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Cannabis use and trauma-focused treatment for co-occurring posttraumatic stress disorder and substance use disorders: A meta-analysis of individual patient data

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Abstract

High rates of cannabis use among people with posttraumatic stress disorder (PTSD) have raised questions about the efficacy of evidence-based PTSD treatments for individuals reporting cannabis use, particularly those with co-occurring alcohol or other substance use disorders (SUDs). Using a subset of four randomized clinical trials (RCTs) included in *Project Harmony*, an individual patient meta-analysis of 36 RCTs (total N = 4046) of treatments for co-occurring PTSD+SUD, we examined differences in trauma-focused (TF) and non-trauma-focused (non-TF) treatment

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Declaration of Competing Interest

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outcomes for individuals who did and did not endorse baseline cannabis use (N = 410; 70% male; 33.2% endorsed cannabis use). Propensity score-weighted mixed effects modeling evaluated main and interactive effects of treatment assignment (TF versus non-TF) and baseline cannabis use (yes/no) on attendance rates and within-treatment changes in PTSD, alcohol, and non-cannabis drug use severity. Results revealed significant improvements across outcomes among participants in all conditions, with larger PTSD symptom reductions but lower attendance among individuals receiving TF versus non-TF treatment in both cannabis groups. Participants achieved similar reductions in alcohol and drug use across all conditions. TF outperformed non-TF treatments regardless of recent cannabis use, underscoring the importance of reducing barriers to accessing TF treatments for individuals reporting cannabis use.

Keywords

Posttraumatic stress disorder; Cannabis; Marijuana; Attendance; Substance use

1. Introduction

Cannabis use is highly prevalent among individuals with post-traumatic stress disorder (PTSD), with nearly one in five adults with PTSD reporting daily cannabis use (Rup et al., 2021). However, the impact of whole plant cannabis use among individuals with PTSD is unclear. In particular, information about how individuals reporting recent use of whole plant cannabis respond to evidence-based treatments (EBTs) for PTSD is limited. Concerns are especially pronounced for individuals with both PTSD and substance use disorders (PTSD+SUD) due to greater functional impairment (Kessler et al., 2005; Simpson et al., 2019) and cannabis use (Connor et al., 2021) associated with PTSD+SUD.

Some evidence suggests that individuals who enter treatment with a recent cannabis use history may have difficulty engaging with, and perhaps benefitting from, EBTs for PTSD. For example, starting or continuing cannabis use during treatment has been associated with PTSD symptom exacerbation (Wilkinson et al., 2015), and a randomized controlled trial (RCT) found that baseline cannabis use was associated with increased dropout and less improvement in PTSD symptoms during PTSD treatment (Bedard-Gilligan et al., 2018). These findings parallel results from studies of cognitive behavioral therapy for anxiety disorders, which link cannabis use to poorer treatment outcomes (Ouellette et al., 2022). However, other studies have failed to find an association between cannabis use and PTSD treatment outcomes (De Aquino et al., 2020; Hale et al., 2021; Petersen et al., 2021; Ruglass, Shevorykin et al., 2017). Moreover, some preclinical research suggests that acute administration of specific constituents of the cannabis plant (e.g., cannabidiol, delta-9- tetrahydrocannabinol) may facilitate memory and learning processes relevant to PTSD (e.g., Das et al., 2013; Klumpers et al., 2012; Rabinak et al., 2013). Based on these findings, clinical trials testing cannabinoids as an adjunct to EBTs for PTSD are underway. These mixed findings have resulted in fieldwide uncertainty that may prevent effective communication about cannabis use between clinicians and patients (Christensen et al., 2021).

In addition, it is unclear whether recent cannabis use may interact differently with different types of EBTs for PTSD. Generally, trauma-focused (TF) interventions, which involve directly addressing and processing traumatic memories (Hien et al., 2022), are considered frontline EBTs for PTSD (Hamblen et al., 2019; VA/DoD PTSD Guideline, 2023). However, some evidence suggests that extinction learning, one of the theoretical mechanisms of TF treatments, may be impaired in individuals using cannabis chronically (Papini et al., 2017). Other lines of evidence indicate that individuals with PTSD who report co-occurring cannabis use are especially likely to use avoidance as a primary strategy for managing PTSD symptoms (Hill et al., 2022). These findings are concerning given that TF treatment utilizes exposure to trauma-related distress to facilitate healing and long-term recovery from PTSD. It is possible that impairment in extinction learning and/or using cannabis to avoid anxiety and negative affect (Metrik et al., 2016) could interfere with TF treatment.

These clinical concerns highlight the need to clarify associations between cannabis use and TF treatment outcomes, particularly for individuals with PTSD+SUD. Because individuals with PTSD+SUD were historically excluded from PTSD clinical trials due to fears that TF treatments would lead to increased substance use (Leeman et al., 2017; Souza & Spates, 2008), uncertainty about the implications of cannabis use may create barriers to accessing EBTs for these individuals. For example, concerns among clinicians that trauma processing among patients with PTSD+SUD may lead to symptom exacerbation, return to substance use, and treatment dropout may influence clinicians to select non-trauma-focused (non-TF) treatments, which focus on enhancing coping strategies to manage current emotional and substance use symptoms (Hien et al., 2022), as the “safer” treatment option (Kline et al., 2023). However, non-TF treatments are less effective than TF treatments and generally have lower effect sizes for the treatment of PTSD (e.g., VA/DoD PTSD Guideline, 2023), including in PTSD+SUD samples (Roberts et al., 2015; Roberts et al., 2022). Clarifying the effects of TF interventions for individuals with PTSD+SUD who use cannabis may provide a stronger evidence base for choosing the most effective treatments for these individuals.

Importantly, our understanding of how individuals who use cannabis respond to EBTs for PTSD has been limited for several reasons. First, most studies have had small sample sizes, which limits statistical power, and only two published studies were RCTs (Bedard-Gilligan et al., 2018; Ruglass, Shevorykin et al., 2017). Second, exclusion of individuals who meet criteria for SUDs (e.g., Bedard-Gilligan et al., 2018) can limit generalizability of findings about treatment outcomes to the co-occurring PTSD+SUD population (Killeen et al., 2015). Third, existing studies of cannabis use as a predictor of treatment outcomes have generally focused on PTSD symptoms; however, additional information is needed about alcohol, other drug use, and attendance outcomes given that uncertainty about the impact of TF treatment on these factors has been a barrier to implementation of TF treatments (Kline et al., 2023). Finally, demographic differences between people who do and do not use cannabis have traditionally made it difficult to isolate and test the impact of recent cannabis use.

