective treatments have demoralized them.[11,20]

As many patients avoid or are proven refractory to standard treatments, a host of complementary and alternative PTSD treatments have arisen and spread widely.[21] One such treatment, equine-assisted therapy (EAT), is being increasingly used for a wide range of physical and mental health conditions, including PTSD.[22,23] EAT advocates assert that horse-human interaction experiences during therapy can potentially foster insight and behavioral changes in patients, as these interactions offer a platform for eliciting thoughts, feelings, and behaviors related to patients' lives outside treatment.[24,25] Furthermore, horses are considered to be especially conducive to this process as they are naturally hypervigilant and sensitive to verbal and nonverbal cues, providing patients instantaneous feedback during the horse-human interactions, which, in turn, afford patients and therapists opportunities to foster emotional awareness, reflection, and attunement to thoughts, behaviors, and forms of communication.[23,26,27]

While EAT has gained popularity and exuberant proponents over the years,[28] there have been no

Clinical Points

- Equine-assisted therapy (EAT) has gained popularity over the years as a complementary and alternative treatment for posttraumatic stress disorder (PTSD). However, there have been no well-specified treatment manuals of how to deliver EAT, nor has there been adequate safety, feasibility, and efficacy research on EAT for PTSD.

- The present study addresses this gap in knowledge by using a rigorous open trial of standardized, manualized EAT-PTSD tailored for military veterans, examining changes in PTSD and depressive symptoms across treatment.

- For veterans with PTSD, EAT may serve as a viable alternative or augmentative treatment, lowering both PTSD and depressive symptoms after treatment and 3 months following treatment termination.

examine whether EAT may be considered a complementary and/or alternative treatment for PTSD.[31,34] A well-designed open trial of a manualized, standardized EAT would be a much needed first step in the right direction.

To address this gap, we recently developed and manualized a group EAT for PTSD (EAT-PTSD) comprising eight 90-minute weekly group sessions and then evaluated it in a very small sample (N = 8 patients from two EAT groups), finding no treatment dropout, high patient satisfaction, and decreases in clinician-assessed PTSD and depressive symptoms from pre- to posttreatment.[35] These encouraging initial findings led to further refinement of the treatment manual. We then undertook the first rigorous open trial of standardized, manualized EAT-PTSD tailored for military veterans with PTSD using well-validated clinician-rated and self-report assessment measures. This moderately large (N = 63) open trial of EAT-PTSD had 4 assessment points: pretreatment, midpoint, posttreatment, and 3-month follow-up. We expected symptom reduction to follow treatment and to persist 3 months later.

METHODS

Eligibility Screening

The study was conducted from July 2016 to July 2019. Figure 1 depicts progress through the study stages. Patients were recruited through clinical referrals from Veterans Administration (VA) centers, other programs affiliated with our center (the New York Presbyterian Military Family Wellness Center at Columbia Veterans Research Center), flyers, print and online advertisements, and through word of mouth. Phone screening for study participation used the PTSD Checklist for *DSM-5* (PCL-5).[36] Individuals scoring ≥ 30, indicating likely PTSD, were invited to an in-person clinical assessment by an independent evaluator, a PhD- or MA-level psychologist trained to ≥ 85% reliability with a senior clinician on all interview-based measures. Primary and comorbid diagnoses were ascertained using the

well-specified treatment manuals of how to deliver EAT, nor has there been adequate safety, feasibility, and efficacy research of EAT. Like many other complementary and alternative treatments, which often either have gone untested or have undergone poorly conceived, likely biased research, lacking adequate standardization or clear therapeutic goals, EAT has also lacked standardization and rigorous testing. Extant EAT research focusing on several mental health conditions, including PTSD, is scarce and generally poorly designed, characterized by small sample sizes, inconsistent assessments, unstandardized treatment procedures, and researcher conflicts of interest. Extant evidence for the efficacy of animal-assisted therapies for PTSD, including EAT, has been mostly anecdotal, mainly focusing on countering dissociative symptoms, emotional numbness, social isolation, and hyperarousal (for a review, see O'Haire et al[29]). These difficulties, reiterated in several reviews,[22,23,26,30–33] have precluded a more mainstream acceptance of EAT. In sum, it is often not clear what EAT comprises or means, let alone whether it works. Thus, more methodologically sound and rigorous research is needed to

