

Review

Psychological interventions for adult posttraumatic stress disorder: A systematic review of published meta-analyses

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ABSTRACT

Objective: A large and growing number of published meta-analyses have examined the efficacy of psychological interventions for post-traumatic stress disorder (PTSD). Conclusions drawn from these meta-analyses on treatment efficacy greatly influence clinical practice. This study aimed to provide a comprehensive review of meta-analyses of randomized controlled trials (RCTs) on psychological interventions for adult PTSD, focusing on their content, methodology, and reporting quality.

Method: Systematic database searches were conducted in March 2024 using MEDLINE, PsycInfo, PTSDpubs, Web of Science, and the Cochrane Database of Systematic Reviews. The quality of meta-analyses was assessed using AMSTAR 2. The systematic review was registered on PROSPERO (CRD42020151234).

Results: Overall, 55 meta-analyses with 93 meta-analytic comparisons at treatment endpoint and 28 comparisons at follow-up were included. Meta-analyses most consistently showed superiority of psychological interventions over control conditions. However, beneficial long-term effects exceeding one-month post-treatment were limited to trauma-focused cognitive behavior interventions (TF-CBT) and eye movement desensitization and reprocessing (EMDR). There was a substantial overlap of primary RCTs, indicating redundancy between meta-analyses. Furthermore, the quality of meta-analyses varied substantially.

Conclusions: There is a need to enhance the methodological and reporting quality of meta-analyses, avoid the production of redundant meta-analyses, and conduct more high-quality, large RCTs with long-term assessments.

1. Introduction

Posttraumatic stress disorder (PTSD) is a common and impairing condition with high individual and societal costs. Results from the World Mental Health Surveys indicated a cross-national PTSD lifetime prevalence of 5.6% among trauma-exposed individuals, with half of them reporting persistent symptoms (Koenen et al., 2017). Furthermore, over a third of patients do not respond sufficiently to treatment (Semmlinger et al., 2024), underscoring the need for research on the further development of efficacious psychological treatments for PTSD.

Randomized controlled trials (RCTs) are considered the gold standard in psychotherapeutic research. The growing number of RCTs on the efficacy of psychological interventions for PTSD has been summarized in numerous systematic reviews and meta-analyses, which, in turn, exert significant influence on international treatment guidelines, health care

professionals, and institutions regarding the relative efficacy of different interventions. Current treatment guidelines recommend psychological interventions as the first-line treatment for PTSD (American Psychological Association, 2017; International Society for Traumatic Stress Studies, 2018; National Institute for Health and Care Excellence, 2018; Phoenix Australia, 2022; US Department of Veterans Affairs, & Department of Defense, 2023). In particular trauma-focused cognitive behavior therapy (TF-CBT) protocols such as cognitive processing therapy, cognitive therapy, or prolonged exposure, as well as eye movement desensitization and reprocessing (EMDR) protocols have achieved strong recommendations.

Over the past decades, a large number of meta-analyses on the efficacy of PTSD treatments have been published. To illustrate this development, we compiled the number of hits in Medline and PsycInfo for meta-analyses on PTSD interventions from 2000 to 2024 (see

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Supplement A for details on the search). The results, presented in Fig. 1, suggest an exponential increase in the available meta-analytic evidence. More advanced approaches to aggregate primary data, such as living meta-analytic databases, mega-analyses or individual participant data meta-analyses, and network meta-analyses have emerged in recent years, yet the conventional meta-analysis remains the most widely used approach (Eisenhauer, 2021). Researchers, practitioners, and decision makers alike face increasing difficulty in keeping up with the meta-analytic evidence (Bastian et al., 2010). Readers are challenged to integrate all available information to draw conclusions on findings. This integration may be particularly difficult if results reported in different meta-analyses are inconsistent or even contradictory. For instance, some meta-analyses reported on a significant difference in the efficacy of TF-CBT and EMDR for PTSD (L. Chen et al., 2015 & Khan et al., 2018), whereas other meta-analyses reported no significant differences in the relative efficacy (e.g., Lewis et al., 2020 & Morina et al., 2021). Furthermore, the majority of both original trials and meta-analyses have focused on treatment short-term effects at the end of treatment as opposed to long-term efficacy.

