Journal of Anxiety Disorders 92 (2022) 102645

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

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

Treatment response trajectories in residential PTSD programs for veterans: A national cohort investigation

Peter P. Grau [a,b,c,*], Rebecca K. Sripada [b,c,d], Robert H. Pietrzak [e,f], Dara Ganoczy [d], Ilan Harpaz-Rotem [e,f,g]

[a] VA Serious Mental Illness Treatment Resource and Evaluation Center (SMITREC), 2800 Plymouth Road, Bldg 16, Ann Arbor, MI 48109, United States
[b] VA Ann Arbor Healthcare System, 2215 Fuller Road, Ann Arbor, MI 48105, United States
[c] Department of Psychiatry, University of Michigan Medical School, United States
[d] Veterans Affairs Center for Clinical Management Research, Health Services Research and Development, Ann Arbor, MI, United States
[e] Veterans Affairs National Center for PTSD, Veteran Affairs Connecticut Healthcare System, West Haven, CT, United States
[f] Yale University, Department of Psychiatry, New Haven, CT, United States
[g] Veterans Affairs Northeast Program Evaluation Center, West Haven, CT, United States

ARTICLE INFO

Keywords:
PTSD
Veterans
Residential Treatment
Trajectory analysis
Evidence-based Treatment

ABSTRACT

Although improving residential PTSD care is a priority for the Department of Veterans Affairs, previous evaluations have been limited by a lack of systematic data collection across more than two timepoints. This study used recently available data to assess symptom trajectories in a large, national sample of veterans who engaged in residential PTSD treatment. Group-based trajectory analysis PROC TRAJ was used to identify PTSD residential treatment response in a national cohort of veterans ($n = 10,832$) and the subset of veterans ($n = 6515$) receiving evidence-based psychotherapy (EBP). PTSD symptoms were assessed at intake, discharge, and 4-month follow-up. Predictors of trajectory membership were estimated using multinomial models. For the full cohort, a three-group trajectory model provided the best fit with the following identified groups: "Severe/Stable" (51.8%), "Moderate/Rebound" (40.1%), and "Mild/Rebound" (8.1%). For the EBP sub-cohort, a three-group trajectory model was selected with the following groups: "Severe/Stable" (58.5%), "Moderate/Rebound" (34.1%), and "Mild/Rebound" (7.4%). Across all trajectories, psychological distress, pain severity, substance use, Iraq/Afghanistan combat era, non-White race, and treatment dropout were associated with poorer treatment response. In the EBP sub-cohort, homelessness and unemployment at the time of admission were also associated with poorer treatment outcomes to varying degrees. This study demonstrates that residential treatment for PTSD is associated with heterogeneous treatment trajectories which highlight the need to continue to explore and improve residential PTSD treatment outcomes. Our results underscore the importance of obtaining follow-up data and identifying ways to maintain therapeutic gains following discharge.

While a majority of posttraumatic stress disorder (PTSD) care in the Department of Veterans Affairs (VA) is conducted in outpatient settings (VA, 2013), veterans with more severe or chronic cases of PTSD are often treated in residential rehabilitation treatment programs (RRTPs; Cook et al., 2014; VHA, 2017). An estimated 2.8% of VA patients with PTSD treatment are treated in residential settings (Harpaz-Rotem & Hoff, 2020). Importantly, there is substantial variability in RRTP structure and focus (Smith et al., 2019), including a wide range of adoption rates for evidence-based practices (EBPs) for PTSD (Cook et al., 2019). In a recent study focused on dropout from RRTPs conducted by Smith and colleagues (2019), approximately half of veterans who dropped out of residential PTSD treatment did not receive a PTSD EBP. Moreover, evidence for the effectiveness of PTSD EBPs in these settings is mixed. Some evaluations suggested a positive effect of EBP delivery on RRTP outcomes (Alvarez et al., 2011), while others found minimal differences in PTSD symptom change between RRTPs with low and high rates of EBP adoption (Cook et al., 2019). Across RRTPs, is it unclear what factors might lead to these discrepant findings (e.g., type of EBP, demographic and clinical characteristics). Regardless, considerable and ongoing effort has been directed towards improving retention and outcomes in residential PTSD treatment, which remains a significant issue in VA (Smith et al., 2019).

* Correspondence to: Serious Mental Illness Treatment Resource and Evaluation Center, 2800 Plymouth Road, 016, Ann Arbor, MI 48109, USA.
E-mail address: peter.grau1@va.gov (P.P. Grau).

https://doi.org/10.1016/j.janxdis.2022.102645
Received 22 June 2022; Received in revised form 5 October 2022; Accepted 28 October 2022
Available online 31 October 2022
0887-6185/Published by Elsevier Ltd.

Length of stay may also play a significant role in treatment outcome. In one of the few studies that characterized treatment response in a national sample of veterans attending RRTPs, Sripada and colleagues (2019) found that longer length of stay was associated with greater PTSD symptom reduction. Additionally, they identified several variables associated with poorer treatment outcomes, including greater pain severity, the presence of a comorbid personality disorder, greater initial PTSD symptom severity, Black race, male sex, and recent application for service-connected disability. Banducci et al. (2017) also reported that longer length of stay is related to larger levels of symptom reduction, especially for veterans who were admitted with more severe PTSD symptoms.

Another important issue in the extant research on PTSD RRTPs is that, until recently, there was no systematic collection of programs' discharge data (Sripada et al., 2019). The VA's Northeast Program Evaluation Center (NEPEC) collects and maintains data from RRTPs. Historically, they have collected data from two timepoints: admission and 4-month follow-up. Beginning in 2014, they began collecting data at the time of RRTP discharge. The availability of three timepoints, including discharge, allows for a more precise discussion surrounding treatment gains and maintenance. Given this newly available data, it is important to continue to expand our understanding of the factors that lead to positive or negative residential treatment outcomes across VA.

One method of understanding treatment effectiveness at a more nuanced level is to estimate group-based trajectories over multiple timepoints and to characterize veterans who fall into these trajectories. Group-based trajectory modeling has been used to identify the longitudinal course of PTSD symptoms in veterans and other trauma-affected populations, with results most commonly showing four distinct trajectories (Armenta et al., 2019; Dickstein et al., 2010; Magruder et al., 2016; Steenkamp et al., 2012). While these trajectories differ somewhat by study, the authors commonly identified a "resilience" or "Mild/Rebound" trajectory, an "improving" trajectory, a "recovery" trajectory, and a "chronic" trajectory. In studies focused on treatment response in veterans, most research has been conducted in outpatient settings and consistently identified three trajectories, most often labeled as "responders," "non-responders," and "subclinical" (Allan et al., 2017; Currier et al., 2014; Elliott et al., 2005; Galovski et al., 2016; Schumm et al., 2013). All studies identified a non-response trajectory that included the highest percentage of participants, which suggests that a concerning number of individuals with PTSD do not respond to treatment (Dewar et al., 2020). Across these studies, poor treatment response was predicted by baseline depression, anxiety, alcohol abuse, and older age (Dewar et al., 2020). It is difficult to predict if veterans engaged in PTSD RRTPs will demonstrate similar trajectories; this population is characterized by complex comorbidities and histories of non-response to other outpatient PTSD treatments (Cook et al., 2014), though VA has committed substantial resources to PTSD RRTP programs with generally mixed results (Cook et al., 2019). Given the lack of systematic data collection across three time points, these analyses were not possible in the RRTP setting until 2014.