Figure 1. Participants' Progress Through the Study Stages

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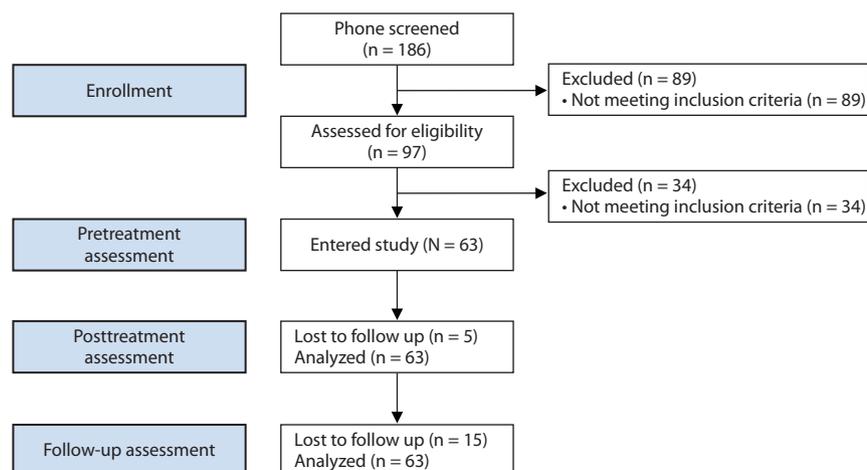
Table 1. Sample Demographic and Clinical Characteristics		
Characteristic	n	%
Sex		
Male	40	63.5
Female	23	36.5
Ethnicity		
Hispanic	14	22.2
Non-Hispanic	45	71.4
Prefer not to respond	4	6.3
Race		
White	16	25.4
Black/African American	26	41.3
Other	15	23.8
Prefer not to respond	6	9.5
Index trauma		
Combat-related	27	42.9
Military sexual trauma	23	36.5
Physical assault	9	14.3
Sexual assault	1	1.6
Child abuse	23	36.5
Traumatic accident	4	6.3
Natural disaster	1	1.6
Traumatic sudden loss	7	11.1
Other	16	25.4
Service era		
1960–1969	6	9.5
1970–1979	14	22.2
1980–1989	20	31.7
1990–1999	20	31.7
2000–2009	31	49.2
2010–2019	15	23.8
Conflicts (participated in)		
Vietnam/Korea	10	15.9
OEF/OIF	23	36.5
Other	5	7.9
None	25	39.7
Employment status		
Working full-time	9	14.3
Working part-time	1	1.6
Student	5	7.9
Unemployed	9	14.3
Disabled	20	31.7
Retired	11	17.5
Prefer not to respond	8	12.7
Annual household income		
< $30,000	30	47.6
$30,000–$60,000	15	23.8
$60,000–$90,000	8	12.7
> $90,000	7	11.1
Prefer not to respond	3	4.8
Marital status		
Single/never married	20	31.7
Married	12	19.0
Divorced/separated	29	46.1
Prefer not to respond	2	3.2
Concurrent treatment		
Psychotherapy only	5	7.9
Pharmacotherapy only	11	17.5
Both	31	49.2
Comorbid diagnoses		
Major depressive disorder	25	39.7
Persistent depressive disorder	16	25.4
Other depressive disorder	1	1.6
Generalized anxiety disorder	5	7.9
Obsessive-compulsive disorder	1	1.6
Social anxiety disorder	1	1.6
Alcohol use disorder	5	7.9
Substance use disorder	4	6.3
Adjustment disorder	1	1.6
Attention-deficit/hyperactivity disorder	1	1.6

Abbreviation: OEF/OIF = Operation Enduring Freedom/Operation Iraqi Freedom.

Structured Clinical Interview for *DSM-5*, Research Version (SCID-5-RV).[37] PTSD diagnosis was confirmed using the Clinician-Administered PTSD Scale (CAPS-5).[38]

Inclusion criteria were (*a*) primary diagnosis of PTSD, (*b*) age 18–70 years, (*c*) reported military experience, and (d) English fluency. Current pharmacotherapy or psychotherapy was permitted providing it had been stable for at least 3 months; patients were asked to hold the regimen stable for the study duration. Importantly, none of those in concurrent psychotherapy were receiving a strict manualized well-defined progressive protocol for PTSD treatment, such as prolonged exposure (PE) or cognitive-behavioral therapy (CBT), but rather were receiving long-term, stable supportive talk therapy in different settings. Exclusion criteria were (*a*) history of psychotic disorder or current unstable bipolar disorder, determined by SCID-5-RV; (*b*) 17-item Hamilton Depression Rating Scale (HDRS)[39] score > 25; (*c*) elevated suicide risk, determined by clinical assessment; (*d*) severe substance or alcohol use disorder within the past 6 months, or moderate use disorder within the past 2 months (SCID-5-RV); and (*e*) physical limitations impeding participation in equine-assisted activity.