Several approaches have been suggested to summarize evidence in research fields with multiple published meta-analyses that often yield different findings. Mega meta-analyses (e.g., Ferguson et al., 2019) comprise meta-analyses across all trials that have been included in previous meta-analyses in the field. An important limitation is that these analyses inherit all limitations from previous meta-analyses and can only indirectly point towards evidence gaps in previous work. Umbrella reviews (e.g., Leichsenring et al., 2022) frequently select the largest or most recent meta-analysis to draw conclusions for a given field or research question (Aromataris et al., 2015; Fusar-Poli and Radua, 2018). Crucially, even meta-analyses on the same psychological intervention may vary in terms of their specific research question, inclusion criteria, methodological quality, or details of reporting and the largest or most recent meta-analyses might not be the most adequate or representative to answer a given research question. Finally, mega-maps, systematic reviews of reviews, or systematic reviews of meta-analyses (e.g., Saran et al., 2020) provide a narrative summary of available meta-analytic evidence in a given field. Such reviews can inform clinicians and researchers about the current state of evidence, enable them to comprehend inconsistencies across meta-analyses and to assess strengths and limitations of individual meta-analyses. While clinicians are supported in deriving evidence-based treatment recommendations, researchers are further adverted to research gaps as well as methodological limitations of previous work that may be addressed in the future.

To our knowledge, there is currently no comprehensive review of meta-analyses examining the efficacy of psychological interventions for PTSD in adults. To address this gap, we conducted a thorough overview of the breadth and quality of the existing meta-analytic evidence, encompassing both effects at treatment endpoint as well as on mid- and long-term effects. As PTSD has recently evolved into a more diverse diagnosis with the introduction of complex PTSD into the 11th revision

of the International Classification of Diseases (ICD), the review encompasses both meta-analyses on PTSD and complex PTSD treatments following all types of traumatic events.

2. Method

We pre-registered the systematic review on PROSPERO (CRD42020151234). We adhered to the PRISMA 2020 guidelines for systematic reviews (Page et al., 2021).

2.1. Identification and selection of meta-analyses

Medline, PsycInfo, PTSDpubs, Web of Science, and the Cochrane Database of Systematic Reviews were searched from inception to March 12th, 2024, using terms indicative of PTSD, intervention, and meta-analysis with the Boolean operator AND. The complete search strategy is provided in Supplement B. No publication restrictions were applied. We additionally checked the publication status of all PROSPERO records of systematic reviews with meta-analyses on PTSD interventions that were registered before March 12th, 2024, and searched for associated publications on Google Scholar. Finally, we conducted a manual search of the reference lists from included meta-analyses and relevant reviews.

We considered meta-analyses as eligible if they compared a specific psychological intervention for PTSD with any type of control condition or a psychological intervention from a different treatment family (see Supplement C). A minimum of four RCTs were required per meta-analysis to focus on results with adequate power to inform about treatment effects (Morina et al., 2021). Following the inclusion criteria reported in most meta-analyses, we included studies that required clinically relevant PTSD symptoms, even if participants did not necessarily meet full diagnostic criteria for PTSD. Clinically relevant PTSD symptoms included self-reported symptoms exceeding established cutoff values on a self-report measure, partial PTSD diagnosis, or the presence of PTSD symptoms as specified in the inclusion criteria. This approach constitutes a deviation from the initial protocol, which required all participants to be diagnosed with PTSD. Nonetheless, we excluded meta-analyses that did not require PTSD symptoms at baseline or that focused solely on trauma exposure. We excluded meta-analyses on medical interventions (including augmentation strategies) and interventions that focused on the prevention of PTSD or on exclusive PTSD symptoms (e.g., trauma-related nightmares or anger). Furthermore, we excluded individual participant data meta-analyses as study-level meta-analyses are restricted to studies that provided complete data and we included only aggregated effect sizes from pairwise comparisons in network meta-analyses. Meta-analyses were required to be based on a systematic literature search and we excluded meta-analyses on pre-selected primary trials. Finally, we excluded comparisons within the same treatment family (e.g., two TF-CBT interventions) given that the comparative efficacy within treatment families was not the focus of the review. We included meta-analyses irrespective of the delivery format of