The current study sought to address these limitations by comparing responses to TF and non-TF treatments in clinical trials for PTSD+SUD among individuals with and without a history of recent cannabis use at the start of treatment. Specifically, data were pooled from four RCTs comparing Concurrent Treatment of PTSD and Substance Use Disorders Using

Prolonged Exposure (COPE; Back et al., 2014), an integrative, TF treatment for PTSD+SUD with the greatest base of research support to date, with non-TF treatments in PTSD+SUD samples from multiple research sites (additional details below in Methods and Results). We then tested effects of each treatment type on treatment-related changes in PTSD symptoms, alcohol use severity, other drug use severity, and treatment attendance in participants who endorsed or did not endorse recent cannabis use at baseline.

2. Materials and methods

2.1. Study selection

Data for the four studies included in the present analyses came from *Project Harmony (PH)*, a meta-analysis of individual patient data (MIPD) comprising RCTs of behavioral and pharmacological treatments for PTSD+SUD. A detailed description of the *PH* study selection procedures has been previously published (Saavedra et al., 2021). *PH* investigators conducted a systematic review of PTSD+SUD treatment studies indexed in PSYCINFO and MEDLINE at the time of submission of the grant application (1995–2017), as well as unpublished data from either completed, in-progress, or under submission trials registered on Clinicaltrials.gov.

From the 36 studies included in the full *PH* virtual clinical trial (Hien et al., 2023), we used the following inclusion criteria to select studies that: (1) measured past 30-day cannabis use at a pre-treatment baseline assessment; (2) tested the efficacy of an intervention targeting either PTSD, alcohol or drug use disorder, or both; and (3) compared a trauma-focused with a non-trauma-focused psychosocial treatment. Four parent studies testing a trauma-focused intervention met these criteria, and all four tested COPE (Back et al., 2019; Mills et al., 2012; Norman et al., 2019; Ruglass, Lopez-Castro et al., 2017). To reduce variability among non-trauma-focused treatment conditions, inclusion criterion (3) ensured that these conditions were comparable to COPE with respect to treatment length, modality, delivery, etc. This criterion served to reduce excess variability that was due to extraneous differences between interventions rather than trauma versus non-trauma focus.

To address limitations of pooling summaries of treatment effects, we used MIPD with propensity score weighting (PSW) to analyze raw, participant-level data from these four studies, using integrative data analysis (IDA) to address variations in measurement across studies (Morgan-López, Hien et al., 2022; Saavedra et al., 2021).

2.2. Interventions

Participants in each parent study were randomized to either COPE (Back et al., 2014) or one of several non-TF control conditions; Table 1 shows a summary of treatment conditions and the attendance and substance use characteristics of each of the four samples.

COPE is a TF, integrated treatment for PTSD and SUDs that combines the core components of psychoeducation and in vivo and imaginal exposures from Prolonged Exposure (Foa et al., 2019) with cognitive behavioral relapse prevention skills for SUDs (Kadden et al., 1992). COPE consists of 90-minute, weekly individual therapy sessions; treatment length was 12 sessions in two of the included studies (Back et al., 2019; Ruglass, Lopez-Castro et al.,

2017), 13 sessions in one study (Mills et al., 2012), and a variable length of 12 to 16 sessions in one study (Norman et al., 2019), with treatment continuation with the study therapist after 12 sessions offered if participants and therapists agreed that treatment goals were not yet met.

Non-TF control conditions included four condition types: Relapse Prevention Therapy (RP; Kadden et al., 1992), Seeking Safety (SS; Najavits, 2002), SUD treatment as usual (SUD-TAU; Mills et al., 2012), and an active monitoring control group (AMCG; Ruglass, Lopez-Castro et al., 2017). RP is a cognitive behavioral SUD intervention focused on improving substance-related coping skills that is typically delivered in 60-minute sessions, but in the included studies was delivered in 12, 90-minute sessions to control for the length of time and attention in the COPE group (Back et al., 2019; Ruglass, Lopez-Castro et al., 2017). SS is a present-focused (i.e., non-TF) treatment to improve coping skills for managing PTSD and SUD symptoms that is typically delivered in 24 sessions of 60 min, but was adapted to include 12 to 16, 90-minute individual therapy sessions to control for the length of time and attention (Norman et al., 2019). SUD-TAU allowed participants to attend any form of inpatient, outpatient, residential, or pharmacological treatment for SUDs (Mills et al., 2012). AMCG precluded any PTSD or SUD treatment but included 12 weekly meetings (for approximately 30 min) with research assistants to complete self-report measures, urine toxicology, and alcohol breathalyzer (Ruglass, Lopez-Castro et al., 2017).

2.3. Measures

2.3.1. Individual-level predictors

2.3.1.1. Treatment assignment.: Participants were classified into one of two treatment assignment conditions: 1) TF, which included participants from all four studies who received COPE, and 2) non-TF, which pooled participants from all control conditions across the four studies.

2.3.1.2. Baseline cannabis use.: To assess frequency of past 30-day cannabis use at the baseline assessment, two studies (Back et al., 2019; Ruglass, Lopez-Castro et al., 2017) used an item from the self-report Addiction Severity Index (McLellan et al., 1980) which asked participants to report on their use of “cannabis,” “marijuana” and/or “hashish.” Mills and colleagues (2012) assessed frequency of past 30-day use of “marijuana, dope, grass, hash, or pot” during a clinical interview. Norman and colleagues (2019) used the Timeline Follow-Back (Sobell & Sobell, 1992), a calendar-assisted structured clinical interview assessing days on which “marijuana” was used over the prior 90 days. For the current study, we harmonized these measures by creating a dichotomous baseline cannabis use status variable indexing the presence versus absence of cannabis use in the 30 days preceding the baseline assessment for each study.

Further, a higher frequency of cannabis use threshold (i.e., used cannabis at least 15 of the past 30 days) was used to create a second dichotomous baseline cannabis use status variable indexing “frequent cannabis use.” This “frequent cannabis use” variable was then used in sensitivity analyses to test whether results were consistent even for frequent levels of cannabis use.

2.3.1.3. Baseline covariates.: Baseline age, sex, race and ethnicity, education, marital status, veteran status, non-study concomitant psychotropic medication prescription status, and PTSD symptom, alcohol use, and non-cannabis drug use severity were considered as covariates. Because treatment arms were grouped across studies in the current analyses, the original within-study randomization to treatment groups could not be assumed to hold (i.e., there was the potential for correlations between treatment status and various baseline covariates). To adjust for these correlations, as well as correlations between baseline cannabis use status and covariates, PSW was used to balance the treatment and cannabis groups on the above-mentioned covariates, as described below in the data analytic plan. This approach allowed us to isolate and test main and moderating effects of baseline cannabis use status and treatment assignment on clinical outcomes, following the procedure outlined by Bansak (2021).

