This article has been accepted for publication in BMJMENT following peer review.
The definitive copyedited, typeset version is available online at
10.1136/bmjment-2024-301159

Predictors of Study Dropout in Cognitive Behavioral Therapy with a Trauma Focus for Posttraumatic Stress Disorder in Adults: An Individual Participant Data Meta-Analysis

Simonne L. Wright[1,2], Eirini Karyotaki, [2] Pim Cuijpers [2, 43], Jonathan I. Bisson[3], Davide Papola[4, 44], Anke B. Witteveen[2], Sudie E. Back[5], Dana Bichescu-Burian[6], Liuva Capezzani [7], Marylene Cloitre [8], Grant J. Devilly [9], Thomas Elbert [10], Marcelo Mello [11], Julian D. Ford[12], Damion Grasso[12], Pedro Gamito[13], Richard Gray[14], Moira Haller[15], Nigel Hunt[16], Rolf J. Kleber[17, 18], Julia König[19], Claire Kullack[20], Jonathan Laugharne[21], Rachel Liebman[22], Christopher William Lee[21], Jeannette Lely[23], John C. Markowitz[24, 25], Candice Monson[26, 27], Mirjam J. Nijdam[18, 28], Sonya B. Norman[15], Miranda Olff[18, 28], Tahereh Mina Orang[29], Luca Ostacoli[30], Nenad Paunovic[31], Eva Petkova[32], Patricia Resick[33], Rita Rosner[19], Maggie Schauer[10], Joy M Schmitz[34], Ulrich Schnyder[35], Brian Smith[36, 37], Anka A. Vujanovic[38], Yinyin Zang[40], Érica Panzani Duran [41], Francisco Lotufo Neto [41], Soraya Seedat [1, 42], and Marit Sijbrandij [2].

[1] South Africa PTSD Research Programme of Excellence, Department of Psychiatry, Faculty of Medicine & Health Sciences, Stellenbosch University. South Africa.

[2] Department of Clinical, Neuro- and Developmental Psychology, World Health Organization Collaborating Center for Research and Dissemination of Psychological Interventions, Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, The Netherlands.

[3] Division of Psychological Medicine and Clinical Neurosciences, Cardiff University, Cardiff, UK.

[4] WHO Collaborating Centre for Research and Training in Mental Health and Service Evaluation, and Department of Neuroscience, Biomedicine, and Movement Sciences, Section of Psychiatry, University of Verona, Verona, Italy.

[5] Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, South Carolina, USA.

[6] Center for Psychiatry Reichenau, Academic Hospital of the University of Konstanz, Konstanz, Germany.

[7] The International Institute for Psychoanalytic Research and Training of Health Professionals (IIPRTHP).

International School for Psychotherapy (SIPSI), Rome.

[8] National Center for PTSD Dissemination and Training Division. Clinical Professor (Affiliate) Stanford University Department of Psychiatry and Behavioral Sciences.

[9] School of Applied Psychology & Griffith, Criminology Institute, Griffith University, Australia.

[10] Department of Psychology, University of Konstanz, Konstanz, Germany.

[11] Departamento de Psiquiatria, Escola Paulista de Medicina. Universidade Federal de São Paulo, Faculdade Israelita de Ciencias da Saude Albert Einstein, Brazil.

[12] University of Connecticut School of Medicine, Connecticut, USA.

[13] Universidade Lusófona, Portulgal.

[14] Director, Research at Research and Recognition Project, New York, USA.

[15] National Center for PTSD, White River Junction, VT, University California, San Diego School of Medicine, La Jolla, CA and VA San Diego Healthcare System, San Diego, CA.

[16] The University of Nottingham, Faculty of Medicine & Health Sciences, School of Medicine, Nottingham, UK.

[17] Department of Clinical Psychology, Utrecht University, Utrecht, the Netherlands.

[18] ARQ National Psychotrauma Centre, Diemen, the Netherlands.

[19] Department of Psychology. Catholic University of Eichstätt-Ingolstadt, Germany.

[20] Pax Centre. West Leederville. Australia.

[21] Faculty of Health and Medical Sciences. The University of Western Australia. Australia.

[22] Adjunct Professor, University of Toronto. Department of Psychology, Canada.

[23] ARQ Centrum'45, Diemen, the Netherlands.

[24] Research Psychiatrist, New York State Psychiatric Institute.

[25] Professor of Clinical Psychiatry, Columbia University Vagelos College of Physicians & Surgeons.

[26] Professor of Psychology. Toronto Metropolitan University, Canada.

[27] Nellie Health, Chief Executive Officer.

[28] Amsterdam University Medical Center location University of Amsterdam, Department of Psychiatry & Amsterdam Public Health, Amsterdam, The Netherlands.

[29] International Psychosocial Organisation, Berlin, Germany.

[30] Department of Clinical and Biological Sciences, University of Turin, Turin, Italy, IT.

[31] Department of Psychology, Stockholm University, Stockholm, Sweden.

[32] Department of Population Health. New York University Langone School of Medicine.

[33] Duke Health, Durham, NC, USA.

[34] Center for Neurobehavioral Research on Addiction. Department of Psychiatry and Behavioral Sciences. McGovern Medical School. University of Texas Health Science Center at Houston.