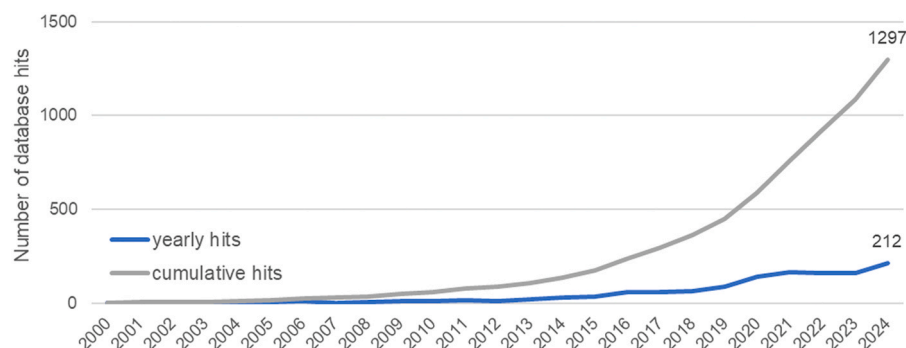


Fig. 1. Published Meta-analyses on Psychological Interventions for Posttraumatic Stress Disorder per Year as Indexed in Medline/PsycInfo.

interventions. All eligible meta-analyses were included irrespective of overlapping datasets, to create a comprehensive overview of the available evidence. For the same purpose, we did not verify the eligibility of primary RCTs for the purpose of the individual research questions.

Title and abstract of all hits were screened by two independent reviewers using Rayyan (Ouzzani et al., 2016). Any discrepancies were rated by a third reviewer and discussed until consensus was reached. Full texts were assessed independently by the same reviewers.

2.2. Data extraction

A data extraction form was designed a priori in an Excel spreadsheet to document all relevant information. Two independent investigators extracted information on publication details, sample characteristics (i.e., age, gender, trauma type, number of participants in trial and in active intervention group), psychological intervention (i.e., delivery format and sessions) and control condition characteristics as well as relevant statistics (i.e., effect size, 95 % confidence interval [CI], I^2). For the comparisons of TF-CBT and EMDR, we coded EMDR as the experimental condition and TF-CBT as control to facilitate easier comparability. For the same reason, for comparisons of interventions with Present-Centered Therapy (PCT), the latter one was coded as control condition although some meta-analyses evaluated it as the active intervention arm. Given that some publications report multiple outcome measures, we selected those analyses with a higher number of included RCTs for the same comparison. For ease of comparability, all effect sizes were converted into Hedges' g and positive effect sizes always favor the first-mentioned treatment condition. Hedges' g may be interpreted according to Cohen's guidelines with 0.20 reflecting a small, 0.50 a medium and 0.80 a large

effect (Cohen, 1988). Results at treatment endpoint included all assessments conducted up to one month post-treatment. In line with previous meta-analytic research, mid-term follow-ups were defined as outcome assessments one to five months after treatment endpoint and long-term follow-ups were defined as outcome assessments at least six months after treatment endpoint (Hoppen et al., 2023). We further determined the percentage of unique RCTs in each meta-analytic comparison as indicator of the extent of overlap between and redundancy of meta-analyses. Trials were classified as unique if they were included in only one meta-analytic comparison. Finally, we quantified the number of meta-analyses to which each primary trial contributed to estimate the impact of primary RCTs on meta-analytic results. In case of missing data, we contacted the authors of meta-analyses to obtain additional information, followed by a reminder if no response was received.

2.3. Reporting quality assessment

The reporting quality of included meta-analyses was assessed by two independent reviewers using AMSTAR 2 (A Measurement Tool to Assess systematic Reviews; Shea et al., 2017), a 16-item instrument to assess the methodological and reporting quality of systematic reviews and meta-analyses. We used the individual domains to provide an overview of strengths and limitations of individual meta-analyses.