1. Present study

To date, treatment trajectories of veterans across RRTPs remain unexplored. Given the variability of treatment approach (i.e., EBP vs. non-EBP approaches) and the potential severity of PTSD cases seen by PTSD RRTPs, it is important to extend previous trajectory-based work to understand how veterans respond to residential PTSD care. Of particular interest are how these trajectories are impacted by patient demographics, psychiatric characteristics, and relevant treatment variables. Additionally, given the mixed findings concerning the effectiveness of PTSD EBPs in residential settings (Cook et al., 2019), it is important to continue to explore outcomes for both the full cohort of veterans in PTSD RRTPs and those who engaged in EBPs for PTSD. Thus, the main goal of this study was to identify group-based trajectories and associated predictors for veterans during their time in PTSD RRTPs and at four-month follow-up, with an additional focus on those veterans who received a PTSD EBP during the course of treatment.

2. Method

2.1. Participants

Data were obtained from a national sample of 10,832 veterans enrolled in RRTPs between Fiscal Years 2014–2016. Participants completed the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) at admission, discharge, and follow-up (approximately four months after discharge). This sample was predominantly White (55.7%), male (88.7%), non-Hispanic (92.3%), and heterosexual (93.8%). Veterans in the sample were 45.5 years old (SD=13.3; range=21–91) and completed an average of 13.4 years of education (SD=1.9, range=8–26). Approximately 75% of participants reported experiencing combat trauma, while approximately 28% reported experiencing sexual trauma. Seventy-six percent of veterans in this sample completed the program, and 61.6% received a PTSD EBP (i.e., CPT or PE). The average length of stay in the program was approximately 50 days (median = 48.0; mode = 46.0; SD=26.5; range=3–364). Full demographics by trajectory are included in Table 1.

2.2. Procedure

Data were collected from The VA Northeast Program Evaluation Center (NEPEC), which routinely collects treatment outcome information from RRTPs for the purpose of program evaluation and research. This study was approved and granted a waiver of informed consent for access to protected health information by the local Institutional Review Board.

2.3. Measures

2.3.1. Dependent variables

The main outcome measure was the PCL-5, a 20-item self-report measure of PTSD symptom severity that maps onto DSM-5 criteria (Weathers et al., 2013). The measure uses a 5-point Likert scale (0 = Not at all, 4 = Extremely) and scores range from 0 to 80. Higher scores indicate greater symptom severity. The PCL-5 has demonstrated excellent psychometric properties including convergent and discriminant validity, as well as high internal consistency (Blevins et al., 2015). In our sample, the PCL-5 demonstrated adequate internal consistency at admission ($\alpha = 0.91$).

2.3.2. Independent variables

Independent variables were selected based on prior research (e.g., Sripada et al., 2019) and inclusion in the intake packet for the RRTPs.

2.3.3. Treatment-related variables

Treatment-specific variables included length of stay (number of days in treatment), treatment completion (yes/no), and EBP receipt (yes/no). EBP receipt was determined by program manager report, which was entered as a binary variable for each veteran.

2.3.4. Demographic variables

The demographic variables included in this study are routinely collected for all patients at the RRTPs. These variables included age, race (dichotomized to White and non-White/Unknown), gender, ethnicity (dichotomized to Hispanic or Latino or non-Hispanic or Latino), sexual orientation, (dichotomized to heterosexual and non-heterosexual), relationship status (dichotomized to married/domestic partnered and other), years of education completed, employment status (dichotomized to yes/no), homelessness status (dichotomized to yes/no), and combat era (Iraq/Afghanistan, Post-Vietnam/Gulf War, Vietnam, Pre-Vietnam).

Table 1
Demographic, Trauma, and Clinical Characteristics by Trajectory Group.

Demographic Categories	Full Sample Trajectories (n = 10,832)			EBP Trajectories (n = 6515)		
	Mild/ Rebound (n = 875; 8.1%)	Moderate/ Rebound (n = 4346; 40.1%)	Severe/ Stable (n = 5611; 51.8%)	Mild/ Rebound (n = 485; 7.4%)	Moderate/ Rebound (n = 2220; 34.1%)	Severe/ Stable (n = 3810; 58.5%)
Age Mean (SD)	49.6 (14.8)	45.7 (13.6)	44.7 (12.8)	49.2 (14.0)	44.8 (13.2)	43.9 (12.3)
Years of Education Mean (SD)	13.4 (2.0)	13.4 (1.9)	13.4 (1.9)	13.4 (1.9)	13.5 (1.9)	13.4 (1.9)
Gender (Male)	87.9%	88.1%	89.3%	86.5%	87.3%	89.0%
Race (White)	60.2%	58.8%	52.7%	60.6%	59.6%	55.3%
Ethnicity (Hispanic)	6.4%	6.7%	8.8%	6.5%	7.3%	7.8%
Sexuality (Heterosexual)	92.2%	93.6%	94.1%	93.8%	93.4%	94.7%
Partnered (Married/ Domestic Partner)	41.4%	38.6%	39.1%	40.5%	39.5%	38.8%
Working Prior to Admission	21.8%	20.2%	18.7%	22.2%	22.8%	18.8%
Homeless at the Time of Admission	35.4%	37.4%	39.8%	39.0%	35.7%	40.5%
Psychiatric Symptoms						
PCL-5 Score at Admission	37.3 (11.4)	54.3 (8.9)	65.9 (7.7)	39.2 (12.1)	54.8 (10.3)	64.2 (8.4)
PCL-5 Score at Discharge	20.4 (10.3)	35.2 (10.1)	59.4 (9.4)	19.5 (10.8)	34.2 (10.2)	59.6 (9.0)
PCL-5 Score at Follow-up	27.7 (11.1)	45.8 (11.4)	61.3 (10.5)	28.9 (11.4)	48.1 (11.4)	62.8 (10.2)
BAM use score Mean (SD)	2.1 (3.0)	2.5 (3.3)	2.8 (3.5)	2.1 (3.0)	2.4 (3.2)	2.7 (3.4)
Pain Severity Mean (SD)	4.3 (2.7)	4.9 (2.6)	5.7 (2.5)	4.3 (2.6)	4.8 (2.7)	5.6 (2.5)
Psychological Distress Mean (SD)	15.9 (4.6)	20.1 (4.2)	23.4 (3.9)	16.1 (4.5)	20.2 (4.4)	23.0 (4.1)
Combat Era						
Iraq/Afghanistan	46.4%	55.4%	57.6%	45.6%	56.9%	60.0%
Post-Vietnam/Gulf War	23.7%	25.6%	27.3%	28.3%	26.3%	27.3%
Vietnam	29.4%	18.9%	15.0%	25.6%	16.7%	12.7%
Pre-Vietnam	<1%	<1%	<1%	<1%	<1%	<1%
Trauma Type						
Combat Trauma	74.5%	75.3%	76.2%	71.9%	74.2%	76.5%
Sexual Trauma	26.7%	28.1%	28.3%	30.4%	29.5%	29.0%
Other Trauma (violence/ accident/disaster)	89.5%	90.5%	89.2%	89.1%	89.0%	89.1%
Treatment Factors						
Completed Treatment	88.2%	78.9%	72.1%	92.3%	92.0%	69.0%
Received an EBP	57.9%	62.6%	61.4%	*NA*	*NA*	*NA*
Length of Stay Mean (SD)	48.3 (28.0)	49.3 (24.3)	51.5 (28.0)	55.9 (24.6)	53.0 (18.8)	54.0 (25.8)

2.3.5. Psychiatric and physical variables

Veterans indicated whether or not they had experienced combat trauma, sexual trauma, or "other" form of trauma. Veterans indicated alcohol and substance use on the "Use" subscale of the Brief Addiction Monitor (Cacciola et al., 2013), which has been shown to have strong psychometric properties (Nelson et al., 2014). In our sample, the "Use" subscale demonstrated marginal internal consistency at admission (α = 0.62). Overall psychological distress was measured via the Kessler Psychological Distress Scale (Kessler et al., 2002), which is a widely used and psychometrically strong measure of psychological distress (Umucu et al., 2021). In our sample, the Kessler Psychological Distress Scale demonstrated good-to-excellent internal consistency at admission (α = 0.85). Veterans indicated overall pain severity on a 0–10 scale.