All clinical evaluations took place at New York State Psychiatric Institute (NYSPI). Participants received $100 compensation per assessment. The NYSPI Institutional Review Board approved the study. Participants provided written informed consent (ClinicalTrials.gov identifier: NCT03068325).

Outcome Measures

Primary outcome—clinician-rated PTSD. PTSD symptom severity, measured by the CAPS-5,[38] was the primary outcome. The CAPS-5, a structured interview diagnosing PTSD based on *DSM-5* criteria, is widely used in research. It has demonstrated excellent reliability, convergent and discriminant validity, diagnostic utility, and sensitivity to change.[40] Cronbach α in the current sample was 0.74, 0.83, 0.95, and 0.91, for pretreatment, midpoint, posttreatment, and follow-up assessments, respectively.

Clinically significant change (CSC) was defined a priori as ≥ 30% CAPS score reduction at posttreatment as per CSC scoring practices for prior PTSD studies.[41–43]

Secondary outcome—self-reported PTSD. PTSD symptoms were also assessed using PCL-5,[36] a 20-item questionnaire assessing presence and severity of PTSD symptoms. With well-documented psychometric properties, it is considered a valid, reliable PTSD instrument.[44] Cronbach α in this sample was ≥ 0.92 at all assessments.

Depression. Clinician-rated depressive symptoms were measured using the HDRS,[39] which has demonstrated strong internal consistency and interrater and test-retest reliability.[45] Cronbach α in the current sample was 0.69, 0.79, 0.92, and 0.85 at the assessment intervals. Depression was further assessed using the self-report Beck Depression Inventory-II (BDI-II).[46] The 21-item BDI-II has high internal consistency and good test-retest reliability.[47] The sample Cronbach α was ≥ 0.93 at all assessments.

Table 2. Outcome Measures by Assessment Point[a]

Measure	Pretreatment	Midtreatment	Posttreatment	Follow-Up
Per Time Point	n = 63	n = 59	n = 58	n = 48
CAPS-5	38.55 (8.06)	29.36 (10.69)	26.41 (12.71)	26.06 (13.26)
PCL-5	50.72 (13.79)	39.93 (14.60)	34.12 (17.32)	35.77 (19.24)
HDRS	16.25 (5.59)	13.25 (6.70)	12.00 (6.67)	11.81 (7.23)
BDI-II	27.40 (13.17)	23.54 (13.49)	20.74 (14.53)	20.23 (14.27)
Intent-to-Treat	n = 63	n = 63	n = 63	n = 63
CAPS-5	38.55 (8.06)	29.60 (10.41)	26.88 (12.44)	26.69 (11.88)
PCL-5	50.72 (13.79)	40.19 (14.16)	34.57 (16.72)	35.87 (17.49)
HDRS	16.25 (5.59)	13.23 (6.49)	12.09 (6.46)	11.88 (6.50)
BDI-II	27.40 (13.17)	23.71 (13.07)	20.80 (13.98)	19.72 (12.95)
Participants Assessed at All 4 Time Points	n = 48	n = 48	n = 48	n = 48
CAPS-5	37.62 (7.57)	28.56 (10.93)	25.98 (13.38)	26.06 (13.26)
PCL-5	50.52 (14.64)	39.40 (14.99)	34.90 (17.85)	35.77 (19.24)
HDRS	16.00 (5.96)	12.85 (6.43)	12.02 (7.00)	11.81 (7.23)
BDI-II	27.98 (14.33)	24.00 (14.04)	21.43 (15.18)	20.29 (14.27)

[a]All values are shown as mean (SD) scores.
Abbreviations: CAPS-5 = Clinician-Administered PTSD Scale, HDRS = Hamilton Depression Rating Scale, PCL-5 = PTSD Checklist for *DSM-5*, PTSD = posttraumatic stress disorder.