3. Results

After examining 1825 unique abstracts, 264 full-text publications were reviewed (see Fig. 2). Most meta-analyses were excluded because they did not focus on the treatment of clinically relevant PTSD

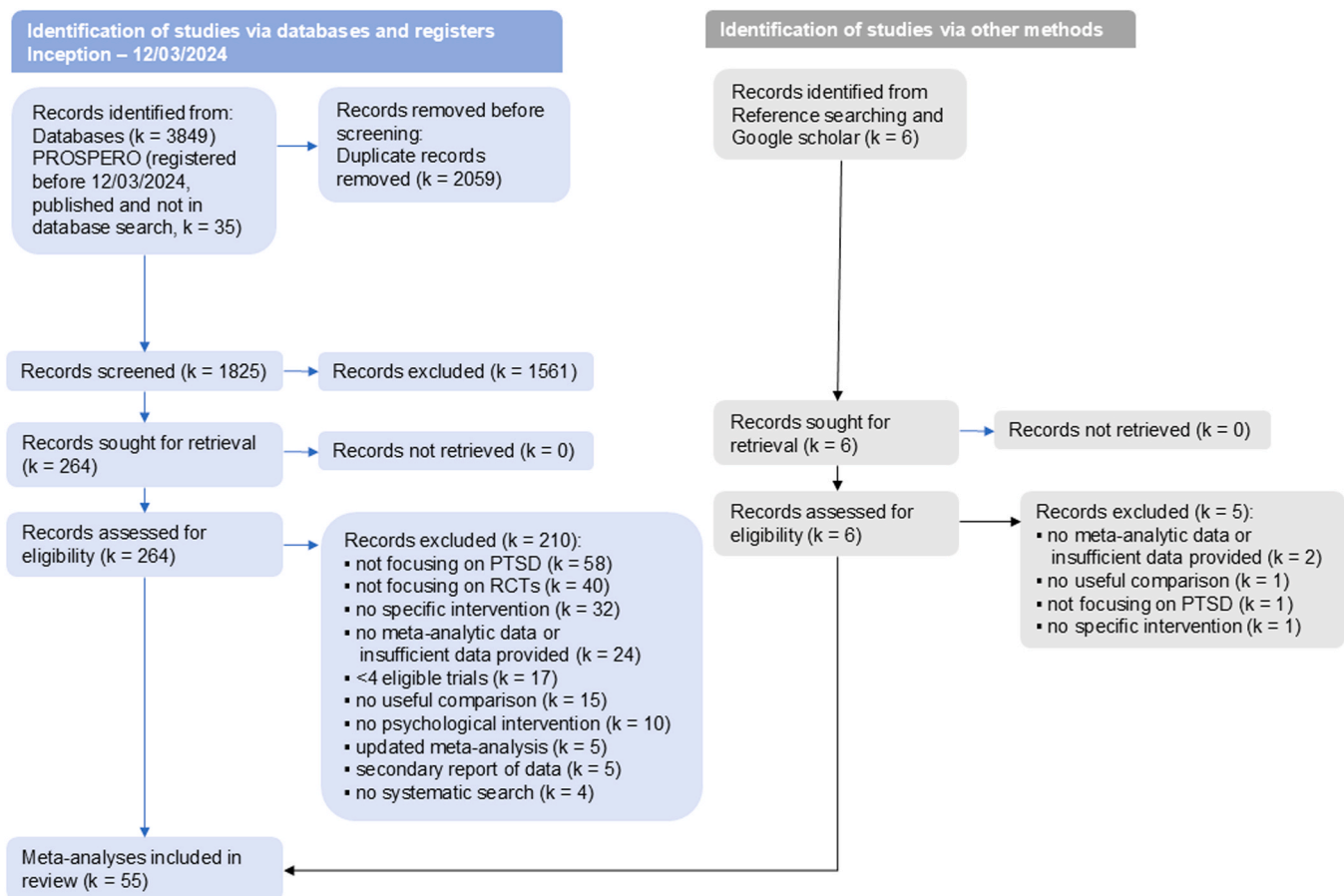


Fig. 2. Flow Chart of Selection Process of Meta-Analyses on Randomized Controlled Trials. Note. PTSD = posttraumatic stress disorder; RCT = randomized controlled trial.

symptoms ($k = 58$) or RCTs ($k = 40$). Supplement D presents a list of excluded meta-analyses with reasons for exclusion. The final review resulted in 55 eligible publications of meta-analyses including 93 relevant comparisons of treatment effects at treatment endpoint and 28 comparisons for mid- and long-term treatment efficacy. Additional information was obtained from authors for two meta-analyses (Carpenter et al., 2018; Gerger et al., 2021). In total, 91 % of meta-analyses were published in the past decade, whereas 49 % were published in the past five years.