2.4. Data analysis

All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC). Group-based trajectory analysis was completed using the SAS-based PROC TRAJ macro (Jones et al., 2001; SAS Institute, 2008). Group-based latent trajectory modeling allows for the description of change in a dependent variable over time for multiple, distinct groups. This allowed us to identify groups of veterans who shared trajectories of PTSD symptom change over the three time points (admission, discharge, and follow-up). To account for the variation in time spent in treatment, we set Time 1 as the date of intake, Time 2 as the length of stay (days from intake to discharge), and Time 3 as the total number of days from intake to 4-month follow-up. This allowed us to measure average change in PCL-5 data as a function of time, both in treatment and through the 4-month follow-up period. There were several outliers in terms of length of stay, but due to a small number of outlying values and a restricted range within the 25th to 75th percentiles of values (38−58), we did not delete outliers from the model. Maximum Likelihood estimation was used to handle missing data, which allows for more robust trajectory estimation and reduces bias in parameter estimation (Jones et al., 2001). Because PCL-5 data is continuous, a censored normal (CNORM) distribution was used with PROC TRAJ to model the conditional distribution of PTSD symptoms based on trajectory membership. Intercepts and linear and quadratic slopes were estimated for all trajectories, though interpretation of these parameter estimates in tobit models with a CNORM distribution differ from traditional quadratic models in that uncensored models do not model conditional distributions and are therefore not exact representations of PCL-5 scores at admission. We generated plots of the trajectories (see Figs. 1 and 2) to allow for easier interpretation of these estimates. Model fit was based on previous explorations of PTSD symptom trajectories (Allan et al., 2017; Currier et al., 2014; Galovski et al., 2016) and model convergence. We used Nagin's (2005) method for model selection, which compares models using BIC differences, minimum group sizes, and posterior probabilities. We estimated up to five different trajectories, which were then compared using a combination of fit indices (i.e., Bayesian Information Criterion [BIC]), inspection of trajectory plots, and participant distribution.

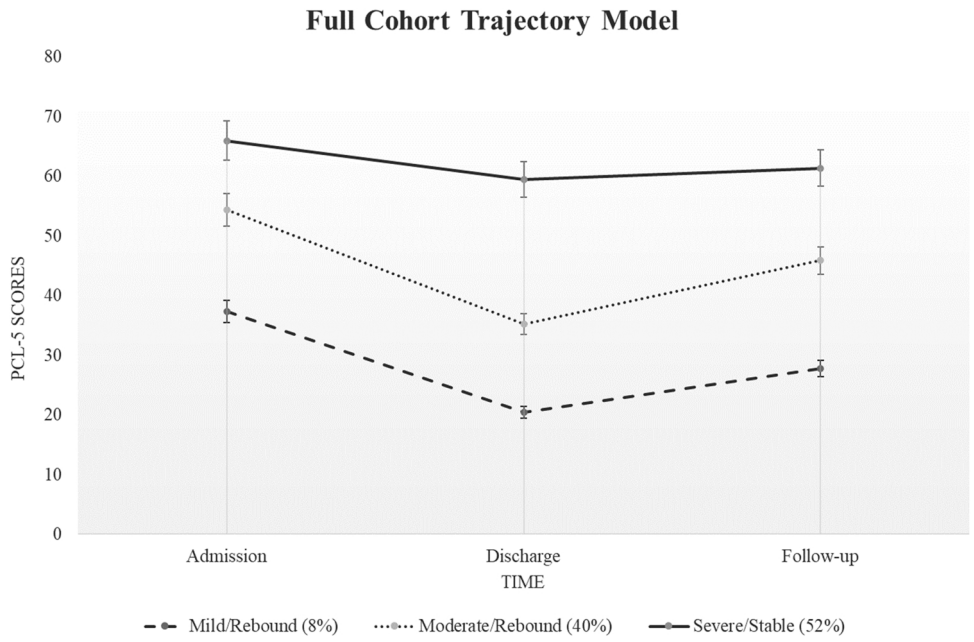

Fig. 1. Three-group Full Cohort Trajectory Model for PCL-5 Scores at Admission, Discharge, and 4-month Follow-up *Note.* PCL-5 stands for PTSD Checklist for DSM-5 score.

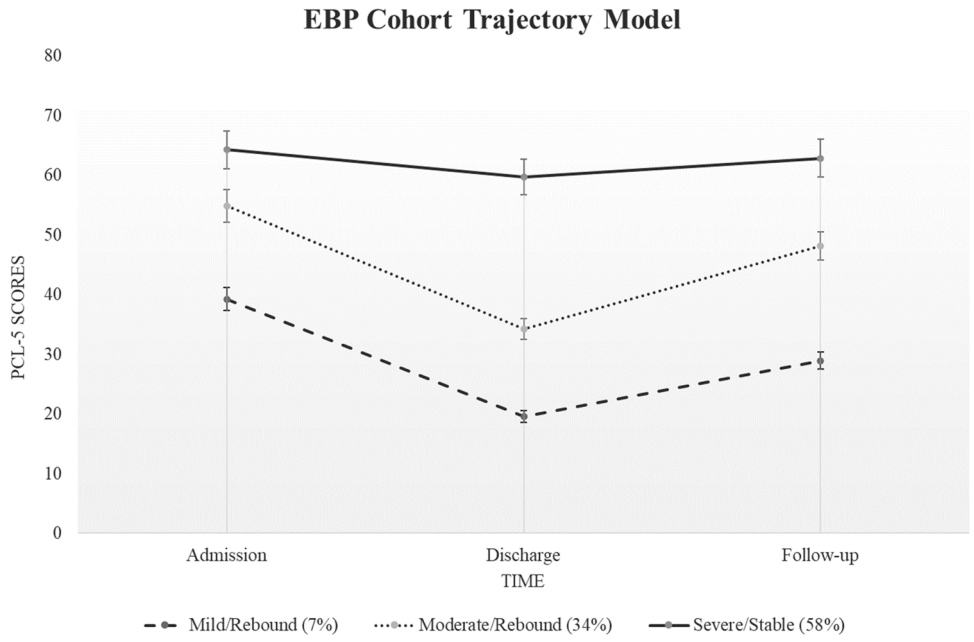

Fig. 2. Three-group EBP Cohort Trajectory Model for PCL-5 Scores at Admission, Discharge, and 4-month Follow-up *Note.* EBP refers to Evidence-based psychotherapy; PCL-5 refers to PTSD Checklist for DSM-5 score.