Equine-Assisted Therapy for PTSD (EAT-PTSD)

Treatment comprised 8 weekly, manual-guided, 90-minute group sessions[35] conducted at a large nearby equestrian center, to which participants received roundtrip transportation. The study comprised 16 EAT groups, each including 3 to 5 veterans. All groups but one were of mixed gender. Sessions were co-led by a licensed mental health professional (LMHP—a licensed professional counselor, or licensed clinical social worker) and a qualified equine specialist (ES). The role of the mental health professional is to facilitate patients' process and reflection on what they experience and feel, typically through short, targeted observations, questions, or gentle directions. The ES guides participants in horse communication and behavior, demonstrates the equine exercises, and offers coaching, encouragement, and advice for engaging in horse-related exercises. An additional equestrian center horse wrangler attended sessions to enhance safety. Each EAT group included the same two horses in all sessions.

Manualized EAT-PTSD is an experiential treatment and hence does not elicit, focus on, or discuss PTSD-associated trauma. Rather, it seeks to increase affective awareness of self and others, improve communication, help regulate emotional response, improve critical thinking/problem solving, and increase self-confidence/self-efficacy while engaging with the horses. Session 1 orients patients to EAT-PTSD (rationale, description, possible benefits). It provides psychoeducation (eg, common reactions to trauma, development and maintenance of PTSD) and a barn tour and ends with meeting the horses in a private "round pen." Subsequent sessions all take place in the round pen, with each session including (*a*) review of the content of previous sessions, (*b*) a grounding exercise focusing attention on current physical sensations, and (*c*) introduction of increasingly complex encounters and interactions with horses, coupled with team feedback and direction. Each session ends with an opportunity for participants to review and discuss their experiences during the session ("closing circle").

Early phase treatment sessions (sessions 2–3) focus on acquainting patients with the horses, on grooming exercises, and on learning "leading"—directing the horses with a rope or a wand. The middle phase (sessions 4–7) furthers patient mastery and comfort with the horses in individual and teamwork exercises. For example, patients learn to use a wand to distance the horse, creating personal space, or to collaboratively maneuver a horse onto a tarpaulin, fostering teamwork and cooperation. The final session includes a graduation ceremony celebrating patients' treatment progress and accomplishments (See Arnon et al[35]).

All treatment sessions were videotaped and reviewed by research personnel to ensure adherent delivery of the intervention. The treatment teams attended weekly supervision calls led by the research team (P.W.F. and A.L.) to discuss each session and provide feedback.

Data Analysis

The Little MCAR (missing completely at random) test on total scores for the CAPS-5, PCL-5, HDRS, and BDI-II from each time point following the baseline assessment (ie, midpoint, posttreatment, and follow-up analysis) was used to test whether data were missing at random.[48]

In line with previous open-trial studies exploring novel psychotherapies for different psychopathologies,[48–52] we used an intent-to-treat analysis, thereby analyzing data from all 63 patients. As missing data were minimal and missing at random (see Results section), we conducted the intent-to-treat analysis with full information maximum likelihood (FIML), a gold standard approach to handling missing data.[53] In addition, we repeated analyses for patients who completed assessments at all 4 time points (n = 48). Treatment effects were explored using a repeated-measures analysis of variance (ANOVA) with time (pretreatment, midpoint, posttreatment, and follow-up) as a within-subjects factor. Post hoc tests using the Bonferroni correction were used to compare the different time points. All statistical tests were 2-sided, using α ≤ .05. Effect sizes are reported using $\eta^2 p$ and Cohen *d* when appropriate.