[35] University of Zurich, Zurich, Switzerland.

[36] Department of Psychiatry, Boston University School of Medicine. Boston, MA.

[37] VA Boston Healthcare System, Boston, MA.

[38] Department of Psychological and Brain Sciences, Texas A&M University, College Station, Texas, USA.

[40] School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing. China.

[41] Institute of Psychiatry, Faculty of Medicine, University of São Paulo, São Paulo, Brazil.

[42] South African Medical Research Council Unit on the Genomics of Brain Disorders. Department of Psychiatry. Stellenbosch University.

[43] Babeș-Bolyai University, International Institute for Psychotherapy, Cluj-Napoca, Romania.

[44] Department of Global Health and Social Medicine, Harvard Medical School, Boston, MA, USA

Corresponding author: Simonne Lesley Wright* simonnewright87@gmail.com

PROSPERO registration number: CRD42020138638

Keywords: PSYCHIATRY;

Funding: This study was funded by the NRF-NUFFIC scholarship (grant number: 115977)

Competing interests: None to declare.

Data sharing: Not applicable, as this study utilized secondary data. Access to the original datasets can be requested directly from the authors of the primary studies.

Patient consent: Not applicable.

Ethical approval: This study received ethics approval from Stellenbosch University's Health Research Ethics Committee for an exemption (Project ID 29730; Ethics Reference Number X23/12/045).

Author contributorship: SW drafted the manuscript and performed the analysis. SS, EK, and MS supervised the overall conduct of the study. All authors (SLW, EK, PC, JIB, DP, ABW, SEB, DB, LC, MC, GJD, TE, MM, JDF, DG, PG, RG, MH, NH, RJK, JK, CK, JL, RL, CWL, JL, JCW, CM, MJN, SBN, MO, TMO, LO, NP, EP, PR, RR, MS, JMS, US, BS, AAV, YZ, EPD, FLN, SS, and MS) contributed to the writing, review, and editing. All authors approved the final manuscript. SW acts as the guarantor.

Acknowledgments: None to declare.

ABSTRACT

Background

Available empirical evidence on participant-level factors associated with dropout from psychotherapies for posttraumatic stress disorder (PTSD) is both limited and inconclusive. More comprehensive understanding of the various factors that contribute to study dropout from cognitive behavioral therapy with a trauma focus (CBT-TF) is crucial for enhancing treatment outcomes.

Objective

Using an individual participant data meta-analysis (IPD-MA) design, we examined participant-level predictors of study dropout from CBT-TF interventions for PTSD.

Methods

A comprehensive systematic literature search was undertaken to identify randomized controlled trials comparing CBT-TF with waitlist control, treatment-as-usual, or another therapy. Academic databases were screened from conception till January 11, 2021. Eligible interventions were required to be individual, and in-person delivered. Participants were considered dropouts if they did not complete the posttreatment assessment.

Findings

The systematic literature search identified 81 eligible studies (n=3330). Data were pooled from 25 available CBT-TF studies comprising 823 participants. Overall, 221 (27%) of the 823 dropped out. Of 581 civilians, 133 (23%) dropped out, as did 75 (42%) of 178 military personnel/veterans. Bivariate and multivariate analyses indicated that military personnel/veterans (RR 2.37) had a significantly greater risk of dropout than civilians. Furthermore, the chance of dropping out significantly decreased with advancing age (continuous; RR 0.98).

Conclusions

These findings underscore the risk of premature termination from CBT-TF among younger adults and military veterans/personnel.

Clinical implication

Understanding predictors can inform the development of retention strategies tailored to at-risk subgroups, enhance engagement, improve adherence, and yield better treatment outcomes.

What is already known on this topic

Psychotherapeutic interventions, particularly CBT-TF, are extensively researched and highly effective for treating PTSD, making them the most recommended treatments. However, high dropout rates are a significant concern, and empirical evidence on factors influencing dropout is limited and inconclusive.

What this study adds

This study provides evidence that military personnel and veterans are at a significantly higher risk of dropping out of CBT-TF compared to civilians. Additionally, the likelihood of dropout decreased with advancing age.

How this study might affect research, practice, or policy

The findings highlight the need for tailored retention strategies for younger adults, and military personnel/veterans in CBT-TF to enhance engagement and adherence, improving treatment outcomes for these at-risk groups.

BACKGROUND

Posttraumatic stress disorder (PTSD) is considered a global public health priority due to the significant burden it places on individuals and society (1). Several psychotherapies have demonstrated efficacy for PTSD with moderate to large effect sizes but high dropout rates are concerning (2).

A recent meta-analysis reported dropout rates ranging from 14% to 22% across psychotherapy trials for PTSD (3). Studies focusing on military veterans have reported considerably higher dropout rates, ranging from 31% to 39% (4-6).

Psychotherapeutic interventions embedded in a framework of cognitive behavioral therapy with a trauma focus (CBT-TF) have been extensively researched and proven highly effective for PTSD (7). CBT-TF is defined as a range of therapeutic approaches that are designed to assist individuals with PTSD and early traumatic stress symptoms by targeting and modifying thoughts, beliefs, and behaviors (8). By employing exposure, cognitive restructuring, and anxiety management techniques, CBT-TF aims to create a safe environment for patients to confront their traumatic memories and modify dysfunctional thoughts and emotions (8). Among these are prolonged exposure therapy (PE; 9), cognitive processing therapy (CPT; 10), narrative exposure therapy (NET; 11), and brief eclectic psychotherapy (BEP; 12), which share common elements.