After selecting the number of trajectories, we generated descriptive analyses for the sample by trajectory, including the percentage of veterans in each trajectory who experienced reliable symptom change (>15-point reduction on the PCL-5) and the percentage who fell below the PCL-5 diagnostic cutoff score (< 28 on the PCL-5; Marx et al., 2021) at 4-month follow-up. Next, we estimated multinomial models to explore the relationship between each independent variable and trajectory membership. Additional odds ratios were generated for between-trajectory comparisons. Trajectory generation, descriptive analyses and multinomial models were then repeated as a sensitivity analysis for the subset of veterans who received an EBP for PTSD. All results are contained and labeled in their respective tables.

3. Results

3.1. Full cohort trajectory analysis

PROC TRAJ, using a CNORM distribution and Maximum Likelihood estimation for missing data, was used to generate and compare five trajectories of PCL-5 change over three timepoints (admission, discharge, and 4-month follow-up). Nagin's (2005) method for model selection, which assesses BIC differences, group sizes, and posterior probabilities, was used to compare and select models. The four-group trajectory model was rejected due to poor fit indices, non-significant dropout coefficients in one of the groups, and two groups with

average posterior probabilities below the minimum threshold of.70 (0.56 and.66, respectively), so model comparisons were completed for the remaining one-, two-, and three-group models. A three-group trajectory model (Fig. 1) was selected with the following identified groups: "Severe/Stable," "Moderate/Rebound," and "Mild/Rebound." Veterans were assigned to a trajectory for which their probability of membership was the highest. Fit statistics are included in Table 2. Following Nagin's (2005) method, additional tests of model adequacy were conducted. The estimated probability of group membership and the proportion assigned to that group based on the posterior probability of group membership were within 3% points for all groups. The "Severe/Stable" and "Moderate/Rebound" odds of correct classification (OCC) based on posterior probabilities were slightly below a threshold of 5 (4.08 and 3.70, respectively), while the final OCC for the "Mild/Rebound" group was 33.9. The average of the posterior probabilities of group membership for individuals assigned to each group exceeded a minimum threshold of 0.7 for all groups (range =0.72 −0.79). Given the totality of the evidence, the three-group model was retained. Within the three-group model, all trajectory slope comparisons were significantly different from one another ($p < .001$). See supplementary material for an overview of reliable symptom change and diagnostic cutoff results for the full cohort.

3.2. Full cohort multinomial models

Odds ratio differences (including direction and strength of findings) between individual trajectories for the full cohort can be found in Table 3. Psychological distress, pain severity, age, combat era, treatment completion, and BAM Use differentiated all of the groups. Length of stay only differentiated the "Severe/Stable" trajectory from both the "Mild/Rebound" and "Moderate/Rebound" trajectories, while EBP treatment engagement differentiated the "Mild/Rebound" and "Moderate/Rebound trajectories." Veterans in the "Severe/Stable" trajectory spent slightly more time in treatment than veterans in the other trajectories, and veterans were most likely to receive an EBP if they were in the "Moderate/Rebound" trajectory. Approximately 72% of veterans in the "Severe/Stable" group completed treatment, and over half of the veterans in each trajectory received an EBP (range = 57.9%−62.6%).

3.3. EBP trajectory analysis

As with the full cohort, in the EBP cohort, after assessing BIC differences, group sizes, trajectory plots, and posterior probabilities, a three-group model was determined to be the best fit to the data. Fit statistics are included in Table 2. Following Nagin's (2005) method, additional tests of model adequacy were conducted. The estimated probability of group membership and the proportion assigned to that group based on the posterior probability of group membership were within 4% points for all groups. The odds of correct classification based on posterior probabilities were all above a minimum threshold of 5 (range = 5.76–46.06). The average of the posterior probabilities of group membership for individuals assigned to each group exceeded a minimum threshold of 0.7 for all groups (range =0.79 −0.88). Given the totality of the evidence, the three-group model was retained. These trajectories were labeled "Severe/Stable," "Moderate/Rebound," and "Mild/Rebound." Descriptive statistics and PCL-5 scores at each timepoint by trajectory are contained in Table 1 and trajectory plots are shown in Fig. 2. Within the three-group model, all trajectory slope comparisons were significantly different from one another ($p < .001$). See supplementary material for an overview of reliable symptom change and diagnostic cutoff results for the EBP sub-cohort.

3.4. EBP multinomial models

Odds ratio differences (including direction and strength of findings)

Table 3
Significant Trajectory Differences: Full Cohort.

Trajectory Comparisons	Odds Ratio
Race	
Non-White vs. *White*	
Severe/Stable – Mild/Rebound	1.36, CI[1.18, 1.57]
Severe/Stable – Moderate/Rebound	1.28, CI[1.18, 1.39]
Ethnicity	
Hispanic vs. *Non-Hispanic*	
Severe/Stable – Mild/Rebound	1.40, CI[1.05, 1.87]
Severe/Stable – Moderate/Rebound	1.35, CI[1.15, 1.57]
Age	
Mild/Rebound – Moderate/Rebound	1.02, CI[1.02, 1.03]
Severe/Stable – Mild/Rebound	0.97, CI[0.97,0.98]
Severe/Stable – Moderate/Rebound	0.99, CI[0.99, 1.00]
Combat Era	
Vietnam vs. *Iraq/Afghanistan*	
Severe/Stable – Mild/Rebound	0.41, CI[0.34,0.50]
Moderate/Rebound –Mild/Rebound	0.54, CI[0.45,0.65]
Severe/Stable – Moderate/Rebound	0.76, CI[0.68,0.86]
Pre-Vietnam vs. *Iraq/Afghanistan*	
Severe/Stable – Mild/Rebound	0.06, CI[0.01,0.34]
Moderate/Rebound –Mild/Rebound	0.17, CI[0.04,0.67]
BAM Use	
Mild/Rebound – Moderate/Rebound	0.96, CI[0.93,0.98]
Severe/Stable – Mild/Rebound	1.07, CI[1.04, 1.10]
Severe/Stable – Moderate/Rebound	1.03, CI[1.01, 1.04]
Psychological Distress	
Mild/Rebound – Moderate/Rebound	0.80, CI[0.79,0.82]
Severe/Stable – Mild/Rebound	1.52, CI[1.48, 1.55]
Severe/Stable – Moderate/Rebound	1.22, CI[1.21, 1.23]
Pain Severity	
Mild/Rebound – Moderate/Rebound	0.92, CI[0.89,0.94]
Severe/Stable – Mild/Rebound	1.23, CI[1.19, 1.27]
Severe/Stable – Moderate/Rebound	1.13, CI[1.11, 1.15]
Length of Stay	
Severe/Stable – Mild/Rebound	1.01, CI[1.00, 1.01]
Severe/Stable – Moderate/Rebound	1.00, CI[1.00, 1.01]
Treatment Completion	
Mild/Rebound – Moderate/Rebound	2.00, CI[1.58, 2.52]
Severe/Stable – Mild/Rebound	0.35, CI[0.28,0.44]
Severe/Stable – Moderate/Rebound	0.69, CI[0.63,0.77]
EBP Treatment (No: ref)	
Mild/Rebound – Moderate/Rebound	1.22, CI[1.05, 1.41]

Note. All post-hoc comparisons are significant at $p < .05$

Table 2
Fit Statistics for Trajectory Solutions.