Figure 2. Mean CAPS-5, PCL, HDRS, and BDI-II Scores by Time (Pretreatment, Midpoint, Posttreatment, Follow-Up) for (A) Available Data per Time Point (n = 63, 59, 58, and 48, Respectively), (B) Intent-To-Treat Analysis (n = 63), and (C) Analysis of Participants Assessed at All 4 Time Points (n = 48)[a]
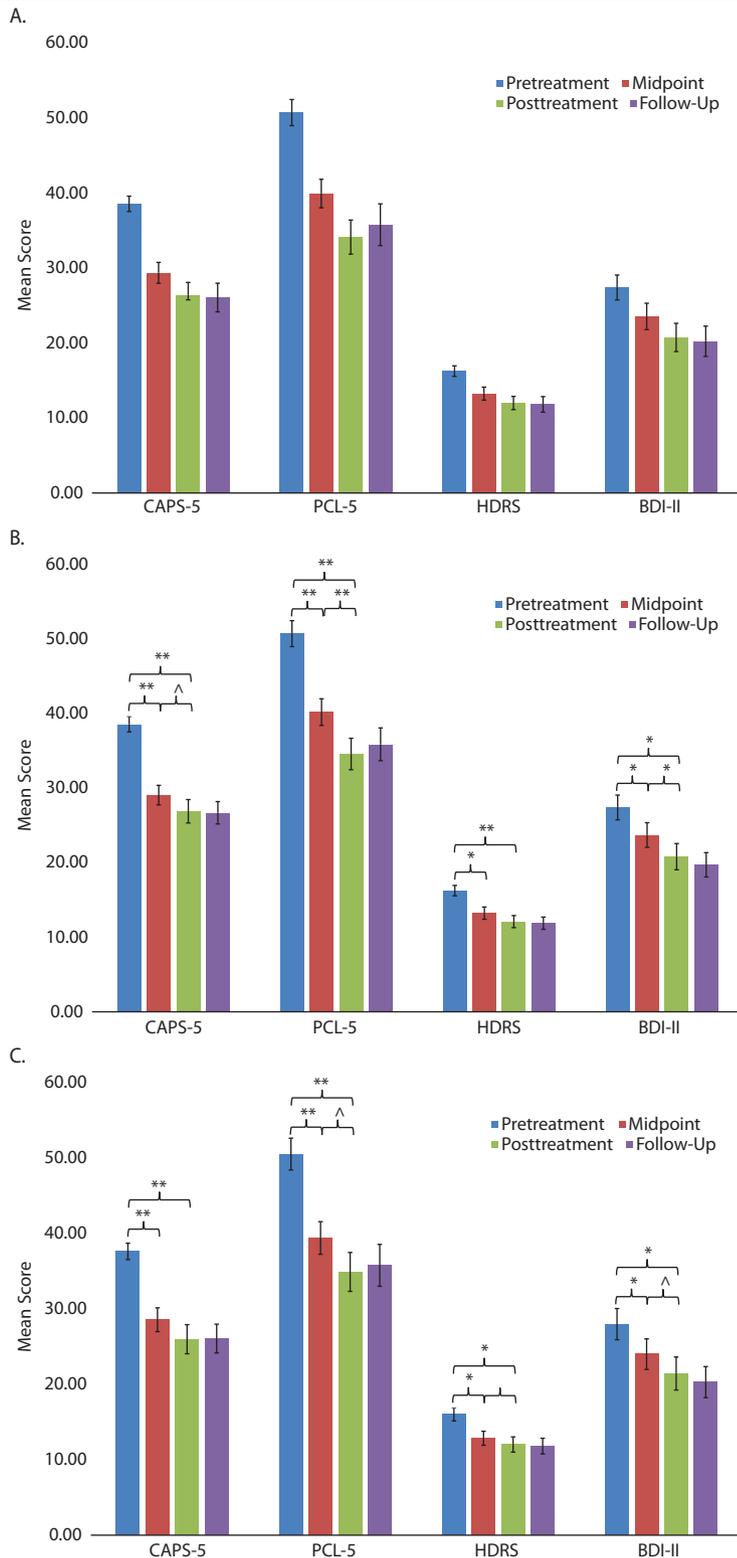
[a]Error bars denote standard error of the mean (SEM).
^$P < .07$, *$P < .01$, **$P < .001$.
Abbreviations: BDI-II = Beck Depression Inventory-II, CAPS-5 = Clinician-Administered PTSD Scale, HDRS = Hamilton Depression Rating Scale, PCL-5 = PTSD Checklist for *DSM-5*, PTSD = posttraumatic stress disorder.

RESULTS

Of 186 phone-screened veterans, 97 were invited for clinical intake, yielding a final sample of 63 veterans with PTSD (mean [SD] age = 50.01 [12.38] years; range, 27–70 years; n = 23 [37%] female) (Figure 1). Of enrolled veterans, 47 were receiving concurrent treatment: psychotherapy alone (n = 5), pharmacotherapy alone (n = 11), or both (n = 31). Forty-eight had at least 1 comorbid disorder. See Table 1 for a more complete description of the sample.

Attrition Rates

Table 2 and Figure 2A depict outcome measures over time. All 63 subjects completed baseline assessments. Attrition was low: only 5 patients (7.9%) discontinued EAT, 4 patients (6.3%) before midpoint (with 1 dropping out following baseline assessment, attending no EAT-PTSD sessions) and 1 patient (1.6%) after. Forty-eight patients (76.2%) provided 3-month follow-up data. The Little MCAR test indicated that data were missing at random ($\chi^2_{14} = 17.53$, $P = .23$). In addition, there were no adverse events or safety concerns reported by any of the participants or staff members.