Predictors of dropout from CBT-TF trials have been inconsistent and underpowered. One study found male gender predicted dropout (13), whereas another found female gender did (14). Dropout risk decreased with advancing age in some studies (6, 15) but increased in another (16). Lower education (17, 18) and shorter military service duration (4) are associated with higher dropout.

Some evidence suggests marital status (13, 17), medication use (19), and exposure to multiple traumas (19) are not related to dropout. Some studies found higher baseline PTSD severity associated with higher dropout (20, 21); others have not (19, 22). Similarly, elevated baseline depression scores predicted higher dropout in a few studies (21, 23) but not in others (17, 18). Findings on comorbid alcohol and substance use disorder and dropout are similarly inconsistent (24).

Randomized controlled trials (RCTs) often have small samples and, consequently, low statistical power to detect meaningful associations between predictors and outcomes (25). This can undermine the value of predictor analyses in individual studies, ultimately rendering them unreliable. Aggregating data from RCTs typically provides only summarized study-level information. Individual Participant Data Meta-Analysis (IPD-MA) combines harmonized data from multiple studies into a single dataset, offering enhanced statistical power for more precise estimates and better detection of significant associations (25). The enhanced statistical power allows more precise predictor estimates and improves the detection of significant associations. IPD-MA is gaining popularity with the growing focus on data sharing (26).

OBJECTIVE

The primary objective was to investigate sociodemographic and clinical predictors of study dropout in CBT-TF interventions for PTSD using an IPD-MA approach.

HYPOTHESES

Based on the preponderance of findings from prior individual studies, we hypothesized that higher risk of dropout would be associated with (1) military service/veteran (versus civilian) status, (2) lower educational attainment, and (3) younger age. Analyses of other predictors reported in individual investigations were considered exploratory, given the mixed results for those variables across those studies.

METHODS

Eligibility Criteria

Study inclusion was restricted to RCTs comparing a CBT-TF intervention to any comparison group (e.g., waiting list control, treatment-as-usual, or another psychological intervention). We excluded pharmacotherapy-based comparison groups. The interventions were required to be individual therapy and delivered in person. Studies comprised adults (> 17 years old) with PTSD. In each study, a minimum of 70% of the study sample had to be diagnosed with PTSD according to any version of the Diagnostic or Statistical Manual of Mental Disorders (27) or the International Classification of Diseases (28). Due to the substantial

prevalence of comorbidity in persons with PTSD, we placed no restriction on the co-occurrence of psychiatric or physical conditions (29).

Search Strategy and Study Identification

An existing psychotherapy trials database for PTSD, which included studies published from conception till May 1, 2018, was obtained from the Cardiff University Traumatic Stress Research Group. We subsequently updated the search to include articles published until January 11, 2021. The screened academic databases included PubMed, EMBASE, PsycINFO, PTSDpubs, and CENTRAL (refer to Appendix 1). Searches incorporated terms related to PTSD, trauma, and psychotherapy. Authors contacted for their participant-level datasets were asked if they had any additional studies that might meet study inclusion. Furthermore, we searched past systematic reviews for unidentified articles that met our study inclusion criteria (30, 31). The titles and abstracts of all hits identified in the academic search were independently examined by two reviewers (SLW and DP for the initial screening and SLW and ABW for the update). Both reviewers then independently screened the included full texts. A third team member (MS) resolved any uncertainties surrounding study inclusion. This review was reported in line with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) IPD Statement (32). Refer to Appendix 2 for the PRISMA study selection process.

Data Collection

Primary authors of studies that met the final inclusion criteria were emailed to request access to their anonymized, participant-level datasets. We used the email contact details available in the study's publication and a more recent email address when available online on academic websites or in more recent publications. We sent six reminder emails before reaching out to another two co-authors

Data sharing and storage of the participant-level data complied with the European General Data Protection Regulation (Regulation [EU] 2016/679).

Data Extraction

The outcome of interest was study dropout from CBT-TF s for PTSD. A list of the definitions of these CBT-TF protocols is provided in Appendix 3. Participants were considered study dropouts if they did not

complete the posttreatment assessment, allowing us to retain data from the maximum number of available participants. This made it possible to keep the dropout definition consistent across the included studies. Posttreatment assessment refers to the assessment conducted directly after completion of the treatment protocol. Putative predictors included years of age (continuous), years of education, gender (male or female), marital status (married or unmarried), divorced versus other (single/married/cohabiting), using psychotropic medication (no or yes), PTSD total severity score, intrusion severity score, avoidance severity score, hyperarousal severity score, comorbid substance use problem (abuse or dependence including alcohol; no or yes), comorbid Major Depressive Disorder (MDD; no or yes), psychiatric comorbidity (substance use, mood or anxiety disorder; no or yes), and population (military personnel/veterans or civilian).