Model	BIC	Adjusted BIC	AIC	LL	Entropy	% Smallest Class
Full Cohort						
2-class	-92768.72	-92766.95	-92745.08	-92739.08	0.87	24%
3-class	**-90712.98**	**-90708.56**	**-90653.88**	**-90638.88**	**0.76**	**8%**
4-class	-90512.11	-90506.22	-90433.31	-90413.31	0.67	7%
EBP Sub-cohort						
2-class	-55417.32	-55413.65	-55372.96	-55360.96	0.89	34%
3-class	**-55113.51**	**-55108.02**	**-55046.98**	**-55028.98**	**0.84**	**7%**
4-class	-54982.56	-54975.24	-54893.86	-54869.86	0.74	6%

Note: Table shows Bayesian information criterion (BIC), adjusted Bayesian information criterion, Akaike information criterion (AIC), log likelihood (LL), entropy, and % smallest class

between individual trajectories for the EBP sub-cohort can be found in Table 4. White veterans were slightly more likely be in the "Mild/Rebound" and "Moderate/Rebound" trajectories than the "Severe/Stable" trajectory. Younger age was associated with trajectory severity in that younger veterans were more likely to be in the "Moderate/Rebound" and "Severe/Stable" trajectories. Employment status and homelessness differentiated the "Moderate/Rebound" and "Severe/Stable" trajectories, in that working prior to admission was associated with increased odds of membership in the "Moderate/Rebound" trajectory, while homelessness was associated with increased odds of membership in the "Severe/Stable" trajectory. BAM Use scores differentiated the "Mild/Rebound" and "Severe/Stable" groups as well as the "Moderate/Rebound" and "Severe/Stable" groups, indicating that BAM Use is strongly associated with membership in the "Severe/Stable" trajectory. Psychological distress and pain severity differentiated all of the groups and these variables demonstrated an inverse relationship with treatment response. Finally, treatment completion differentiated the "Mild/Rebound" and "Severe/Stable" groups as well as the "Moderate/Rebound" and "Severe/Stable" groups, indicating that Treatment Completion is strongly, negatively associated with membership in the "Severe/Stable" trajectory.

4. Discussion

This study analyzed data from a national sample of veterans engaged in residential treatment for PTSD. For the full cohort, a three-trajectory model was retained with the following groups: "Mild/Rebound," "Moderate/Rebound," and "Severe/Stable." For the subset of veterans who received an EBP (approximately 60% of the full cohort), a three-trajectory model was retained with the following groups: "Mild/Rebound," "Moderate/Rebound," and "Severe/Stable." With respect to the full cohort, race, ethnicity, age, length of stay, EBP treatment engagement, BAM Use, overall psychological distress, pain severity, treatment completion, and combat era differed across trajectories. In the EBP sub-cohort model, 10 variables, including race, age, employment status, homelessness, combat trauma status, BAM Use, overall psychological distress, pain severity, treatment completion, and combat era predicted trajectory memberships.

Table 4
Significant Trajectory Differences: Sub-cohort who Received EBP.

Trajectory Comparisons	Odds Ratio
Race	
Non-White vs. *White*	
Severe/Stable – Mild/Rebound	1.24, CI[1.03, 1.51]
Severe/Stable – Moderate/Rebound	1.19, CI[1.07, 1.32]
Age	
Mild/Rebound – Moderate/Rebound	1.03, CI[1.02, 1.04]
Severe/Stable – Mild/Rebound	0.97, CI[0.96,0.98]
Severe/Stable – Moderate/Rebound	0.99, CI[0.99, 1.00]
Working	
Severe/Stable – Moderate/Rebound	0.78, CI[0.68,0.90]
Homelessness	
Severe/Stable – Moderate/Rebound	1.23, CI[1.09, 1.38]
Combat Trauma	
Severe/Stable – Mild/Rebound	0.78, CI[0.62,0.99]
Combat Era	
Vietnam vs. *Iraq/Afghanistan*	
Severe/Stable – Mild/Rebound	0.38, CI[0.29,0.49]
Moderate/Rebound –Mild/Rebound	0.52, CI[0.40,0.68]
Moderate/Rebound – Severe/Stable	0.72, CI[0.61,0.85]
Pre-Vietnam vs. *Iraq/Afghanistan*	
Severe/Stable – Mild/Rebound	0.05, CI[0.00,0.52]
BAM Use	
Mild/Rebound – Moderate/Rebound	0.96, CI[0.93, 1.00]
Severe/Stable – Mild/Rebound	1.07, CI[1.03, 1.10]
Severe/Stable – Moderate/Rebound	1.03, CI[1.01, 1.04]
Psychological Distress	
Mild/Rebound – Moderate/Rebound	0.82, CI[0.80,0.84]
Severe/Stable – Mild/Rebound	1.42, CI[1.39, 1.46]
Severe/Stable – Moderate/Rebound	1.17, CI[1.15, 1.18]
Pain Severity	
Mild/Rebound – Moderate/Rebound	0.93, CI[0.90,0.97]
Severe/Stable – Mild/Rebound	1.20, CI[1.15, 1.25]
Severe/Stable – Moderate/Rebound	1.12, CI[1.09, 1.14]
Treatment Completion	
Severe/Stable – Mild/Rebound	0.19, CI[0.13,0.27]
Severe/Stable – Moderate/Rebound	0.20, CI[0.16,0.23]

Note. All post-hoc comparisons are significant at $p < .05$

Notably, this study demonstrated little to no difference in treatment trajectory between the full cohort and the EBP sub-cohort. This suggests that, on average, the receipt of an EBP was not related to success (or lack thereof) in residential PTSD treatment. This is a surprising and concerning finding without a clear explanation, though several elements warrant further consideration. First, it is important to note that more nuanced information concerning the specific type and dose of EBPs offered is important to collect in future research, as these factors can help to explain how to maximize EBP effectiveness in the residential setting. We also caution against the interpretation that our results suggest EBPs do not work in the residential setting, as there are multiple factors (e.g., frequency and intensity of EBP delivery, EBP type) that must be explored before reaching that conclusion. Given the comparatively severe symptom profiles of veterans in the RRTP format, it may be that a higher dose of an EBP might be a way to increase EBP effectiveness to rates seen in outpatient settings. Recent studies of group PE (Sripada et al., 2022) and massed treatment formats in VA intensive outpatient programs (e.g., Yamokoski et al., 2022) have shown promising results, and massed treatment will soon be piloted in the RRTP setting. This will provide much needed information to clarify the best method of EBP delivery in RRTPs, which will help extend and clarify our findings.

With those limitations in mind, there are several additional explanations for our results. Multiple studies have attempted to explore barriers and facilitators for EBP implementation in PTSD RRTPs (e.g., Cook et al., 2019). These studies have highlighted multiple elements that may impact the effectiveness of EBPs in the RRTP setting, including partial implementation, only offering one EBP (thereby limiting patient choice), or discomfort with a particular EBP. Additionally, it may be that restrictions in treatment format (e.g., offering only group vs. individual CPT) limits effectiveness in some programs, though this likely would not fully account for the overall trends seen in this investigation.

Overall, our findings indicate relatively high levels of PTSD symptom severity across treatment and follow-up for a large number of veterans; specifically, 51.8% of the full cohort and 58.5% of the EBP subset fell into the respective "Severe/Stable" trajectories. In both the full cohort and the EBP subset, the "Severe/Stable" trajectory was characterized by admission and follow-up PCL-5 scores in the mid-60 s, with a slight reduction reported at discharge. This is consistent with other trajectory-based work that identified a cohort of patients who do not respond to trauma-focused treatment (e.g., Currier et al., 2014). We also identified similar predictors of membership in the "Severe/Stable" trajectory, including pain severity, psychological distress, more problems with substance use, and a slightly longer length of stay. A finding that is unique to our RRTP investigation, but not to other investigations of PTSD treatment outcomes (e.g., Steenkamp et al., 2012), is that membership in the "Severe/Stable" trajectory was strongly related to poorer rates of treatment completion.