Treatment Effects

Table 2 and Figure 2B present results for CAPS-5, PCL-5, HDRS, and BDI-II scores at each of the 4 time points for the intent-to-treat analysis (n = 63). Table 2 and Figure 2C present results for patients who were assessed on all 4 time points. Results were highly similar (see Supplementary Appendix 1).

Mean (SD) CAPS-5 scores decreased from 38.6 (8.1) at baseline to 26.9 (12.4) at termination, with 29 participants (46.0%) and 23 participants (36.5%) scoring below the cutoff score of 25 at posttreatment and follow-up, respectively. Repeated-measures ANOVA with time as the within-subjects factor was significant ($F_{3,186} = 30.41$, $P < .0001$, $\eta^2_p = 0.33$). Post hoc tests with Bonferroni correction revealed a significant pre- to posttreatment reduction ($P < .0001$, $d = 1.11$), which persisted at 3-month follow-up ($P = .88$). This pre- to posttreatment reduction was evident at midpoint ($P < .0001$, $d = 0.96$), with further trend-level significant reduction at posttreatment ($P = .050$, $d = 0.24$). Based on CAPS-5 scores, 32 veterans (50.8%) demonstrated CSC at posttreatment and 34 (54.0%) at 3-month follow-up.

Mean (SD) PCL-5 scores decreased from 50.7 (13.8) at baseline to 34.6 (16.7) at termination. Repeated-measures ANOVA

was significant ($F_{3,186} = 30.85$, $P < .0001$, $\eta^2_p = 0.33$). Post hoc analyses revealed significant reduction from pre- to posttreatment ($P < .0001$, $d = 1.05$), maintained at 3-month follow-up ($P = .39$). This pre- to posttreatment significant reduction in symptoms was evident at midpoint assessment ($P < .0001$, $d = 0.70$), with additional reduction from mid- to posttreatment ($P < .0001$, $d = 0.34$).

Depression Measures

Mean (SD) HDRS scores decreased from 16.3 (5.6) at baseline to 12.1 (6.5) at termination ($F_{3,186} = 13.82$, $P < .0001$, $\eta^2_p = 0.18$). Bonferroni-corrected post hoc tests revealed significant pre- to posttreatment reduction ($P < .0001$, $d = 0.69$), evident at midtreatment ($P = .003$, $d = 0.50$) without additional reduction from mid- to posttreatment ($P = .13$), which was maintained at 3-month follow-up ($P = .72$).

Mean (SD) BDI-II scores similarly decreased from 27.4 (13.2) at baseline to 20.8 (14.0) at termination ($F_{3,186} = 15.92$, $P < .0001$, $\eta^2_p = 0.20$). Post hoc analyses revealed a significant pre- to posttreatment reduction ($P = .001$, $d = 0.49$), maintained at 3-month follow-up ($P = .22$). This pre- to posttreatment significant reduction was evident at the midpoint assessment ($P = .005$, $d = 0.28$), with additional reduction from midpoint to posttreatment assessment ($P = .001$, $d = 0.22$).

DISCUSSION

This open trial examined the first rigorously defined, manualized group EAT intervention for PTSD (EAT-PTSD) in a relatively large sample of military veterans, with clinician-rated and self-report outcome measures of PTSD and depression. Results suggest EAT-PTSD is potentially safe and well-tolerated, with large–effect size improvement on standard ratings. Posttreatment findings generally corroborate those of our previous small pilot study (N = 8),[35] showing significant symptom reduction from pre- to posttreatment. Unlike in our earlier pilot study, treatment benefits across all outcome measures largely persisted for 3 months following treatment. Although the group mean CAPS-5 score (26.9) remained above the diagnostic threshold of 25, 50.8% and 54.0% of veterans demonstrated clinically significant change at posttreatment and follow-up, respectively, with 46.0% and 36.5% scoring below the cutoff score at posttreatment and follow-up, respectively. Yet, as this trial was an open trial, present findings need to be regarded with caution. Clinical efficacy of EAT needs to be more exhaustively examined in a randomized controlled trial to allow a more formal testing of its efficacy.