Risk of Bias

The Cochrane Risk of Bias 2 tool (33) was used to assess the risk of bias within the available studies included in these analyses. Two reviewers (DP and SW) rated the risk of bias related to the randomization process (D1), deviations from the intended intervention (D2), and measurement of the outcome (D4). The domains missing outcome data (3) and selection of the reported result (5) were not relevant because the analyses made use of participant-level data. The risk of bias for each domain was rated as *low*, *high*, or *some concerns*.

Data Analysis

Data were only extracted for the CBT-TF intervention groups because we focused on examining predictors of dropout within these intervention groups. Data analysis was conducted in STATA version 17 (34). Once having received the datasets, we extracted sociodemographic and clinical participant-level characteristics. Datasets were then harmonized by converting key variables to a uniform format. Baseline PTSD scores were standardized (transformed into z scores) within each available study before combining the individual datasets into one large, pooled dataset. Sociodemographic data were inconsistently reported across trials. Imputation of data that were completely missing in a study would require estimates based entirely on data from other samples that could not be assumed to be comparable to those from which the

data were missing. Therefore, the probability of data being missing in studies for which a sociodemographic variable was not reported could not be assumed to be related to the outcome variable, and listwise deletion was used rather than imputation (35).

We analyzed the effects of predictors on dropout accounting for the clustering of participants within studies using multilevel analyses. We conducted the analyses in three steps: (1) we conducted a series of multilevel bivariate analyses to assess the RR of each factor at a time (the so-called 'bivariate model'), (2) we repeated the analyses entering all factors simultaneously into the multilevel multivariate model (the 'complete model'), and (3) we simplified the complete model, retaining only those factors in the model that were statistically significant (the 'parsimonious model').

Post hoc power analyses were conducted to assess the statistical power of the predictor analyses. The power calculations were based on the sample sizes, effect sizes (expressed as the natural log of the relative risk), number of included studies, and a significance level of 0.05 for each predictor.

Sensitivity analyses were run to examine the robustness of our findings and potential interaction effects. First, we explored the effect of removing any studies rated to have a high risk of bias on any domain. We then examined the risk of dropping out by age category (18-29, 30-39, 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 years and older). We also reexamined the population variable while independently controlling for baseline PTSD symptom severity as well as by publication year.

We explored the possible interaction effect of MDD. We did not include MDD as a predictor in main bivariate and multivariate analyses due to the small sample. We first ran a multilevel bivariate model for MDD. Second, we included it in the parsimonious model. Finally, we also looked at the risk of dropping out for MDD while controlling for age (continuous) and population independently.

FINDINGS

Study Selection

A total of 81 eligible studies (n=3330) were identified. Fifty-six eligible datasets were not accessible and could not be included in this IPD-MA (see Appendix 4 for the list of eligible studies).

Study Characteristics

Participant-level data from 28 CBT-TF intervention groups from 25 studies(n=823) was pooled. Of these studies, three provided data from two different CBT-TF intervention groups for analysis, and both were included in the current study. Study characteristics and intervention details are presented in Appendix 5.

Overall, 221 (27%) participants of 823 dropped out. Of 581 civilians, 133 (23%) dropped out, as did 75 (42%) of 178 military personnel/veterans. The mean (SD) number of treatment sessions completed for participants who dropped out of the study without completing the posttreatment assessment was 4.91 (4.28; n=164) compared to 13.66 (5.16; n=348) for study completers. On average, 13 treatment sessions were offered between the baseline and first posttreatment assessment. Participants who dropped out attended 35% of treatment sessions offered, whereas study completers attended 88% of treatment sessions offered. A summary of participant characteristics is presented in Appendix 6.

Risk of Bias

Some concerns arose in (D1) Randomization process, and (D2) Deviations from intended interventions. In D1, 10 studies were rated with *some concerns* because of baseline differences. Bias in D2 was attributed to some uncertainty due to slight deviations in protocol adherence or insufficient information in 7 studies. No studies were rated as *high* risk of bias on these two domains. All studies were rated *low* risk of bias on (D4) Measurement of the outcome because the outcome was study dropout (see Appendix 7 for risk of bias ratings).

Predictors of Dropout in CBT-TF Treatment for PTSD

The results of the multilevel bivariate, multivariate, and parsimonious analyses of participant-level predictors and dropout are presented in Table 1. Results from bivariate analyses indicated that the chance of dropping out decreased with increasing age (RR 0.98; p=.010). The chance of dropping out was significantly higher for military personnel/veterans (RR 1.94; p=.045) than for civilians (population).

Other predictors were not significant. Under the multivariate model, age (RR 0.98; p=.003) and population (RR 1.87; p=.017) remained statistically significant predictors of study dropout. Under the

parsimonious model, both age (RR 0.98; *p*=.001) and population (RR 2.37; *p*=.000) remained statistically significant predictors of study dropout.

We explored the effect of removing the one study rated with a high risk of bias (36). Results from this multilevel multivariate analysis found both age (RR 0.98; 95% CI 0.97-0.99; *p*=.001) and population (RR 2.37; 95% CI 1.51-3.71; *p*=.000) remained statistically significant predictors of dropout. Post hoc power analyses uncovered varying degrees of statistical power for the predictors examined. Notably, continuous variables showed lower power while dichotomous variables demonstrated higher power (see Appendix 8).