2.3.2. Primary outcomes—Latent scores measuring severity of PTSD symptoms, alcohol use, and non-medical use of substances other than alcohol or cannabis (heretofore: "non-cannabis drug use") were estimated using methodology described in detail in prior *PH* publications (Hien et al., 2023; Morgan-López, Hien et al., 2022; Saavedra et al., 2021). The estimation of each severity score is outlined briefly below. Descriptions include summaries of the assessment instruments used by the parent studies included in the current analyses to measure severity of PTSD symptoms, alcohol use, and non-cannabis drug use, as well as strategies used to harmonize across measures.

2.3.2.1. Attendance.: Attendance was harmonized across studies as an index of the proportion of available therapy sessions attended (range: 0 to 1).

2.3.2.2. Latent PTSD severity.: Using an Integrative Data Analysis/Moderated Non-Linear Factor Analysis (IDA/MNLFA) framework (Bauer, 2017; Hussong et al., 2020), a PTSD severity score was created from clinical interviews and self-report measures used to assess PTSD in the individual parent studies (Hien et al., 2022). Prior to MNLFA scale score estimation, each item from the original assessment systems was placed on the same metric (i.e., item harmonization) to create 42 indicators of underlying PTSD. This was accomplished using the primary method from each measure for converting frequency and intensity items for each PTSD symptom into binary indicators of the presence or absence of that symptom. These conversion rules were used to harmonize items from the clinical interviews into 21 binary symptoms and to harmonize items from the self-report measures into an additional 21 binary symptoms based on the Diagnostic and Statistical Manual for Mental Disorders (DSM) versions IV-Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) and 5 (5th ed.; DSM–5; American Psychiatric Association, 2013) criteria for PTSD. Due to slight differences in the PTSD criteria between DSM-IV-TR and DSM-5, each of these sets of 21 symptoms included the 16 symptoms that are common to both DSM-IV-TR and DSM-5, the one symptom that is unique to DSM-IV-TR, and the four symptoms that were added to DSM-5. This approach resulted in a set of 42 harmonized PTSD symptoms in the IDA dataset.

Using these 42 indicators, we then tested for unidimensionality of PTSD and estimated measurement non-invariance (MNI) or differential item functioning (DIF) under the

MNLFA framework following the general recommendations of Bauer (2017). In the final MNLFA scoring model, the scale of the PTSD severity score was set to N (0,1) at baseline and allowed to vary across all other timepoints, so that change over time can be interpreted in standardized mean difference (i.e., Cohen's *d*) units. This approach created comparability in measures across studies, which assessed the same construct (i.e., PTSD symptoms) with variation in item content (for a more detailed description, please see Hien et al., 2023).

For the current analyses, the PTSD severity score (factor score range: −3.75 to 2.68) was created from the two clinical interviews and two self-report measures administered at baseline and follow-up assessments in the included studies. One study (Norman et al., 2019) administered the Clinician Administered PTSD Scale for DSM-5 (CAPS-5) and the remaining three studies (Back et al., 2019; Mills et al., 2012; Ruglass, Lopez-Castro et al., 2017) administered the CAPS-IV clinical interview, which is the previous version of the CAPS based on DSM-IV-TR criteria for PTSD (American Psychiatric Association, 2000). The two self-report assessments were both based on DSM-IV-TR criteria and administered in two studies: the PTSD Checklist-Military (PCL-M; Weathers et al., 1994) was administered by Back and colleagues (2019), and the modified PTSD Symptom Scale Self-Report (MPSS-SR; Falsetti et al., 1993) was administered by Ruglass, Lopez-Castro, and colleagues (2017).

2.3.2.3. Latent alcohol use severity.: Using the IDA/MNLFA framework outlined for PTSD severity, a latent alcohol use severity score (factor score range: −1.89 to 1.87) was estimated using two highly correlated indicators: (1) number of days of alcohol use in the past 30 days, and (2) any alcohol use to intoxication in the past 30 days. Similar to assessment of cannabis use, measures used to assess alcohol use severity in the included studies were: the TLFB (Sobell & Sobell, 1992; used by Norman et al., 2019 and Back et al., 2019) the ASI (McLellan et al., 1980; used by Back et al., 2019 and Ruglass, Lopez-Castro et al., 2017), the self-report Substance Use Inventory (Weiss et al., 1995; used by Ruglass, Lopez-Castro et al., 2017), and a question from a structured clinical interview assessing frequency of past-month alcohol use (used by Mills et al., 2012). Three of these measures (the TLFB, ASI, and clinical interview item) naturally assessed alcohol severity as a 30-day use outcome; however, the SUI measured past 7-day alcohol use. To harmonize the 7-day use item to 30 days, the SUI alcohol use item was multiplied by 4.285 (so that a report of 7 days of use per week translated to 30 days of use in the past 30 days).

2.3.2.4. Latent non-cannabis drug use severity.: Finally, we estimated a latent non-cannabis drug use severity score (factor score range: −1.41 to 2.39) using the same IDA/MNLFA steps outlined for PTSD severity. For non-cannabis drug use, a six-indicator latent variable was created using binary indicators indexing any use in the past 30 days of the following substances: (1) cocaine, (2) other psychostimulants, (3) heroin, (4) other opioids (excluding heroin), (5) sedatives, and (6) hallucinogens. The measures yielding the scores used for the alcohol use severity indicators (listed above) were the same as those for non-cannabis drug use.

2.4. Procedures

Each of the four included parent studies assessed participants' PTSD severity, alcohol use severity, and non-cannabis drug use severity at baseline, at various times in treatment, and at various follow-up assessments. Timing of assessments differed between studies. To approximate standardized assessment timepoints, only the baseline, mid-treatment, and end-of-treatment assessments were included in the current analyses. Harmonized data for the mid-treatment assessment was missing for one study (Norman et al., 2019). End-of-treatment was defined as the post-treatment assessments from three of the four studies (Back et al., 2019; Norman et al., 2019; Ruglass, Lopez-Castro et al., 2017); the fourth study (Mills et al., 2012) did not include a post-treatment assessment but did measure the selected outcome variables at an assessment conducted three months following the baseline assessment. Because the study by Mills and colleagues (2012) offered 13 weekly therapy sessions, this 3-month post-baseline assessment was treated as the end-of-treatment assessment for this study. This was done to approximate as closely as possible the length of time between the baseline and end-of-treatment assessments across the four studies.