Importantly, while our rates of membership in the "Severe/Stable" trajectory mirror other VA RRTP investigations (e.g., Currier et al., 2014), trajectory analyses in massed treatment programs (e.g., Held et al., 2021) appear to have lower rates of membership (16.0%) in this trajectory. This can be explained by the nature of the RRTP programs that mainly treat more severe PTSD symptomatology, which can be difficult to manage in an outpatient setting. Another caveat to this finding is that we also assessed 4-month follow-up, which resulted in an increase in PTSD symptom severity across trajectories. Notably, at 4-month follow-up, only 26.5% of the full cohort and 27.9% of the EBP sub-cohort reported reliable symptom change (> 15-point decrease in

PCL-5 scores; Marx et al., 2021) and approximately 9% of both the full and EBP sub-cohort reported PCL-5 scores below the clinical cutoff (< 28; Marx et al., 2021). There are several explanations for these findings, including limited evidence-based aftercare options (Cook et al., 2019), lack of support for Veterans re-entering the community (Holliday et al., 2020), and the return of home- and work-related stressors that were minimized during the residential stay. These are universal issues across RRTPs that deserve increased attention. Even without symptom follow-up, almost half of veterans in this study received minimal benefit during treatment, which is a cause for concern. Moreover, while all trajectories showed a reduction of PTSD symptoms at the time of discharge, the "Mild/Rebound" and "Moderate/Rebound" trajectories lost approximately half of their gains at 4-month follow-up. It is important to note that, for the approximately 10% of veterans in the full cohort "Mild/Rebound" trajectory and 9% of veterans in the EBP sub-cohort, "Mild/Rebound" trajectory, average PCL-5 scores at follow-up were either at or below the diagnostic cutoff.

Several variables predicted trajectory membership in both the full and EBP sub-cohorts. Higher psychological distress, BAM Use, and higher pain severity were associated with poorer response to treatment. These results are consistent with other trajectory-based investigations that have found higher levels of psychiatric and physical comorbidity, as well as increased levels of substance use, are linked to lack of PTSD symptom improvement (e.g., Allen et al., 2017; Currier et al., 2014). Additionally, veterans from minoritized backgrounds and Iraq- and Afghanistan-era service members were also more likely to be classified into the "Severe/Stable" treatment trajectory. With respect to race and ethnicity, we found that non-White and Hispanic veterans were more likely to be represented in the "Moderate/Rebound" and "Severe/-Stable" trajectories than in the "Mild/Rebound" trajectory. This finding is unfortunately consistent with research that has pointed to a broad failure of VA PTSD treatment to adequately help veterans of color (e.g., Maguen et al., 2020). This is a pressing concern for VA. Additional research should assess the effectiveness of PTSD EBPs for people of color (Grau et al., 2021), including any potential modifications that might be necessary to account for cultural variability. The findings regarding service era are somewhat inconsistent with previous research that has showed older veterans are more likely to complete, but not necessarily benefit from evidence-based PTSD treatment than are younger veterans (Allan et al., 2017; Sripada et al., 2019). This highlights the continued need to improve engagement in care for younger veterans, which has been a major area of focus for VA in recent years (Holder et al., 2020).

That veterans in the "Moderate/Rebound" trajectory were more likely than veterans in the "Severe/Stable" trajectory to complete treatment is unsurprising. It should also be noted that, especially for veterans in the "Severe/Stable" trajectory, there is likely a reciprocal relationship between symptom severity and treatment completion, as there is a dose-response relationship for PTSD treatment (Hale et al., 2019; Hanson et al., 2002). Subsequently, veterans with higher symptoms at intake are more likely to discontinue treatment (Hale et al., 2019). As such, efforts to retain veterans, especially those who enter with the highest levels of symptom severity, should remain a top priority for PTSD RRTPs, while also acknowledging that dropout in veterans who enter treatment with lower symptom burden is not necessarily indicative of a treatment failure. Additional research is much needed to better understand the mechanisms by which veterans separate out into an improving or stable trajectory, especially when entering treatment with relatively elevated levels of PTSD symptomology.

The few differences in treatment predictors that emerged between the full cohort and EBP sub-cohort warrant attention, though the predictors of treatment success in the full and EBP sub-cohorts at least partially mirror findings from other studies (e.g., Sripada et al., 2019). This suggests that clinicians may need to attend to a slightly different set of variables depending on whether or not the veterans in their care do or do not receive EBPs during residential PTSD treatment. First, with respect to trajectories, while the "Severe/Stable" and "Moderate/Rebound" trajectories both demonstrated admission PCL-5 scores similar to those found in the corresponding trajectories from the full cohort, the "Mild/Rebound" trajectory showed slightly higher PCL-5 admission scores (39.2vs. 37.3) and demonstrated similarly low symptom levels (compared to the full cohort "Mild/Rebound trajectory") at both discharge and follow-up, both of which were below the conventional diagnostic cutoff score of 33 (Bovin et al., 2016). However, it should be noted that more recent investigations (Marx et al., 2021) have listed 28 as an appropriate diagnostic cutoff, and only the "Mild/Rebound" trajectory demonstrated average PCL-5 scores approaching this threshold at 4-month follow-up. Nevertheless, this suggests that, for a certain percentage of veterans who receive an EBP for PTSD, residential treatment can yield significant gains that are relatively well-maintained at follow-up. Additionally, while residential treatment appears to be effective for veterans in "Moderate/Rebound" EBP trajectory, follow-up data show that these gains are only partially maintained, which suggests that more research is critically needed to determine ways to maintain therapeutic gains following discharge from intensive PTSD treatment.

Other factors in the EBP sub-cohort, such as working at the time of admission and homelessness, only differentiated the "Moderate/Rebound" and "Severe/Stable" trajectories. Veterans who were homeless were slightly more likely to fall into the "Severe/Stable" EBP trajectory, which is possibly tied to the fact that veterans who have experienced homelessness are at greater risk for developing PTSD and for continuing to experience trauma (Brignone et al., 2016). Finally, a history of combat trauma differentiated the "Mild/Rebound" and "Severe/Stable" EBP trajectories. This appears to be in line with previous work in PTSD RRTPs (Currier et al., 2014), which suggests that some level of combat exposure does not preclude veterans from benefitting from PTSD EBPs, but combat exposure is inversely correlated with treatment success in severe cases of PTSD.

4.1. Limitations and future directions

This study has several limitations. First, due in part to the variability between programs, extensive diagnostic information was not available, which might have provided additional detail germane to trajectory membership. These comorbidities, including substance use and personality disorders, are especially prevalent in veterans who attend VA RRTPs (VA, 2013), which suggests they could be important to consider in future trajectory-based analysis. While previous research has demonstrated that facility-level variation only accounted for 7% of the variance in PCL score change (Sripada et al., 2019), future multilevel analyses might be able to continue to explore the impact of specific elements of care within and across facilities. A core feature that varies across facilities, EBP receipt, was included in the multinomial models. However, other elements, such as detailed information about EBP type and fidelity, were not available for this analysis.