Table 2 presents the risk of dropout within specific age cohorts, where participants aged 18 to 29 years served as the reference group for the analysis. Compared to participants in the 18 to 29 year age group, the 30 to 39 (*p*=.399), 40 to 49 (*p*=.264), and 50 to 59 (*p*=.098) did not differ significantly. The risk of dropping out only differed significantly between the 18 to 29 group and the 60 to 69 (*p*=.043) year age group. There was a slight increase in risk of dropping out for participants aged 70 and older (*p*=.186).

When controlling for baseline PTSD symptom severity, population (RR 1.94; 95% CI: 1.04-3.64; *p*=.038) remained a statistically significant predictor, as well as when controlling for publication year (RR 2.01; 95% CI: 1.02-3.95; *p*=.043).

We explored the risk of dropout between patients with and without baseline comorbid MDD. We did not include comorbid MDD in the main predictor analyses due to the small sample (n=360). The results of the sensitivity analysis appear in Table 3. Multilevel bivariate analysis found a higher risk of dropout in patients with comorbid MDD compared to those without (RR 1.91; *p*=.015). When including comorbid MDD in the parsimonious model, both age (RR 0.97; *p*=.004) and population (RR 1.87; *p*=.003) remained significant, but comorbid MDD no longer did (RR 1.55; *p*=.110). When we removed population, both age (RR 0.98; *p*=.006) and comorbid MDD (RR 1.77; *p*=.032) were significant. However, when we removed the age variable, only population (RR 1.73; *p*=.009) was significant, and MDD (RR 1.70; *p*=.052) was marginally significant.

DISCUSSION

This study examined factors predicting study dropout in CBT-TF interventions for PTSD using data from 25 RCTs. The overall dropout rate (27%), consistent with previous findings but significantly higher among military personnel and veterans (42%) compared to civilians (23%)(3).

Consistent with earlier research, this study identified limited predictors of treatment dropout (24, 37). This aligns with the broader literature, which has found that commonly examined predictors have limited utility in explaining why patients discontinue therapy (24, 37).

Bivariate and multilevel analyses indicated a significantly greater likelihood of study dropout among military personnel and veterans than civilians. This result remained robust after controlling for PTSD severity, publication year, and comorbid MDD. Post-hoc power analysis confirmed the strong predictive value of population. Higher dropout in military personnel may stem from the unique challenges of combat trauma, lack of support, therapist factors, or comorbid conditions (38, 39).

Initial analysis showed individuals with comorbid MDD were at a higher risk of dropout. This suggests that PTSD patients with comorbid MDD may face additional challenges. However, when controlling for age and population, the effect was non-significant. Caution is needed in interpreting these results due to the small MDD subgroup, and further replication in future studies is necessary.

Findings showed dropout risk decreased with increasing age. While this predictor yielded low power, it remained significant in all analyses, suggesting robustness. Sensitivity analysis revealed no significant differences in dropouts among participants aged 30 to 59 compared to those aged 18 to 29. There was a significant drop in risk among individuals aged 60 to 69, with a small uptick after 70 years, which might be attributed to relatively few participants in this age category. However, we did observe a decreasing trend in p-values across age groups, from 30 to 70 years. These findings align with PTSD (4, 6, 17, 18) and depression research (40). Younger adults may face more challenges in managing various life responsibilities such as childcare, education, and work demands, obstacles that might affect their ability to complete treatment or effectively cope with treatment-related distress (2).

None of the other baseline covariates achieved statistical significance in predicting dropout. Removing studies rated with high risk of bias did not substantially alter the results.

Statistical power was high for variables like marital status, being divorced, PTSD intrusion severity, psychiatric comorbidity, and population. However, power was low for predictors, such as age, education, PTSD severity, avoidance severity, hyperarousal severity, and substance use problems, reducing our ability to detect significant effects. Future RCTs with larger sample sizes are required to increase power in pooled analyses and clarify these relationships.

On average, participants who dropped out in this study only attended 35% of available treatment sessions, whereas posttreatment assessment completers attended 88% of available treatment sessions. This aligns with previous research that found most participants who dropped out did so before the halfway point of the intervention protocol (2, 41). While some participants may drop out due to symptomatic improvement, it is unlikely that only a third of the treatment course would suffice (41).

Interpreting these findings requires acknowledging the study's limitations. A common issue in IPD-MA is inconsistent reporting across studies. Several trauma-related predictors (e.g., frequency, severity, chronicity of trauma; childhood vs. adult-onset trauma) were not included due to inconsistent or absent data. Most studies provided no data on living status, although marital status was available. In contemporary society, these concepts often diverge due to changing social norms, financial factors, or personal choices. Similarly, most studies measured sex/gender with limited options preventing analysis of sexual orientation.

Including pharmacotherapy comparisons in our meta-analysis would have added value, but due to the small number of relevant studies, we excluded them during the design phase of this project to ensure a focused and robust analysis. There was an insufficient number of the different CBT-TF treatment types to compare the dropout rate among them reliably. While examining participant-level predictors in conventional meta-analysis is not possible, this design would be better suited for examining the risk of dropout among different CBT-TF protocols in all the eligible CBT-TF studies. Finally, we only had MDD diagnosis data for a limited proportion of the total sample, restricting our ability to investigate its effect on dropout.