2.5. Data analytic plan

Missing data on predictors, covariates, and outcome variable scale scores were multiply imputed using the R package 'mice' (Van Buuren & Groothuis-Oudshoorn, 2011), which uses fully conditional specification to handle missing data that have a multilevel structure and contain a mix of continuous and categorical variables.

Outcomes analyses for the current study were performed using SAS version 9.4 statistical software and proceeded in four steps. First, descriptive statistics were computed, and ANOVAs and chi-square tests were used to compare the four treatment assignment and baseline cannabis use status groups (non-TF + no cannabis [n = 138], non-TF + cannabis [n = 63], TF + no cannabis [n = 136], TF + cannabis [n = 73]; heretofore: "treatment/cannabis groups") on continuous and categorical baseline characteristics, respectively. Second, because treatment status and cannabis use were not randomized across the four studies (despite within-study treatment randomization; see Morgan-López, McDaniel et al., 2022; Saavedra et al., 2021), a multinomial logistic regression model was used to create inverse probability of treatment weights that balanced the four groups with respect to key baseline demographic and clinical characteristics. In this model, treatment/cannabis group was treated as the criterion and baseline age, sex, race and ethnicity, education, marital status, veteran status, psychotropic medication prescription status, parent study, and PTSD symptom, alcohol use, and non-cannabis drug use severity were treated as predictors.

Third, to examine change in clinical outcomes within each of the four treatment/cannabis groups, separate multilevel mixed effects models for each group were estimated for each clinical outcome (i.e., proportion of sessions attended, PTSD severity, alcohol use severity, and non-cannabis drug use severity). These models included random intercepts at the study level, and random intercepts and slopes at the participant level, as part of the multilevel structure of the data (measurements nested within participants nested within studies). Fixed effects included the intercept (predicted value of each outcome at baseline for each model's respective treatment/cannabis group) and the coefficient of "wave," a continuous variable

indexing change in PTSD severity, alcohol use severity, and non-cannabis drug use severity, respectively, from baseline through mid-treatment to end-of-treatment. Propensity score weights obtained in Step 2 were applied to all models.

Fourth, to test whether baseline cannabis use status interacted with treatment condition to predict treatment outcomes, differences-in-differences tests calculated functions of the fixed effects coefficients from the models in Step 3, using the intercept from the attendance models and the coefficient of "wave" from the PTSD, alcohol, and drug use severity models. Markov chain Monte Carlo simulation procedures were used to estimate empirical confidence intervals for these functions using SAS Proc MCMC (see e.g., Miočević et al., 2018). Specifically, the simple effect of treatment conditions (non-TF versus TF) was calculated within baseline cannabis use status (cannabis use versus no cannabis use). Comparative effect sizes were calculated by converting model estimates into model-based Cohen's d effect sizes by using the methods of conversion outlined by Feingold (2017).

For each step, analyses were first conducted using the primary baseline cannabis use variable (indexing any cannabis use versus no cannabis use in the past 30 days). Then, sensitivity analyses were conducted using the "frequent cannabis use" variable to test whether results varied for participants reporting frequent baseline cannabis use.

3. Results

3.1. Sample characteristics and mitigation of covariate imbalance using PSW

Of the 413 participants in the four included studies, 410 participants (mean [SD] age, 40.19 [11.05] years; 286 [69.8%] male) reported on their baseline cannabis use and were included in the current analyses. Of these participants, 136 (33.2%) reported baseline cannabis use, with a mean of 16.7 (SD = 12.1, range = 1–30) days of cannabis use in the past 30 days. Of those who endorsed baseline cannabis use, 50 participants (36.8%) reported at least daily cannabis use, 76 (55.9%) reported using cannabis at least half the days, and 98 (72.1%) reported at least 5 days of cannabis use (approximating weekly use) in the 30 days preceding the baseline assessment. The number of participants endorsing cannabis as their primary substance to target in treatment was available for 3 of 4 studies (this information was not available for Back et al., 2019). Of the participants in these studies, 29 out of 329 (8.8%) selected cannabis as their primary treatment target. Raw demographic and baseline characteristics of the included participants are presented for the full sample and by treatment/cannabis groups in Table 2, which shows significant differences between the four groups on several background variables, including age, sex, race, veteran status, and psychotropic medication status. Table 3 presents demographic and clinical characteristics of the four groups after PSW, which successfully mitigated group differences in baseline characteristics.

3.2. Outcomes models

3.2.1. Rate of attendance and changes in PTSD, alcohol, and non-cannabis drug use severity within each treatment/cannabis group—

Table A.1 in the Appendix presents raw scores on all outcomes (attendance, PTSD, alcohol, and non-

cannabis drug use severity) by treatment/cannabis groups for each assessment timepoint. Table A.2 presents estimates and confidence intervals of the fixed effects from each of the four mixed models for all outcomes. Estimated levels of treatment attendance were highest for individuals in the non-TF conditions who did and did not report cannabis use at baseline (intercept = 0.78 and 0.75, respectively), and lower for individuals in the TF conditions who did and did not report cannabis use at baseline (intercept = 0.56 and 0.54, respectively). In all four models (i.e., within each of the four treatment/cannabis groups), PTSD, alcohol, and drug use severity all decreased significantly (β for "wave" ranged from −0.24 to −0.66 and no confidence intervals included zero), indicating improvement across these three outcomes for all levels of treatment assignment and baseline cannabis use status. Fig. 1 presents intercepts and slopes in each of the four treatment/cannabis groups for PTSD severity, alcohol use severity, and non-cannabis drug use severity. Across outcomes in all four models, study-level variance was not statistically significant ($p > .05$ for all models); however, study-level intraclass correlations (ICC) ranged from 0.01 to 0.07 for the attendance models, 0.10 to 0.20 in PTSD models, 0.05 to 0.10 in alcohol use models, and 0.05 to 0.24 in drug use models. Given the small N at the study level (N = 4 studies), tests of statistical significance were likely underpowered, but ICCs suggest heterogeneity in latent PTSD, alcohol, and drug use severity across studies.

Results of sensitivity analyses using the "frequent cannabis use" variable in place of the primary baseline cannabis use variable found a similar pattern of results, with PTSD severity, alcohol use severity, and non-cannabis drug use severity decreasing significantly for participants in all four treatment/cannabis groups.

3.2.2. Simple effects of treatment condition and baseline cannabis use on outcomes—

With respect to attendance, participants attended a greater proportion of non-TF versus TF therapy sessions whether they endorsed (estimate = 0.22, 95% CI [0.01, 0.42) or did not endorse (estimate = 0.21, 95% CI [0.02, 0.41]) baseline cannabis use. With respect to PTSD severity, results revealed a significant main effect of treatment assignment within both baseline cannabis use groups. Specifically, participants achieved greater reductions in PTSD symptoms in the TF versus non-TF treatment condition regardless of whether they endorsed baseline cannabis use (estimate = 0.26, 95% CI [0.04, 0.48], $d = 0.70$), or did not endorse baseline cannabis use (estimate = 0.19, 95% CI [0.02, 0.35], $d = 0.73$).