3.1. Characteristics of included meta-analyses

A total of 62 meta-analytic comparisons focused on TF-CBT interventions (53 at treatment endpoint and nine at follow-up). Besides overarching meta-analyses on overall TF-CBT approaches, more meta-analyses focused on exposure-based interventions such as prolonged exposure (18 comparisons) and narrative exposure therapy (10 comparisons) than cognitive interventions such as cognitive processing therapy (10 comparisons) and cognitive therapy (4 comparisons). EMDR was covered by 31 meta-analytic comparisons. Non-trauma-focused interventions included mindfulness-based, meditation, and yoga interventions (13 comparisons), interpersonal psychotherapy, CBT without trauma focus, hypnotherapy, and seeking safety (one comparison each). The majority of meta-analyses did not require a formal PTSD diagnosis but included trials based on the presence of self-reported PTSD symptoms. Different delivery formats were only reported for TF-CBT comparisons, namely virtual reality, internet-based, distance-delivered (i.e., internet-based, via telephone or videoconferencing), or group setting. The mean age of participants ranged from 20.3 to 53.5 years, proportion of female participants from 0 % to 98.8 %. While the majority of meta-analytic comparisons included samples with diverse traumatic experiences, ten comparisons focused on a specific population, namely military personnel and refugees. Passive control conditions included waitlist or minimal attention, active control conditions included supportive counseling, treatment as usual, or health education. Details on each included meta-analytic comparison are presented in Table 1.

3.2. Meta-analyses on intervention effects at treatment endpoint

3.2.1. Trauma-focused cognitive behavior therapy

Fig. 3 displays effect sizes of meta-analyses at treatment endpoint as well as the reporting quality. As expected, meta-analyses including more trials with passive control conditions found larger treatment effects than meta-analyses with active control conditions. All meta-analyses that compared TF-CBT to active controls and/or PCT found very similar results ranging from $g = 0.45$ (95 % CI 0.09–0.81; Lewis et al., 2020) to $g = 0.55$ (95 % CI -0.08–1.17; Diehle et al., 2014), it is noteworthy that this effect size was not significant, except for U.S. Tran and Gregor (2016) that found a smaller effect of $g = 0.17$ (95 % CI 0.00–0.32). The only other non-significant results were obtained by Morina et al. (2021), which was the only meta-analysis that included other trauma-focused interventions as control conditions, namely dialogical exposure therapy and imagery rescripting ($g = 0.08$; 95 % CI -0.03–0.20). Internet-based or distance-delivered TF-CBT interventions yielded effect sizes ranging from $g = 0.61$ (95 % CI 0.29–0.93; Simon et al., 2021) to $g = 0.95$ (95 % CI 0.46–1.43; Küster et al., 2016) compared to passive and active control conditions. Finally, there was only one meta-analysis on group-based TF-CBT that found a large effect size of $g = 1.02$ (95 % CI 0.78–1.26) compared to passive and active control conditions (Lewis et al., 2020).

The influence of passive vs. more active control conditions was less clear in meta-analyses on exposure interventions. One explanation may be that meta-analyses used different inclusion criteria. While some included only trials on prolonged exposure, others also included individual trials on different exposure-based interventions such as written

exposure or narrative exposure therapy. Among the comparisons of face-to-face exposure to primarily passive control conditions, the lowest effect sizes was reported by Karatzias et al. (2019); $g = 1.05$; 95% CI 0.58–1.52) who included samples with a minimum age of 16 years and at least one additional symptom of complex PTSD. Virtual reality delivery or written exposure appeared to yield smaller effect sizes relative to face-to-face conditions. An exception is the meta-analysis by Gerger et al. (2021) that found a large effect size for enhanced writing ($g = 1.00$; 95 % CI 0.69–1.30). This meta-analysis focused on both participants with clinician-rated full diagnosis as well as self-reported elevated symptoms of PTSD.