Another area for improvement is the variation in randomization timing across studies. Some studies randomized participants after the baseline assessment, counting those who missed the first session as dropouts. Others deferred randomization until after the first session, potentially lowering dropout rates.

Most studies were not designed to evaluate dropout reasons and rarely reported why patients discontinued. Even when asked, patients may not disclose the true reasons. As a result, this study could not examine dropout reasons. Similar to other IPD-MA studies, obtaining participant-level data provided a significant challenge. Despite the substantial time and effort spent on data collection, lost datasets, data storage in outdated formats (e.g., paper charts or floppy disks), lack of willingness to share, restrictive institutional policies, and other regulatory hurdles, were impediments. As a result, many eligible studies could not be included.

While dichotomous variables demonstrated greater power than continuous variables, overall power for detecting significant moderators was still constrained despite combining participant-level data from 28 CBT-TF intervention groups. This highlights the need for larger sample sizes within individual trials.

This study has notable strengths that contribute to its reliability and comprehensiveness. First, the relatively large overall sample size compared to individual RCTs and conventional meta-analyses is a strength. By utilizing participant-level data, we could delve into individual-level factors, such as age, gender, and other sociodemographic characteristics. While we could not investigate all desired variables, employing an IPD-MA approach enabled us to conduct participant-level predictor analyses with statistical power tailored for such investigations.

Further research is required to explore predictors of non-trauma-focused therapies for PTSD, factors contributing to dropout in military veterans/personnel and younger adults, and therapist factors that may be associated with study dropout including, training in retention and logistical factors (e.g., in-person therapy versus telehealth).

Our definition of dropout aimed to maximize available participant data for a more comprehensive analysis. However, this approach may not fully account for all true completers. Differences in dropout definitions across studies present a significant challenge when seeking to make direct comparisons,

complicating efforts to synthesize findings and draw broader conclusions. Therefore, our study highlights the urgent need for standardized definitions of dropout in future PTSD treatment studies to enhance the comparability and reliability of results.

CLINICAL IMPLICATIONS

Given the higher dropout rates among military personnel and veterans, clinicians may consider additional support measures tailored to their unique challenges. Our findings also suggest that younger adults are more likely to dropout of CBT-TF. Clinicians should explore age-specific engagement strategies to address the particular life challenges that younger adult's face, such as work, education, and childcare responsibilities.

These results highlight the importance of adequate power in study design to identify meaningful predictors of treatment dropout which can inform better intervention strategies. Despite several limitations, this study contributes to a more granular understanding of the factors associated with study dropout in studies investigating CBT-TF interventions for PTSD.

REFERENCES

1. Watson P. PTSD as a Public Mental Health Priority. Curr Psychiatry Rep. 2019;21(7):61.
2. Gutner CA, Gallagher MW, Baker AS, Sloan DM, Resick PA. Time course of treatment dropout in cognitive-behavioral therapies for posttraumatic stress disorder. Psychol Trauma. 2016;8(1):115-21.
3. Lewis C, Roberts NP, Gibson S, Bisson JI. Dropout from psychological therapies for post-traumatic stress disorder (PTSD) in adults: systematic review and meta-analysis. Eur J Psychotraumatol. 2020b;11(1):1709709.
4. Berke DS, Kline NK, Wachen JS, McLean CP, Yarvis JS, Mintz J, et al. Predictors of attendance and dropout in three randomized controlled trials of PTSD treatment for active duty service members. Behav Res Ther. 2019;118:7-17.
5. Goetter EM, Bui E, Ojserkis RA, Zakarian RJ, Brendel RW, Simon NM. A Systematic Review of Dropout From Psychotherapy for Posttraumatic Stress Disorder Among Iraq and Afghanistan Combat Veterans. J Trauma Stress. 2015;28(5):401-9.
6. Kehle-Forbes SM, Meis LA, Spoont MR, Polusny MA. Treatment initiation and dropout from prolonged exposure and cognitive processing therapy in a VA outpatient clinic. Psychol Trauma. 2016;8(1):107-14.
7. Hamblen JL, Norman SB, Sonis JH, Phelps AJ, Bisson JI, Nunes VD, et al. A guide to guidelines for the treatment of posttraumatic stress disorder in adults: An update. Psychotherapy (Chic). 2019;56(3):359-73.
8. International Society for Traumatic Stress Studies. ISTSS Guidelines Position Paper on Complex PTSD in Adults.; 2019.
9. Foa E, Hembree EA, Rothbaum BO, Rauch S. Prolonged Exposure Therapy for PTSD: Emotional Processing of Traumatic Experiences - Therapist Guide: Oxford University Press; 2019 01 Aug 2019.
10. Resick P, Monson C, Chard K. Cognitive processing therapy for PTSD: A comprehensive manual. New York, NY, US: The Guilford Press; 2017. xv, 312-xv, p.
11. Schauer M, Schauer M, Neuner F, Elbert T. Narrative Exposure Therapy: A Short-Term Treatment for Traumatic Stress Disorders: Hogrefe Publishing; 2011.
12. Gersons BPR, Meewisse ML, Nijdam MJ, Olff M. Protocol Brief Eclectic Psychotherapy for Posttraumatic Stress Disorder (BEPP): Center for Psychological Trauma, Department of Psychiatry, Academic Medical Center at the University of Amsterdam, and Arq Psychotrauma Expert Group.; 2011.
13. van Minnen A, Arntz A, Keijsers GP. Prolonged exposure in patients with chronic PTSD: predictors of treatment outcome and dropout. Behav Res Ther. 2002;40(4):439-57.
14. Eftekhari A, Ruzek JI, Crowley JJ, Rosen CS, Greenbaum MA, Karlin BE. Effectiveness of national implementation of prolonged exposure therapy in Veterans Affairs care. JAMA Psychiatry. 2013;70(9):949-55.
15. Rauch SAM, Venners MR, Ragin C, Ruhe G, Lamp KE, Burton M, et al. Treatment of posttraumatic stress disorder with prolonged exposure for primary care (PE-PC): Effectiveness and patient and therapist factors related to symptom change and retention. Psychol Serv. 2023;20(4):745-55.
16. Alpert E, Carpenter JK, Smith BN, Woolley MG, Raterman C, Farmer CC, et al. Leveraging observational data to identify in-session patient and therapist predictors of cognitive processing therapy response and completion. J Trauma Stress. 2023;36(2):397-408.