With respect to alcohol use severity and non-cannabis drug use severity, results revealed no significant simple effects of treatment condition within baseline cannabis use status groups. Specifically, results revealed similar reductions in alcohol use across TF and non-TF treatment conditions in both the baseline cannabis use group (estimate = −0.04, 95% CI [−0.25, 0.11], $d = 0.33$) and the no baseline cannabis use group (estimate = −0.04, 95% CI [−0.16, 0.09], $d = 0.39$). Likewise, reductions in non-cannabis drug use severity were similar for participants receiving TF and non-TF therapy who endorsed baseline cannabis use (estimate = 0.05, 95% CI [−0.05, 0.15], $d = 0.34$) and those who did not endorse baseline cannabis use (estimate = 0.00, 95% CI [−0.10, 0.10], $d = 0.37$).

In sensitivity analyses using the “frequent cannabis use” variable in place of the primary baseline cannabis use variable, the difference in attendance to TF versus non-TF treatment among participants reporting cannabis use was no longer statistically significant (estimate = 0.23, 95% CI [−0.03, 0.49]). All other simple effects were unchanged.

4. Discussion

This MIPD is the first, to our knowledge, to examine differences in the efficacy of TF and non-TF treatments in individuals with PTSD+SUD with and without a history of recent cannabis use. Results showed that participants in both cannabis groups achieved significantly greater reductions in PTSD symptom severity when receiving TF versus non-TF treatment but attended fewer sessions. There were no significant differences in attendance or PTSD severity reduction between participants who did and did not endorse cannabis use in the month preceding treatment. With respect to alcohol and other drug use severity, participants achieved significant and similar gains irrespective of treatment assignment or baseline cannabis use. These findings are notable, given longstanding concerns that patients using cannabis may be at risk of increased substance use or PTSD symptom exacerbation during TF therapy, or treatment dropout (Gielen et al., 2014; Killeen et al., 2011).

Findings from this study may help clarify mixed results from the existing literature on PTSD treatment and cannabis use, which is largely lacking in rigorous RCTs. A few recent observational studies, which compared veterans with and without recent cannabis use who entered intensive PTSD treatment programs that provided a mix of TF and non-TF treatments, found null results when testing for cannabis group differences on treatment outcomes (De Aquino et al., 2020; Hale et al., 2021; Petersen et al., 2021). Although these studies offer important insights, specificity of results is limited due to comparisons between heterogeneous TF and non-TF treatments ranging from brief inpatient admissions to long-term residential programs, reliance on medical record and self-report measures of PTSD and other outcomes, and comparison of cannabis use groups with pre-existing differences on key variables. The current findings therefore build on previous literature by providing methodologically rigorous and fine-grained information about the specific benefit of TF treatment for ameliorating PTSD symptoms in this population. Specifically, we found that TF treatment outperformed non-TF treatment among participants who both did and did not endorse baseline cannabis use. These results increase confidence in the efficacy of TF interventions for individuals who report recent cannabis use and underscore the importance of reducing barriers to their access to TF treatment.

One previous RCT evaluating treatment outcomes associated with baseline cannabis use found that participants without SUDs, but who reported cannabis use at baseline, were more likely to drop out from Prolonged Exposure therapy for PTSD and experienced smaller reductions in PTSD symptoms during treatment (Bedard-Gilligan et al., 2018). Although we found higher treatment attendance among participants receiving non-TF treatments, this effect was consistent across both baseline cannabis use groups, and both cannabis use groups achieved similar and significant reductions in PTSD symptoms. There are several possible explanations for these differences between prior results and those of the present study.

First, differences may be due, in part, to the larger sample size and more fine-grained, continuous measure of treatment attendance used in the current study. Second, it is possible that cannabis use may be associated with poorer treatment outcomes for individuals without SUD but not for individuals with more severe substance use problems. Third, there may be a benefit to integrated treatment of PTSD and substance use for individuals using cannabis. For example, additional treatment elements specific to COPE may have helped participants with cannabis use to remain in and benefit more from treatment. These elements included information about the relationship between PTSD symptoms and substance use, how substance use can function as an avoidant coping strategy that maintains PTSD symptoms over time, and skills for managing cravings and reducing or quitting substance use (Back et al., 2014). It is possible that the integrated nature of the PTSD and SUD treatment components successfully addressed potentially problematic patterns of cannabis use.

Another area of study with potential relevance to the current findings stems from translational research from animal studies and a handful of human studies suggesting that acute THC administration may facilitate extinction learning of conditioned fear responses (Diggs et al., 2022; Hammoud et al., 2019). Although we found similar responses to exposure-based treatment in both baseline cannabis groups, inferences about the causal impact of cannabis on treatment outcomes cannot be drawn from our results. This is because cannabis use was only measured at baseline in the present study and patterns of cannabis use during treatment were unknown. TF treatment in this study was integrated with SUD treatment content, and it is plausible that this content enabled participants using cannabis at baseline to reduce their cannabis use in addition to reducing alcohol and non-cannabis drug use during the study period. Nevertheless, it is worth noting that the only existing RCT testing the efficacy of whole plant cannabis as a treatment for PTSD found no differences in symptom reduction between groups receiving cannabis and placebo (Bonn-Miller et al., 2021).

Clinically, results of the current study can allay providers' concerns that cannabis use at the time of, or shortly prior to, beginning TF treatment would preclude optimal engagement in or response to these interventions. The finding that those with baseline cannabis use achieved greater reductions in PTSD severity from TF versus non-TF treatment bolsters findings from recent research indicating that baseline substance use should not prevent provision of TF therapies (Kline et al., 2023), and supports TF treatment as an effective option for treating PTSD+SUD comorbidity (Hien et al., 2022). Results of the current study do not, however, minimize the clinical importance of routinely assessing and discussing cannabis use with patients to ensure it is not interfering with optimal treatment engagement and response or impairing functioning outside the context of PTSD. Depending on patients' goals related to cannabis use, it is likely helpful to integrate strategies for addressing maladaptive patterns of cannabis use with trauma-focused content, as presented in the COPE manual. This may include, for example, supporting patients in abstaining from cannabis use before, during, and after in vivo exposure and homework exercises, discussing cannabis use as a possible PTSD safety behavior, and targeting cognitions linking PTSD symptoms and cannabis use (e.g., "I need to use cannabis to manage my symptoms").