Two meta-analyses on the efficacy of narrative exposure therapy were conducted on specific trauma populations, namely war- and conflict-related trauma in civilians and refugees (Dossa and Hatem, 2012; Nosè et al., 2017). Their results showed smaller effect sizes ($g = 0.72$; 95 % CI 0.12–1.33 and $g = 0.78$; 95 % CI 0.38–1.18) than meta-analyses on mixed trauma populations (g 's = 1.03–1.55) compared to passive and active control conditions. All meta-analyses produced significant results, with the smallest effect found by Wei and Chen (2021); $g = 0.34$; 95% CI 0.02–0.65). This meta-analysis and the one by Raeder et al. (2023); $g = 0.79$; 95% CI 0.04–1.54) included other trauma-focused interventions as control condition, namely trauma counseling and Emotional Freedom Techniques. The main difference between these two meta-analyses is the inclusion of trials with young former child soldiers and genocide orphans (mean age < 20 years) in Wei and Chen (2021), which may account for the difference in effect size.

The effect size (Hedges' g) in the meta-analysis on cognitive processing therapy that focused only on passive control conditions (Lenz et al., 2014) was over 0.4 larger than in meta-analyses that included active control conditions or other treatment comparators ($g = 1.79$ vs. $g = 0.29$ –1.35). The only non-significant effect was reported by Raines et al. (2024); $g = 0.57$; 95% -0.21–1.36) that focused on military personnel and veterans. All meta-analyses on cognitive therapy were based on the minimum number of four trials each. It is noteworthy that the meta-analysis by van Dis et al. (2020) focused on "cognitive restructuring", which in one case included cognitive processing therapy.

3.2.2. EMDR and other trauma-focused interventions

The meta-analysis by Bradley et al. (2005) was chronologically the first to report on aggregated effects of psychological interventions for PTSD and the authors reported an extremely wide 95 % CI for EMDR treatment effects ranging from $g = -0.96$ –3.46. Effect sizes for meta-analyses including passive control conditions ranged from $g = 0.82$ (95 % CI -0.10–1.74; Kitchiner et al., 2019) to $g = 1.26$ (95 % 0.51–2.01; Karatzias et al., 2019) with Kitchiner et al. (2019) focusing on military-related trauma. From eight meta-analyses that compared EMDR to TF-CBT, two meta-analyses found a superiority of EMDR (L. Chen et al., 2015; Khan et al., 2018) whereas the remaining found no significant differences. The largest difference was reported by Khan et al. (2018); $g = 0.43$; 95% CI 0.12–0.73 and it is noteworthy that over a third of included trials were conducted with youth.

Only one meta-analysis (Kip et al., 2023) reported on the efficacy of imagery rescripting compared to TF-CBT and EMDR and reported no significant differences ($g = -0.15$; 95 % CI -0.38–0.08).

3.2.3. Non-trauma-focused interventions

Most meta-analyses on non-trauma-focused (non-TF) interventions focused on mindfulness-based interventions including mantra repetition, meditation, and body- and movement-oriented interventions such as yoga. Two meta-analyses included all kinds of the above-mentioned interventions (Hilton et al., 2017; Hopwood and Schutte, 2017), with the remaining setting a more specific focus or conducting individual analyses for the different approaches (Gallegos et al., 2017). Overall, meta-analytic results were larger for body- and movement-oriented interventions. However, most of the meta-analyses employed less active

Table 1
 Characteristics of Included Meta-analyses at Treatment Endpoint (ordered by Control Condition from Passive to Active).