Presented findings also suggest high EAT patient tolerability, low attrition, and safety. Dropout rates were low, which is an encouraging preliminary finding in contrast to the roughly 20% treatment dropout rates among PTSD patients broadly[13] and 30%–40% among veterans specifically.[17,54,55] Yet, these findings warrant caution, as the open trial design allowed participants to actively select treatment without facing randomization to a placebo or unwanted alternative condition.[56] We also found patients to be eager to enroll in the EAT-PTSD program, excited by the opportunity for equine engagement. While some patients expressed preference for group treatment over individual psychotherapy, some were more excited about group EAT as an adjunct to ongoing individual treatment. In addition, many patients also expressed looking forward to the EAT sessions, wishing for a longer treatment duration (ie, more than 8 weeks). Finally, while some risk of injury may exist due to propinquity to and handling horses, this risk level is hard to ascertain. Still, wranglers were included in the EAT protocol due to safety concerns, and horses were specifically chosen for their temperament, having no history of aggression. Indeed, no incidents were reported in any of the 16 EAT study groups included in this study.

While this open trial generated encouraging results, why EAT-PTSD yielded benefits is less clear. However, the primary aim of the present study was to explore, using a well-designed and methodologically sound experimental design, whether EAT-PTSD indeed leads to potential therapeutic benefits for veterans, as previous less rigorous research and polemics on EAT have claimed. Hence, we did not address possible underlying constructs or potential mechanisms of action, raising some intriguing questions. For example, is there, as some equine advocates insist, something unique about horses as powerful but fearful prey animals that particularly resonates with veterans with PTSD?[24,25] Or would dogs,[57] dolphins,[58] or dromedaries yield similar outcomes? Does the effect derive from something inherent in the equine interactions, from the human group process, or from the idyllic, bucolic environment, an escape from urban pressures? Might EAT facilitate renewed attachment relationships for traumatized humans who feel distrustful and detached?[59] At this juncture, we can only speculate. Considerable follow-up research is needed to address these and related questions pertaining to underlying constructs and mechanisms of change. Still, we believe that the present study is an important addition to the very limited reliable evidence of the benefits and safety of EAT for veterans with PTSD, providing a much-needed foundation for further explorations of EAT.

Notwithstanding the aforementioned limitations, our recently published substudy[60] yields some preliminary conjectures. We examined a subsample of the present study (N = 20) using longitudinal neuroimaging (ie, structural magnetic resonance imaging [sMRI], resting state functional MRI [rs-fMRI], and diffusion tensor imaging [DTI]) to explore possible mechanisms and predictors of EAT outcome.[60] Results showed a significant increase in caudate functional connectivity (FC) and reduction in gray matter density of the thalamus and the caudate at posttreatment. This increase of caudate FC was further positively associated with clinical improvement at posttreatment and at 3-month follow-up. Higher baseline caudate FC was associated with greater PTSD symptom reduction posttreatment. These exploratory findings suggest that EAT-PTSD may target reward circuitry responsiveness and produce a caudate

pruning effect from pre- to posttreatment. Yet, these exploratory findings should be further examined in future research using additional behavioral tasks and clinical measures of related concepts such as anhedonia, as well as observer and self-report measures of emotional regulation, critical thinking and problem-solving, and self-efficacy.

The study has some limitations. The lack of a control arm in which participants receive no active therapy is a major one. While an open trial is appropriate for this preliminary stage of treatment development, the absence of a control condition precludes testing the clinical efficacy of EAT, especially as many participants had concurrent (stable) psychological and/or pharmacologic treatment. Open trials sometimes deliver overly rosy results, and symptom change could conceivably reflect passage of time. Still, symptom reduction was clinically significant and persisted at 3-month follow-up. Second, independent evaluators could not be blinded to the open treatment. Third, so as not to prevent patients from seeking treatment post-EAT, the study could not control for any additional treatment patients may have received between posttreatment and follow-up assessments. Any additional treatment following the termination of EAT, while not affecting the posttreatment assessment, may have affected clinical status at follow-up unrelated to the specific effects of EAT. Relatedly, we did not exclude participants with stable psychotherapy or psychopharmacology from entering the study. As most (n = 47) received either or both, this may have also affected emergent results. On the other hand, these could also be considered ineffective or insufficient interventions, as patients had typically been receiving them chronically and still met study entry criteria. We did verify that concurrent treatment had been unchanged for at least 3 months and that no study participants were receiving a clearly defined progressive time-limited PTSD treatment such as PE or CBT. Fourth, the potential benefits of EAT may be geographically restricted to venues accessible to horse stables. Relatedly, the study did not assess costs in relation to benefits. Even if future research finds EAT efficacious, it may prove to be an expensive endeavor. Fifth, EAT may have appealed to veterans with an a priori affinity for horses, and findings may be specific to such patients. Finally, several administrative factors of the EAT protocol, less than central to the therapy itself, may have contributed to the observed low attrition rates and symptom reduction. These may include the "outdoor" recreational aspects of EAT, which incorporated a trip outside participants' urban setting, atypical of most PTSD interventions; the relatively high assessment payments (summing potentially to $400); and the simple pleasure of being in a bucolic setting and being around animals, including horses. These factors may have encouraged study participation and completion. Yet, the stable symptom reduction on the CAPS-5, PCL-5, HDRS, and BDI-II and in rates of CSC at 3-month follow-up assessment lend support for the therapeutic value of EAT-PTSD.