Strengths of the current study include its MIPD design and methodology, which involved aggregating and harmonizing data across RCTs to provide greater sample size, statistical power, and precision than can be achieved by examining individual trials independently or pooling effect sizes for a traditional meta-analysis. This approach also enabled the use of PSW, which allowed us to balance the treatment and cannabis use groups on baseline covariates to isolate and test causal effects.

These strengths notwithstanding, the findings should be interpreted in the context of several limitations. First, because cannabis use was not assessed during treatment in each trial, we were unable to evaluate the impact of cannabis use *during* therapy, which reflects an important direction for future research. Despite this limitation, results of this study highlight clinical implications regarding baseline cannabis use, which remains a clinically relevant patient characteristic for providers to consider at the start of treatment, especially amidst growing concerns about increasing cannabis use among American adults (Hasin & Walsh, 2021). Second, this study examined cannabis use in binary terms (i.e., grouping patients into “yes” vs. “no” cannabis use categories). As data on use of specific cannabis products (i.e., CBD, THC concentrates) was not collected in the parent trials included in this meta-analysis, future research would benefit from more granular assessment of cannabis products. It is also unclear whether very frequent cannabis use or meeting criteria for cannabis use disorder may differentially affect attendance and outcomes in PTSD treatment (although it is notable that more than half of participants in the current sample who endorsed cannabis use reported using more than half the days in the past month, and that results remained unchanged when using this higher frequency of cannabis use as a threshold for the baseline cannabis use group). Finally, heterogeneity across studies included variation in inclusion/exclusion criteria, outcome measures, comparators to COPE, and sample characteristics, and results of our analyses suggested study-level heterogeneity in PTSD, alcohol use, and drug use severity. In addition, the joint exposures of cannabis use and treatment assignment were not randomized, as treatment arms were grouped across studies and the original within-study randomization to treatment groups could not be assumed to hold. Although use of the MIPD design with IDA to harmonize measures and PSW to balance treatment and cannabis groups on a wide array of covariates boosts confidence in study results and generalizability, it is not possible to rule out the potential influence of unmeasured covariates.

5. Conclusions

Results of the current study support provision of a range of EBTs, including first-line, trauma-focused therapies for patients presenting with PTSD+SUD and concurrent cannabis use. Compared with participants who did not endorse cannabis use, those who reported baseline cannabis use attended a comparable number of sessions and benefitted similarly from evidence-based PTSD and SUD treatments. Moreover, participants with and without baseline cannabis use experienced greater reductions in PTSD symptom severity during TF versus non-TF treatment. Although these results highlight the importance of offering these individuals frontline TF interventions, our findings also indicate that individuals with and without cannabis use achieved significant reductions in PTSD, alcohol, and drug use severity during non-TF treatment. It is encouraging to note that these treatments were also efficacious, given that attendance was generally higher in non-TF than TF treatments and

some individuals may prefer treatment with a present focus. Future research is needed to clarify how and to what extent cannabis use *during* the treatment phase of therapy interacts with treatment-related factors and processes, such as exposure exercises and homework adherence, to affect treatment outcomes. Such research is likely to optimize implementation of trauma-focused therapies and further elucidate the impact of cannabis use on treatment for PTSD+SUD.

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Appendix A

Table A1

Raw scores on attendance and treatment outcomes at each wave by treatment and baseline cannabis use status.

	Non-TF and no cannabis use (1)			Non-TF and cannabis use (2)			TF and no cannabis use (3)			TF and cannabis use (4)		
Outcome	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Attendance	138	0.72	0.34	63	0.81	0.31	136	0.60	0.34	73	0.49	0.39
PTSD severity												
Baseline	138	0.29	0.98	63	0.26	0.85	136	0.53	0.81	73	0.62	0.89
Mid-treatment	67	−0.32	1.26	42	−0.15	1.28	66	−0.54	0.97	61	−0.13	1.27
End-of-treatment	114	−0.44	1.30	49	−0.20	1.13	125	−0.76	1.29	66	−0.44	1.34
Alcohol use severity												
Baseline	138	0.56	0.83	63	0.44	0.84	136	0.50	0.81	73	0.47	0.94
Mid-treatment	67	−0.57	0.73	42	−0.79	0.47	66	−0.55	0.70	61	−0.54	0.61
End-of-treatment	114	−0.14	0.75	49	−0.19	0.70	125	−0.17	0.78	66	−0.09	0.78
Non-cannabis drug use severity												
Baseline	138	0.07	0.81	63	0.56	0.77	136	−0.15	0.71	73	0.58	0.80
Mid-treatment	67	0.18	0.74	42	0.49	0.70	66	−0.26	0.71	61	0.02	0.66
End-of-treatment	114	−0.49	0.76	49	0.03	0.70	125	−0.60	0.66	66	−0.14	0.71

Note. TF = trauma-focused; PTSD = posttraumatic stress disorder. Smaller Ns at mid-treatment reflect unavailability of mid-treatment assessment from one study of veterans with PTSD and alcohol use disorder (Norman et al., 2019). Attendance is the proportion of available sessions attended (range: 0–1). PTSD severity is a latent factor score using items from clinical interview and self-report PTSD measures as indicators. Alcohol use severity is a latent factor score using past-30-day alcohol use and past-30-day alcohol use to intoxication as indicators. Non-cannabis drug use severity is a latent

factor score using binary indicators indexing any use in the past 30 days of the following substances: (1) cocaine, (2) heroin, (3) opioids (excluding heroin), (4) sedatives, (5) other psychostimulants, and (6) hallucinogens

Table A2

Multilevel mixed regression fixed effects from treatment and baseline cannabis use status group models.

	Model 1	Model 2	Model 3	Model 4
	Non-TF and no cannabis use	Non-TF and cannabis use	TF and no cannabis use	TF and cannabis use
Outcome	**Estimate (95% CI)**	**Estimate (95% CI)**	**Estimate (95% CI)**	**Estimate (95% CI)**
Attendance				
Intercept	0.75 (0.55, 0.95)	0.78 (0.54, 1.02)	0.54 (0.35, 0.73)	0.56 (0.40, 0.71)
PTSD severity				
Intercept	0.42 (−0.43, 1.27)	0.26 (−0.59, 1.11)	0.33 (−0.40, 1.07)	0.47 (−0.25, 1.19)
Wave	−0.47 (−0.58, −0.36)	−0.35 (−0.50, −0.21)	−0.66 (−0.80, −0.53)	−0.61 (−0.78, −0.44)
Alcohol use severity				
Intercept	0.39 (0.00, 0.78)	0.33 (−0.37, 1.03)	0.28 (−0.15, 0.72)	0.43 (−0.09, 0.95)
Wave	−0.36 (−0.44, −0.27)	−0.37 (−0.48, −0.25)	−0.32 (−0.43, −0.22)	−0.30 (−0.43, −0.17)
Drug use severity				
Intercept	0.19 (−0.54, 0.91)	0.28 (−0.40, 0.96)	0.09 (−0.48, 0.66)	0.34 (−0.03, 0.70)
Wave	−0.26 (−0.33, −0.19)	−0.24 (−0.31, − 0.18)	−0.26 (−0.33, −0.19)	−0.29 (−0.38, −0.21)

Note. Inverse probability of treatment weights were applied to all models. Intercept = predicted value of each outcome at baseline for each model's respective treatment/cannabis group. Wave = continuous variable measuring change over time from baseline through mid-treatment to end-of-treatment.