Meta-analysis	k trials (sample)	search & publication range	Control Group	g (95 % CI)	Smallest effect (g)	Largest effect (g)	I ² (%)	Mean age	% female	Specifications
Trauma-Focused Cognitive Behavior Therapy										
<i>Mixed</i>										
Diehle 2014	9 (481)	* –2013 (2002–2011)	PCC	1.56 (1.05; 2.07)	0.06	2.59	82.0	38.22	83.75	number of sessions & format n.r.; mixed trauma; full and partial PTSD (interview or self-report)
Morina 2021	47 (2608)	* –2020 (1989–2019)	PCC	1.23 (1.00; 1.47)	0.10	4.08	85.9	n.r.	n.r.	1–17 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
Kitchiner 2019	10 (524)	* –2018 (1989–2018)	PCC, ACC	1.22 (0.66; 1.78)	–0.29	3.78	86.0	n.r.	7.0	3–30 sessions; military-related trauma; ≥ 70 % with full diagnosis (clinician or interview)
Lewis 2020	51 (1380)	* –2018 (1989–2018)	PCC, ACC	1.32 (1.08; 1.57)	n.r.	n.r.	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
Qureshi 2021	5 (210)	* –2018 (1999–2012)	PCC, ACC	1.24 (0.67; 1.81)	0.72	2.31	72.0	n.r.	n.r.	4–15 individual sessions; majority MVA-related trauma; ≥ 70 % with full diagnosis (method n.r.)
Morina 2021	33 (1717)	* –2020 (1991–2019)	ACC	0.49 (0.33; 0.66)	–0.54	1.74	61.7	n.r.	n.r.	4–18 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
Carpenter 2018	14 (1252)	* –2017 (1991–2015)	ACC, non-TF	0.48 (0.26; 0.71)	0.04	0.99	n.r.	42.90	59.51	group & individual; 4–30 sessions; mixed trauma; full diagnosis (interview or self-report)
Diehle 2014	5 (219)	* –2013 (2002–2012)	ACC, non-TF	0.55 (–0.08; 1.17)	0.20	0.67	79.0	32.33	80.30	number of sessions & session format n.r.; mixed trauma; including one trial on youth; full and partial PTSD (interview or self-report)
Gerger 2014	6 (446)	1980–2010 (1991–2008)	ACC, non-TF	0.48 (0.11; 0.87)	n.r.	n.r.	n.r.	n.r.	n.r.	4–14 individual sessions; mixed trauma; full and subclinical PTSD (interview)
Kitchiner 2019	4 (612)	* –2018 (2007–2018)	PCT	0.50 (0.08; 0.91)	0.10	1.06	80.0	n.r.	62.06	8–12 individual sessions; military-related trauma; ≥ 70 % with full diagnosis (clinician or interview)
Lewis 2020	4 (433)	* –2018 (n.r.)	PCT	0.45 (0.09; 0.81)	n.r.	n.r.	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
U.S. Tran 2016	6 (764)	n.r. (2003–2010)	PCT	0.17 (0.00; 0.32)	–0.51	0.22	15.0	n.r. (21.05–59.4 [†])	58.00 [‡]	number of sessions & format n.r.; mixed trauma, full diagnosis (method n.r.)
Morina 2021	19 (2177)	* –2020 (2003–2020)	non-TF, TF-non-CBT,	0.08 (–0.03; 0.20)	–0.71	0.92	33.5	n.r.	n.r.	4–45 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
<i>Mixed – specific settings</i>										
Küster 2016	8 (891)	* –2015 (2001–2015)	PCC	0.95 (0.46; 1.43)	0.21	2.98	91.3	n.r.	n.r.	internet-based; 6–10 sessions; mixed trauma; full and subclinical PTSD (method n.r.)
Olthuis 2016	6 (460)	n.r. – 2016 (2010–2016)	PCC	0.68 (0.51; 0.86)	0.46	0.92	61.0	n.r.	73.29	distance delivery (telephone, email support); 6–10 modules; mixed trauma; full and subclinical PTSD (interview or self-report)
Sijbrandij 2016	11 (1139)	n.r. (2001–2014)	PCC, ACC	0.71 (0.49; 0.93)	0.14	1.33	64.5	n.r.	n.r.	internet-based (self-help and therapist assisted); 6–10 sessions; mixed trauma; full diagnosis (clinician) and elevated symptoms (self-report)
Simon 2021	10 (608)	1950–2020 (2011–2020)	PCC, ACC ^c	0.61 (0.29; 0.93)	0.05	1.79	69.0	38.93	65.91	internet-based; 3–12 weeks; mixed trauma; including patients ≥ 16 years; ≥ 70 % with full diagnosis (interview or self-report)
Lewis 2020	7 (313)	* –2018 (1997–2016) ^b	PCC, ACC	1.02 (0.78; 1.26)	n.r.	n.r.	n.r.	n.r.	90.50	only group; number of sessions n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
<i>Exposure / Prolonged Exposure</i>										
Bradley 2005	7 (257)	1980–2003 (1989–2002)	PCC	1.26 (0.45; 2.07)	0.22	2.71	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Jericho 2022	9 (757)	* –2020 (1999–2018)	PCC	1.27 (0.86; 1.67)	n.r.	n.r.	n.r.	35.08	52.30	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Forman-Hoffman 2018	14 (885)	* –2017 (2002–2017)	PCC, ACC	1.23 (0.97; 1.50)	0.48	2.01	67.5	34.16	71.09	number of sessions & format n.r.; mixed trauma; > 50 % full diagnosis (method n.r.)
Karatzias 2019	6 (418)	* –2018 (1989–2015)	PCC, ACC	1.05 (0.58; 1.52)	0.24	2.15	79.0	36.70	73.39	9–16 individual sessions; including patients ≥ 16 years; mixed trauma; full PTSD diagnosis + at least on additional cPTSD criterion (interview or self-report)
Lewis 2020	12 (772)	* –2018 (1991–2018) ^b	PCC, ACC	1.59 (1.13; 2.05)	n.r.	n.r.	n.r.	n.r.	n.r.	prolonged exposure; number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)