17. Mott JM, Mondragon S, Hundt NE, Beason-Smith M, Grady RH, Teng EJ. Characteristics of U.S. veterans who begin and complete prolonged exposure and cognitive processing therapy for PTSD. J Trauma Stress. 2014;27(3):265-73.
18. Rizvi SL, Vogt DS, Resick PA. Cognitive and affective predictors of treatment outcome in Cognitive Processing Therapy and Prolonged Exposure for posttraumatic stress disorder. Behav Res Ther. 2009;47(9):737-43.
19. Taylor S, Thordarson DS, Maxfield L, Fedoroff IC, Lovell K, Ogrodniczuk J. Comparative efficacy, speed, and adverse effects of three PTSD treatments: exposure therapy, EMDR, and relaxation training. J Consult Clin Psychol. 2003;71(2):330-8.
20. Back SE, Killeen T, Badour CL, Flanagan JC, Allan NP, Ana ES, et al. Concurrent treatment of substance use disorders and PTSD using prolonged exposure: A randomized clinical trial in military veterans. Addict Behav. 2019;90:369-77.
21. Zayfert C, Deviva JC, Becker CB, Pike JL, Gillock KL, Hayes SA. Exposure utilization and completion of cognitive behavioral therapy for PTSD in a "real world" clinical practice. J Trauma Stress. 2005;18(6):637-45.
22. Belleau EL, Chin EG, Wanklyn SG, Zambrano-Vazquez L, Schumacher JA, Coffey SF. Pre-treatment predictors of dropout from prolonged exposure therapy in patients with chronic posttraumatic stress disorder and comorbid substance use disorders. Behav Res Ther. 2017;91:43-50.
23. Bryant RA, Moulds ML, Guthrie RM, Dang ST, Nixon RD. Imaginal exposure alone and imaginal exposure with cognitive restructuring in treatment of posttraumatic stress disorder. J Consult Clin Psychol. 2003;71(4):706-12.
24. Kline AC, Otis NP, Norman SB, Hunt WM, Walter KH. Dropout in a clinical trial for comorbid PTSD and MDD among US service members: Are pretreatment characteristics predictive? Psychotherapy Research. 2024:1-13.
25. Riley RD, Lambert PC, Abo-Zaid G. Meta-analysis of individual participant data: rationale, conduct, and reporting. BMJ. 2010;340:c221.
26. Barbui C. Sharing all types of clinical data and harmonizing journal standards. BMC Med. 2016;14:63.
27. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Arlington, VA, USA.: American Psychiatric Publishing; 2013.
28. World Health organization. International classification of diseases for mortality and morbidity statistics. 2018.
29. Whitworth JW, Scioli ER, Keane TM, Marx BP. Physical inactivity, cigarette smoking, and psychiatric comorbidity among veterans with posttraumatic stress disorder. Health Psychol. 2022;41(3):169-77.
30. Cusack K, Jonas DE, Forneris CA, Wines C, Sonis J, Middleton JC, et al. Psychological treatments for adults with posttraumatic stress disorder: A systematic review and meta-analysis. Clin Psychol Rev. 2016;43:128-41.
31. Lewis C, Roberts NP, Andrew M, Starling E, Bisson JI. Psychological therapies for post-traumatic stress disorder in adults: systematic review and meta-analysis. Eur J Psychotraumatol. 2020a;11(1):1729633.
32. Stewart LA, Clarke M, Rovers M, Riley RD, Simmonds M, Stewart G, et al. Preferred Reporting Items for Systematic Review and Meta-Analyses of individual participant data: the PRISMA-IPD Statement. Jama. 2015;313(16):1657-65.