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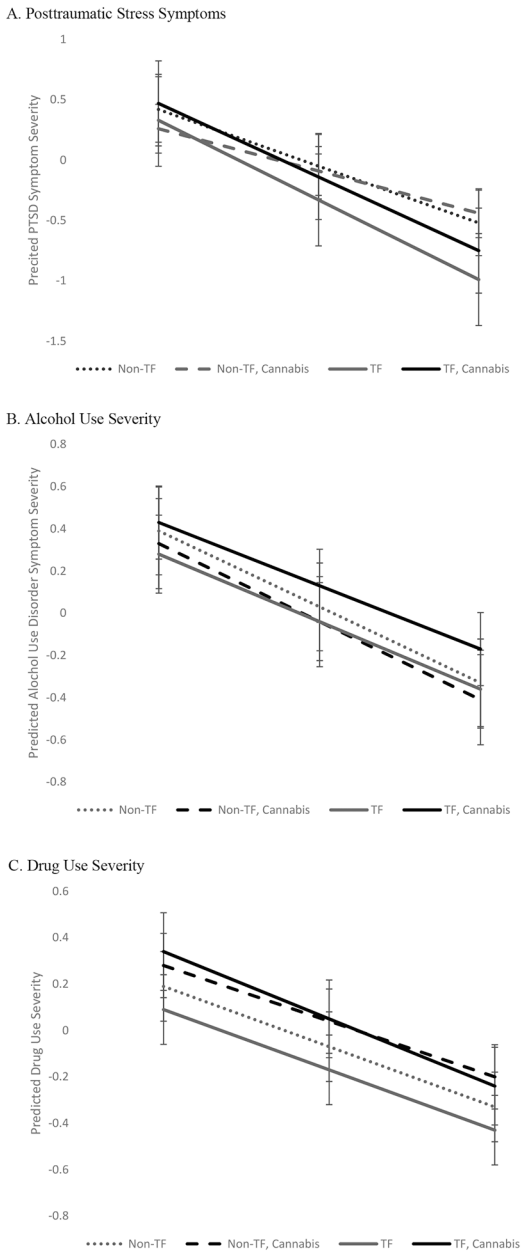

Fig. 1.

Changes in posttraumatic stress, alcohol use, and drug use symptom severity by treatment type and baseline cannabis use status from baseline to end-of-treatment. *Note*. TF = trauma-focused treatment. Cannabis = endorsed baseline cannabis use. Inverse probability of treatment weights were applied to balance groups on baseline age, sex, race and ethnicity, education, marital status, veteran status, psychotropic medication prescription status, parent study, and baseline levels of posttraumatic stress, alcohol use, and drug use symptom severity for all analyses. Error bars represent standard error or measurement. Error bars represent the standard error of measurement.

Table 1

Summary of substance use, treatment, and attendance characteristics of the four clinical trials included in this study.

Lead Author (Year)	*N*	SUD treatment target (%)	Baseline alcohol use disorder n (%)	Baseline drug use disorder n (%)	Baseline cannabis use n (%)	Treatment arms	Proportion of sessions attended (0–1) Mean (SD)
Back (2019)	81	All SUDs (alcohol=63.0, Drug=9.9, alcohol and drug=27.2)	73 (90.0)	30 (37.0)	13 (16.0)	COPE (n = 54), RP (n = 27)	0.70 (0.37)
Ruglass (2017)	110[a]	All SUDs (alcohol=44.5; alcohol and stimulants=24.5; cocaine=16.4; cannabis=8.2; other=6.4)	85 (77.3)	73 (66.4)	38 (35.5)	COPE (n = 39), RP (n = 43), AMCG (n = 28)	0.61 (0.37)
Mills (2012)	103	All SUDs (heroin=21.4; cannabis=19.4; amphetamines= 17.5; benzodiazepines=15.5; alcohol=11.7; cocaine=6.8; other opiates=4.9; hallucinogens=1.0)	NR	NR	69 (67.0)	COPE+TAU (n = 55), TAU (n = 48)	0.71 (0.39)
Norman (2019)	119	Alcohol= 100	119 (100.0)	NR	16 (13.4)	COPE (n = 63), SS (n = 56)	0.61 (0.31)

Note. SUD = Substance use disorder, NR = Not reported, COPE = Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure, RP = Relapse Prevention Therapy, AMCG = Active monitoring control group, TAU = Treatment as usual, SS = Seeking Safety

[a] *N* included in current study was 107, as 3 participants were missing all cannabis use data.

Table 2

Unweighted demographics and baseline characteristics by treatment assignment and baseline cannabis use status groups.