Due to the nature of latent trajectory analysis, these results are less applicable to veterans who have significantly abbreviated or extended stays in treatment. Additional studies could shed light on the factors that influence the length of stay, and associated prognoses, of these veterans. With respect to measurement, it is also likely important to continuously assess the index trauma indicated on the PCL-5, as it may be that Veterans are not referencing a consistent trauma on the main outcome assessment for these programs. However, it is not uncommon for patients to work on different target traumas over the course of an episode of care. Another important limitation is that we did not have access to information concerning treatment engagement (or lack thereof) in the period between discharge and 4-month follow-up. Treatment engagement during this period is important to explore, as different types of care engagement are likely important predictors of maintenance of gains following discharge. Furthermore, given the broad impact of severe PTSD on functioning (Smith et al., 2022), change in symptom severity is an incomplete metric of treatment response. It is important to explore

residential treatment's impact on functioning, such as employment (Stevenson et al., 2021), social (Smith et al., 2022), and physical functioning (Smith et al., 2019). Given the large number of variables collected by NEPEC in the VA PTSD RRTPs, it may be important to identify goals for functional improvement at the onset of treatment and assess changes in corresponding outcomes at discharge and follow-up. Finally, this study is limited by the unique and varied format of VA RRTPs, which likely limits the generalizability of our findings to outpatient programs and non-VA PTSD treatment settings.

Future research might examine the impact of various RRTP program formats on trajectories of symptom change, including elements such as EBP delivery, frequency, and fidelity of the interventions. Previous studies in higher levels of care that delivered a high dose of PTSD EBPs (e.g., Held et al., 2021) have demonstrated positive results in cohorts with complex psychiatric and medical comorbidities. Increasing access to these treatment options might help to improve the percentage of veterans who do not benefit from VA RRTPs, especially given the high percentage of veterans who did not receive any EBP during treatment and the similar treatment trajectories for the full cohort and EBP sub-cohort.

Overall, across both samples, psychological distress, pain severity, and treatment completion were strong predictors of membership in the "Severe/Stable" trajectory. Of particular importance is our finding that the trends we observed might have been obscured if not for the inclusion of 4-month follow-up data, which underscores the need for consistent and adequate collection of posttreatment assessments, as well as increased focus on maintenance of treatment gains. Weekly collection of core assessments is also a potentially beneficial adjustment within the RRTP structure, as it would allow for more fine-grained tracking of symptom change, including attenuation of treatment gains and weekly rate of change.

Ultimately, our analysis revealed a concerning number of veterans who did not benefit from residential PTSD care. Given the results from this analysis, it appears especially important to assess the type (i.e., group vs. individual, vs. combined), quality, and frequency of EBP delivery across different RRTPs. As our results demonstrate a wide range of responses to residential treatment, it will likely be helpful to rely on empirically tested mechanisms of treatment to improve the quality of care. Additionally, the emergence of additional models of care might improve the continuum of care, reaching more veterans who have not responded to residential PTSD treatment.

Declarations of Competing Interest

The authors declare no relevant competing interests.

Appendix 1. Parameter Estimates for the Full and EBP Sub-cohort Models

Group	Parameter	Estimate	Error	*p* value
Full Cohort				
Mild-Rebound	Intercept	38.80	0.70	< 0.001
	Linear	-36.25	1.88	< 0.001
	Quadratic	16.77	0.94	< 0.001
Moderate-Rebound	Intercept	56.16	0.31	< 0.001
	Linear	-51.52	1.26	< 0.001
	Quadratic	26.79	0.74	< 0.001
Severe-Stable	Intercept	63.61	0.21	< 0.001
	Linear	-7.49	0.68	< 0.001
	Quadratic	2.76	0.36	< 0.001
EBP Sub-cohort				
Mild-Rebound	Intercept	39.87	0.74	< 0.001
	Linear	-40.46	2.27	< 0.001
	Quadratic	18.92	1.18	< 0.001
Moderate-Rebound	Intercept	55.15	0.36	< 0.001
	Linear	-52.04	1.34	< 0.001
	Quadratic	27.77	0.45	< 0.001
Severe-Stable	Intercept	63.63	0.23	< 0.001
	Linear	-8.02	0.80	< 0.001
	Quadratic	3.32	0.43	< 0.001

Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.janxdis.2022.102645.

References

Allan, N. P., Gros, D. F., Myers, U. S., Korte, K. J., & Acierno, R. (2017). Predictors and outcomes of growth mixture modeled trajectories across an exposure-based PTSD intervention with veterans. *Journal of Clinical Psychology, 73*(9), 1048–1063. https://doi.org/10.1002/jclp.22408

Alvarez, J., McLean, C., Harris, A. H., Rosen, C. S., Ruzek, J. I., & Kimerling, R. (2011). The comparative effectiveness of cognitive processing therapy for male veterans treated in a VHA posttraumatic stress disorder residential rehabilitation program. *Journal of Consulting and Clinical Psychology, 79*(5), 590.

Armenta, R. F., Walter, K. H., Geronimo-Hara, T. R., Porter, B., Stander, V. A., & LeardMann, C. A. (2019). Longitudinal trajectories of comorbid PTSD and depression symptoms among U.S. service members and veterans. *BMC Psychiatry, 19*(1), 1–12. https://doi.org/10.1186/s12888-019-2375-1

Banducci, A. N., Connolly, K. M., Vujanovic, A. A., Alvarez, J., & Bonn-Miller, M. O. (2017). The impact of changes in distress tolerance on PTSD symptom severity post-treatment among veterans in residential trauma treatment. *Journal of Anxiety Disorders, 47*, 99–105. https://doi.org/10.1016/j.janxdis.2017.01.004

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress, 28*(6), 489–498. https://doi.org/10.1002/jts.22059

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2016). Psychometric properties of the PTSD checklist for diagnostic and statistical manual of mental disorders–fifth edition (PCL-5) in veterans. *Psychological Assessment, 28*(11), 1379–1391. https://doi.org/10.1037/pas0000254

Brignone, E., Gundlapalli, A. V., Blais, R. K., Carter, M. E., Suo, Y., Samore, M. H., … Fargo, J. D. (2016). Differential risk for homelessness among US male and female veterans with a positive screen for military sexual trauma. *JAMA Psychiatry, 73*(6), 582–589. https://doi.org/10.1001/jamapsychiatry.2016.0101

Cacciola, J. S., Alterman, A. I., DePhilippis, D., Drapkin, M. L., Valadez, C., Jr, Fala, N. C., … McKay, J. R. (2013). Development and initial evaluation of the brief addiction

monitor (BAM). *Journal of Substance Abuse Treatment, 44*(3), 256–263. https://doi.org/10.1016/j.jsat.2012.07.013

Cook, J. M., Dinnen, S., Simiola, V., Thompson, R., & Schnurr, P. P. (2014). VA residential provider perceptions of dissuading factors to the use of two evidence-based PTSD treatments. *Professional Psychology: Research and Practice, 45*(2), 136–142. https://doi.org/10.1037/a0036183

Cook, J. M., Schnurr, P. P., Simiola, V., Thompson, R., Hoff, R., & Harpaz-Rotem, I. (2019). Adoption by VA residential programs of two evidence-based psychotherapies for PTSD: effect on patient outcomes. *Psychiatric Services, 70*(7), 553–560. https://doi.org/10.1176/appi.ps.201800338

Currier, J. M., Holland, J. M., & Drescher, K. D. (2014). Residential treatment for combat-related posttraumatic stress disorder: Identifying trajectories of change and predictors of treatment response. *PLoS ONE, 9*(7), Article e101741. https://doi.org/10.1371/journal.pone.0101741