Nonetheless, group EAT for PTSD, the first manualized EAT, might offer an effective primary intervention or adjunctive therapy for PTSD. Current results suggest EAT-PTSD appears safe, tolerable, well-regarded, and beneficial for veterans meeting *DSM-5* PTSD criteria. EAT-PTSD might engage avoidant patients, resistant to more formal treatment modalities, encouraging subsequent openness to additional therapy. These promising open trial findings warrant further testing of this EAT protocol in randomized controlled trials.
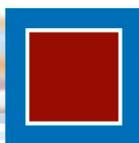
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See supplementary material for this article at PSYCHIATRIST.COM.

Supplementary Material

List of Supplementary Material for the article

1. **Appendix 1**   Supplementary results

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Appendix 1

Analysis of participants that completed all four assessments

Table 2 and Figure 2C illustrate results for CAPS-5, PCL-5, HAM-D, and BDI-II scores at each of the four time points only for those patients who were assessed at each of the four time points (n=48).

PTSD measures

For CAPS-5 scores, the repeated measures ANOVA with time as the within-subjects factor was significant, $F(3,141)=18.68$, $p<.0001$, $\eta^2_p=.28$. Post hoc tests using the Bonferroni correction revealed a significant reduction from pre- to post-treatment, $p<.0001$, *Cohen's d*=1.07, which was maintained at three-months follow-up, $p=1.00$. This pre- to post-treatment significant reduction was evident at the mid-point assessment, $p<.0001$, Cohen's d=0.96, with no additional reduction from mid- to post-treatment, $p=.81$. Rates CSC based on CAPS scores showed that 28 of 58 participants (48.27%) demonstrated CSC at post-treatment, and 26 of 48 participants (54.16%) at follow-up assessment.

For PCL-5 scores, the repeated measures ANOVA was significant, $F(3,141)=19.41$, $p<.0001$, $\eta^2_p=.29$. Post hoc analyses revealed a significant reduction from pre- to post-treatment, $p<.0001$, *Cohen's d*=0.96, which was maintained at three-months follow-up, $p=1.00$. This pre- to post-treatment significant symptom reduction was evident at the mid-point assessment, $p<.0001$, *Cohen's d*=0.75, with an additional reduction from mid- to post-treatment, albeit only at trend-level, $p=.06$, *Cohen's d*=0.27.

Depression measures

For HAM-D scores, the repeated measures ANOVA was significant, $F(3,141)=8.89$, $p<.0001$, $\eta^2_p=.16$. Bonferroni corrected post hoc tests revealed a significant reduction from pre- to post-treatment, $p=.001$, *Cohen's d*=0.61, which was maintained at three-months follow-up, $p=1.00$. This pre- to post-treatment significant reduction was evident at the mid-point assessment, $p=.004$, *Cohen's d*=0.51, with no additional reduction from mid- to post-treatment assessment, $p=1.00$.

For BDI-II scores, the repeated measures ANOVA was significant, $F(3,141)=10.83$, $p<.0001$, $\eta^2_p=.19$. Post hoc analyses revealed that a significant reduction from pre- to post-treatment, $p=.003$, *Cohen's d*=0.44, which was maintained at three-months follow-up, $p=1.00$. This pre- to post-treatment significant reduction in symptoms was evident at the mid-point assessment, $p=.04$, *Cohen's d*=0.28, with an additional trend-level reduction from mid- to post-treatment, $p=.07$, *Cohen's d*=0.18.