	Full sample (N = 410)	Non-TF and no cannabis use (1) (N = 138)	Non-TF and cannabis use (2) (N = 63)	TF and no cannabis use (3) (N = 136)	TF and cannabis use (4) (N = 73)	
	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)	$F/\chi^2, p$
Age	40.19 (11.05)	41.99 (10.68)[a]	37.33 (9.90)[b]	41.68 (12.04)[a]	36.49 (9.46)[b]	6.41, < .001
Sex						
Men	286 (69.8)	97 (70.3)[a,b,c]	35 (55.6)[b]	110 (80.9)[c]	44 (60.3)[a,b]	17.13, < .001
Women	124 (30.2)	41 (29.7)	28 (44.4)	26 (19.1)	29 (39.7)	
Race and ethnicity						
Non-Hispanic White	250 (61.0)	74 (53.6)[a]	37 (58.7)[a,b]	84 (61.8)[a,b]	55 (75.3)[b]	9.64,.022
Non-Hispanic Black	109 (26.6)	48 (34.8)[a]	17 (27.0)[a,b]	32 (23.5)[a,b]	12 (16.4)[b]	
Hispanic	59 (14.4)	22 (15.9)[a]	8 (12.7)[a]	21 (15.4)[a]	8 (11.0)[a]	
AAPI	6 (1.5)	3 (2.2)[a]	0 (0.0)[a]	3 (2.2)[a]	0 (0.0)[a]	
Other	23 (5.6)	4 (2.9)[a,b]	5 (7.9)[a,b]	14 (10.3)[a]	0 (0.0)[b]	
Education						
High school or less	117 (29.1)	43 (32.1)[a]	19 (30.6)[a]	30 (22.6)[a]	25 (34.2)[a]	4.35,.23
Some college	181 (44.1)	57 (41.3)[a]	29 (46.0)[a]	66 (48.5)[a]	29 (39.7)[a]	
College graduate	110 (26.8)	36 (26.1)[a]	15 (23.8)[a]	40 (29.4)[a]	19 (26.0)[a]	
Marital status						
Married	84 (20.5)	31 (22.5)[a]	8 (12.7)[a]	32 (23.5)[a]	13 (17.8)[a]	3.77,.29
Not married	326 (79.5)	107 (77.5)	55 (87.3)	104 (76.5)	60 (82.2)	
Veteran status						
Veteran	200 (48.8)	70 (50.7)[a]	13 (20.6)[b]	101 (74.3)[c]	16 (21.9)[b]	76.62, < .001
Non-veteran	210 (51.2)	68 (49.3)	50 (79.4)	35 (25.7)	57 (78.1)	
Baseline depression	185 (45.1)	54 (39.1)[a]	28 (44.4)[a]	61 (44.9)[a]	42 (57.5)[a]	6.56,.09
Psychotropic medication	237 (57.8)	68 (49.3)[a]	39 (61.9)[a,b]	95 (69.9)[b]	35 (47.9)[a]	15.55,.001
PTSD severity	0.43 (0.90)	0.29 (0.98)[a]	0.26 (0.85)[a]	0.53 (0.81)[b]	0.62 (0.89)[b]	3.62,.013
Alcohol use severity	0.51 (0.84)	0.56 (0.83)[a]	0.44 (0.84)[a]	0.50 (0.81)[a]	0.47 (0.94)[a]	0.39,.76
Drug use severity	0.16 (0.83)	0.07 (0.81)[a]	0.56 (0.77)[b]	−0.15 (0.71)[c]	0.58 (0.80)[b]	21.06, < .001

Note. TF = trauma-focused, AAPI = Asian American and Pacific Islander. Bonferroni corrections were applied to adjust for multiple comparisons. Percentages with differing superscripts differed between cannabis/treatment groups at $p < .05$.

Table 3

Weighted demographics and baseline characteristics by treatment assignment and baseline cannabis use status groups.

	Full sample (Weighted N =1588)	Non-TF and no cannabis use (1) (Weighted N = 399)	Non-TF and cannabis use (2) (Weighted N = 381)	TF and no cannabis use (3) (Weighted N = 418)	TF and cannabis use (4) (Weighted N = 390)	
	Weighted Mean (SD) or Weighted N (%)	Weighted Mean (SD) or Weighted N (%)	Weighted Mean (SD) or Weighted N (%)	Weighted Mean (SD) or Weighted N (%)	Weighted Mean (SD) or Weighted N (%)	$F/\chi^2, p$
Age	39.81 (20.79)	40.61 (18.54)[a]	39.93 (23.46)[a]	39.61 (20.33)[a]	38.97 (23.25)[a]	0.40,.75
Sex						
Men	1089 (69.3)	291 (70.8)[a]	298 (73.3)[a]	269 (65.0)[a]	231 (67.7)[a]	7.58,.06
Women	484 (30.8)	120 (29.2)	108 (26.7)	145 (35.0)	110 (32.3)	
Race and ethnicity						
Non-Hispanic White	991 (63.0)	251 (61.1)[a]	265 (65.3)[a]	257 (61.9)[a]	219 (63.9)[a]	1.82,.61
Non-Hispanic Black	396 (25.2)	111 (27.0)[a]	88 (21.7)[a]	112 (27.0)[a]	85 (25.0)[a]	
Hispanic	219 (13.9)	57 (13.9)[a]	56 (13.8)[a]	57 (13.7)[a]	49 (14.3)[a]	
AAPI	15 (1.0)	11 (2.6)[a]	0 (0.0)[b]	5 (1.2)[a,b]	0 (0.0)[b]	
Other	75 (4.8)	13 (3.2)[a]	37 (9.1)[b]	25 (6.0)[a,b]	0 (0.0)[c]	
Education						
High school or less	480 (30.5)	118 (28.7)[a]	110 (27.1)[a]	133 (32.1)[a]	119 (34.7)[a]	6.16,.10
Some college	669 (42.6)	179 (43.5)[a]	184 (45.2)[a]	179 (43.2)[a]	128 (37.5)[a]	
College graduate	424 (27.0)	114 (27.8)[a]	113 (27.7)[a]	102 (24.7)[a]	95 (27.8)[a]	
Marital status						
Married	334 (21.2)	95 (23.2)[a]	84 (20.6)[a]	85 (20.5)[a]	70 (20.43[a]	1.27,.74
Not married	1239 (78.8)	316 (76.8)	323 (79.4)	329 (79.5)	272 (79.6)	
Veteran status						
Veteran	721 (45.8)	201 (49.0)[a]	191 (40.0)[a]	191 (46.0)[a]	138 (40.3)[a]	6.12,.11
Non-veteran	852 (54.2)	210 (51.0)	215 (53.0)	224 (54.0)	204 (59.7)	
Baseline depression	708 (45.0)	194 (47.2)[a]	183 (45.0)[a]	172 (41.6)[a]	158 (46.4)[a]	2.99,.39
Psychotropic medication	902 (57.3)	242 (59.0)[a]	227 (56.0)[a]	249 (60.0)[a]	184 (53.7)[a]	3.77,.29
PTSD severity	0.39 (1.78)	0.45 (1.67)[a]	0.25 (1.90)[a]	0.44 (1.61)[a]	0.39 (2.15)[a]	1.07,.36
Alcohol use severity	0.54 (1.71)	0.51 (1.48)[a]	0.69 (2.15)[a]	0.44 (1.45)[a]	0.52 (2.07)[a]	1.64,.18
Drug use severity	0.19 (1.65)	0.16 (1.56)[a]	0.10 (2.07)[a]	0.19 (1.45)[a]	0.31 (1.75)[a]	1.05,.37

Note. TF = trauma-focused, AAPI = Asian American and Pacific Islander. Bonferroni corrections were applied to adjust for multiple comparisons. Percentages with differing superscripts differed between cannabis/treatment groups at $p < .05$.