Dewar, M., Paradis, A., & Fortin, C. A. (2020). Identifying trajectories and predictors of response to psychotherapy for post-traumatic stress disorder in adults: a systematic review of literature. *The Canadian Journal of Psychiatry, 65*(2), 71–86. https://doi.org/10.1177/0706743719875602

Dickstein, B. D., Suvak, M., Litz, B. T., & Adler, A. B. (2010). Heterogeneity in the course of posttraumatic stress disorder: Trajectories of symptomatology: trajectories of PTSD Symptomatology. *Journal of Traumatic Stress, 23*(3), 331–339. https://doi.org/10.1002/jts.20523

Elliott, P., Biddle, D., Hawthorne, G., Forbes, D., & Creamer, M. (2005). Patterns of treatment response in chronic posttraumatic stress disorder: An application of latent growth mixture modeling. *Journal of Traumatic Stress, 18*(4), 303–311. https://doi.org/10.1002/jts.20041

Galovski, T. E., Harik, J. M., Blain, L. M., Farmer, C., Turner, D., & Houle, T. (2016). Identifying patterns and predictors of PTSD and depressive symptom change during cognitive processing therapy. *Cognitive Therapy and Research, 40*(5), 617–626. https://doi.org/10.1007/s10608-016-9770-4

Grau, P. P., Kusch, M. M., Williams, M. T., Loyo, K. T., Zhang, X., Warner, R. C., & Wetterneck, C. T. (2021). A review of the inclusion of ethnoracial groups in empirically supported posttraumatic stress disorder treatment research. *Psychological Trauma: Theory, Research, Practice, and Policy, 14*(1), 55–65. https://doi.org/10.1037/tra0001108

Harpaz-Rotem, I., & Hoff, R. (2020). FY2019 Overview of PTSD Patient Population Data Sheet. VA Office of Mental Health Operations. West Haven. *CT: Northeast Program Evaluation Center*.

Held, P., Smith, D. L., Bagley, J. M., Kovacevic, M., Steigerwald, V. L., Van Horn, R., & Karnik, N. S. (2021). Treatment response trajectories in a three-week CPT-Based intensive treatment for veterans with PTSD. *Journal of Psychiatric Research, 141*, 226–232. https://doi.org/10.1016/j.jpsychires.2021.07.004

Holder, N., Shiner, B., Li, Y., Madden, E., Neylan, T. C., Seal, K. H., … Maguen, S. (2020). Timing of evidence-based psychotherapy for posttraumatic stress disorder initiation among Iraq and Afghanistan war veterans in the Veterans Health Administration. *Psychological Trauma: Theory, Research, Practice, and Policy, 12*(3), 260–271. https://doi.org/10.1037/tra0000496

Jones, B. L., Nagin, D. S., & Roeder, K. (2001). A SAS procedure based on mixture models for estimating developmental trajectories. *Sociological Methods & Research, 29*(3), 374–393. https://doi.org/10.1177/0049124101029003005

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L. T., … Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine, 32*(6), 959–976. https://doi.org/10.1017/S0033291702006074

Magruder, K. M., Goldberg, J., Forsberg, C. W., Friedman, M. J., Litz, B. T., Vaccarino, V., … Smith, N. L. (2016). Long-term trajectories of PTSD in Vietnam-era veterans: The course and consequences of PTSD in twins: PTSD trajectories in Vietnam-era veterans. *Journal of Traumatic Stress, 29*(1), 5–16. https://doi.org/10.1002/jts.22075

Maguen, S., Holder, N., Madden, E., Li, Y., Seal, K. H., Neylan, T. C., … Shiner, B. (2020). Evidence-based psychotherapy trends among posttraumatic stress disorder patients in a national healthcare system, 2001–2014. *Depression and Anxiety, 37*(4), 356–364. https://doi.org/10.1002/da.22983

Marx, B. P., Lee, D. J., Norman, S. B., Bovin, M. J., Sloan, D. M., Weathers, F. W., … Schnurr, P. P. (2021). Reliable and clinically significant change in the clinician-administered PTSD Scale for DSM-5 and PTSD Checklist for DSM-5 among male veterans. *Psychological Assessment*. https://doi.org/10.1037/pas0001098

Nelson, K. G., Young, K., & Chapman, H. (2014). Examining the performance of the brief addiction monitor. *Journal of Substance Abuse Treatment, 46*(4), 472–481. https://doi.org/10.1016/j.jsat.2013.07.002

Schumm, J. A., Walter, K. H., & Chard, K. M. (2013). Latent class differences explain variability in PTSD symptom changes during cognitive processing therapy for veterans. *Psychological Trauma: Theory, Research, Practice, and Policy, 5*(6), 536–544. https://doi.org/10.1037/a0030359

Smith, D. L., Kovacevic, M., Montes, M., Pridgen, S., & Held, P. (2022). Improving mental, physical, and social functioning through participation in a 3-week cognitive processing therapy-based intensive PTSD treatment. *Journal of Anxiety Disorders, 88*, Article 102560.

Smith, N. B., Sippel, L. M., Rozek, D. C., Hoff, R. A., & Harpaz-Rotem, I. (2019). Predictors of dropout from residential treatment for posttraumatic stress disorder among military veterans. *Frontiers in Psychology, 10*, 362. https://doi.org/10.3389/fpsyg.2019.00362

Sripada, R. K., Blow, F. C., Rauch, S. A. M., Ganoczy, D., Hoff, R., Harpaz-Rotem, I., & Bohnert, K. M. (2019). Examining the nonresponse phenomenon: Factors associated with treatment response in a national sample of veterans undergoing residential PTSD treatment. *Journal of Anxiety Disorders, 63*, 18–25. https://doi.org/10.1016/j.janxdis.2019.02.001

Sripada, R. K., Rodriguez, J. L., Wright, T. P., Hyland, J. A., Walters, H. M., Ganoczy, D., … Rauch, S. A. (2022). Feasibility and acceptability of group-facilitated prolonged exposure therapy for PTSD in VA residential rehabilitation treatment programs. *Behavior Therapy*.

Steenkamp, M. M., Dickstein, B. D., Salters-Pedneault, K., Hofmann, S. G., & Litz, B. T. (2012). Trajectories of PTSD symptoms following sexual assault: Is resilience the modal outcome?: Trajectories of PTSD Following Sexual Assault. *Journal of Traumatic Stress, 25*(4), 469–474. https://doi.org/10.1002/jts.21718

Stevenson, B. J., Mueller, L., Kelly, M. M., & Rosenheck, R. A. (2021). Correlates of obtaining employment among veterans receiving treatment for severe PTSD in specialized intensive programs. *Psychiatric Quarterly, 92*(3), 981–994.

Umucu, E., Fortuna, K., Jung, H., Bialunska, A., Lee, B., Mangadu, T., … Brooks, J. (2021). A national study to assess validity and psychometrics of the Short Kessler Psychological Distress Scale (K6). *Rehabilitation Counseling Bulletin, 65*(2), 140–149. https://doi.org/10.1177/00343552211043261

VA. (2013). *The long journey home XXII: Treatment of posttraumatic stress disorder (PTSD). West Haven.* CT: Northeast Program Evaluation Center.

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD Checklist for *DSM-5* (PCL-5). *Scale Available from the National Center for PTSD at*. https://doi.org/10.1037/t71324-000. ⟨www.ptsd.va.gov⟩