33. Higgins JPT, Savović J, Page MJ, Elbers RG, Sterne JAC. Cochrane Handbook for Systematic Reviews of Interventions version. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al., editors. Assessing risk of bias in a randomized trial: Cochrane Training; 2022.
34. StataCorp. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC; 2021.
35. Van Buuren S. Flexible Imputation of Missing Data. 2nd ed: CRC Press; 2018.
36. Paunovic N. Exposure inhibition therapy as a treatment for chronic posttraumatic stress disorder: A controlled pilot study. Psychology. 2011;2(6):605.
37. Kehle-Forbes SM, Ackland PE, Spoont MR, Meis LA, Orazem RJ, Lyon A, et al. Divergent experiences of U.S. veterans who did and did not complete trauma-focused therapies for PTSD: A national qualitative study of treatment dropout. Behav Res Ther. 2022;154:104123.
38. Sciarrino NA, Bartlett BA, Smith LJ, Martin CE, Williams W. Factors contributing to PTSD treatment dropout in veterans returning from the wars in Iraq and Afghanistan: A systematic review. Psychol Serv. 2022;19(1):183-200.
39. Wells SY, Morland LA, Hurst S, Jackson GL, Kehle-Forbes SM, Jaime K, et al. Veterans' reasons for dropping out of prolonged exposure therapy across three delivery modalities: A qualitative examination. Psychol Serv. 2023;20(3):483-95.
40. Karyotaki E, Kleiboer A, Smit F, Turner DT, Pastor AM, Andersson G, et al. Predictors of treatment dropout in self-guided web-based interventions for depression: an 'individual patient data' meta-analysis. Psychol Med. 2015;45(13):2717-26.
41. Holmes SC, Johnson CM, Suvak MK, Sijercic I, Monson CM, Wiltsey Stirman S. Examining patterns of dose response for clients who do and do not complete cognitive processing therapy. J Anxiety Disord. 2019;68:102120.

Table 1: Baseline Predictors of Dropout in CBT-TF

	Multilevel Bivariate Model				Multivariate Model N (k) = 363 (11)			Parsimonious Model N (k) = 730 (22)		
Participant level predictors	n (k)	RR	95% CI	*p*	RR	95% CI	p	RR	95% CI	p
Age (continuous)	794 (25)	0.98	0.97-1.00	.010*	0.98	0.96-0.99	.003*	0.98	0.97-0.99	.001*
Education (years)	429 (10)	0.97	0.91-1.04	.386	.	.	.	.	.	.
Male gender	822 (28)	0.95	0.66-1.37	.778	1.10	0.66-1.83	.726	.	.	.
Marital status (married)	535 (19)	1.20	0.83-1.72	.328	1.15	0.80-1.65	.463	.	.	.
Divorced versus other (single/married/cohabitating)	548 (19)	0.85	0.56-1.29	.439	.	.	.	.	.	.
Using psychotropic medication	528 (15)	1.09	0.76-1.56	.627	.	.	.	.	.	.
PTSD total severity	793 (27)	1.04	0.91-1.20	.539	1.03	0.86-1.23	.769	.	.	.
PTSD intrusion severity	499 (20)	1.15	0.96-1.37	.119	.	.	.	.	.	.
PTSD avoidance severity	485 (19)	0.93	0.78-1.11	.413	.	.	.	.	.	.
PTSD hyperarousal severity	486 (18)	0.98	0.82-1.16	.782	.	.	.	.	.	.
Substance use problem (abuse/dependence)	434 (12)	1.01	0.59-1.73	.962						
Psychiatric comorbidity (anxiety, depression, substance use problem)	566 (17)	1.34	0.82-2.22	.246	1.01	0.55-1.88	.964	.	.	.
Population (military personnel/veterans)	759 (25)	1.94	1.01-3.73	.045*	1.87	1.12-3.12	.017*	2.37	1.51-3.71	.000*

n = *number of participants; k = number of included study arms*

Table 2: Risk of dropping out by age category (n = 794, k = 25)

Variable	RR	95% CI	z	p
18 to 29 vs 30 to 39 years	0.86	0.61-1.22	-0.84	.399
18 to 29 vs 40 to 49 years	0.81	0.56-1.17	-1.12	.264
18 to 29 vs 50 to 59 years	0.68	0.44-1.07	-1.65	.098
18 to 29 vs 60 to 69 years	0.41	0.17-0.97	-2.02	.043*
18 to 29 vs 70 + years	0.38	0.09-1.60	-1.32	.186

Table 3: Sensitivity Analysis for the Effects of Baseline Comorbid MDD

	Bivariate[3] n (k) = 360 (9)			Parsimonious[3] n (k) = 321 (8)			Multivariate[3] excluding population n (k) = 359 (9)			Multivariate[3] excluding age n (k) =322 (8)		
	RR	95% CI	p	RR	95% CI	p	RR	95% CI	p	RR	95% CI	p
Comorbid MDD[1]	1.91	1.14-3.21	.015*	1.55	0.91-2.65	.110	1.77	1.05-2.99	.032	1.70	0.99-2.90	.052
Age[2]	.	.	.	0.97	0.96-0.99	.004	0.98	0.96-0.99	.006	.	.	.
Population	.	.	.	1.87	1.24-2.84	.003	.	.	.	1.73	1.15-2.62	.009

[1] Major Depressive Disorder; [2] continuous [3] Models were multilevel