(continued on next page)

Table 1 (continued)

Meta-analysis	k trials (sample)	search & publication range	Control Group	g (95 % CI)	Smallest effect (g)	Largest effect (g)	I ² (%)	Mean age	% female	Specifications
Bradley 2005	4 (121)	1980–2003 (1991–2003)	ACC	0.83 (0.10; 1.56)	0.28	1.27	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Jericho 2022	4 (89)	* –2020 (2008–2011)	ACC	1.53 (0.78; 2.27)	n.r.	n.r.	n.r.	36.81	71.18	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
van Dis 2020	13 (565)	1980–2019 (1991–2017)	PCC, ACC, non-TF	0.83 (0.47; 1.20)	0.13	4.18	n.r.	n.r.	51.38	including trials on NET; individual or telephone delivery; 1–15 sessions; mixed trauma; full diagnosis (interview)
Belsher 2019	5 (658)	* –2019 (2005–2018)	PCT	0.36 (–0.06; 0.78)	–0.23	2.03	82.0	41.87	54.44	prolonged and virtual reality exposure; group & individual; 10–14 sessions; majority combat-related trauma; ≥ 70 % full diagnosis (clinician or interview)
McLean 2022	31 (2751)	* –2020 (1991–2019)	PCC, ACC, non-TF, MED	0.71 (0.48; 0.95)	–0.06	6.43	n.r.	38.49	59.24	7–14 individual sessions; mixed trauma; full diagnosis (method n.r.)
<i>Exposure / Prolonged Exposure – virtual reality</i>										
Deng 2019	5 (195)	* –2019 (2007–2016)	PCC	0.57 (0.27; 0.86)	0.03	1.30	n.r.	33.00	n.r.	6–14 individual sessions; majority military-related trauma; full diagnosis (method n.r.)
Fodor 2018	4 (n.r.)	* –2017 (2010–2016)	PCC, ACC	0.39 (0.04; 0.74)	0.17	0.65	0.0	n.r.	n.r.	number of sessions n.r.; majority military-related trauma; full diagnosis (method n.r.)
<i>Exposure / Prolonged Exposure – written</i>										
Dawson 2021	10 (287)	n.r.–2020 (2004–2016)	PCC	0.48 (0.08; 0.87)	–0.47	1.44	58.0	20.30	81.24	Expressive writing (Pennebaker); 3–4 sessions; only university settings; mixed trauma; full diagnosis (interview) or elevated symptoms (self-report)
Gerger 2021	4 (202)	* –2020 (2001–2016)	PCC	0.18 (–0.16; 0.52)	–0.17	0.69	33.0	37.73	40.19	Expressive writing (Pennebaker); 3–5 sessions; mixed trauma; full diagnosis (interview or self-report) and elevated symptoms (self-report)
Gerger 2021	10 (943)	* –2020 (2001–2017)	PCC	1.00 (0.69; 1.30)	0.42	3.47	78.0	37.96	72.39	Enhanced writing; 5–11 sessions; mixed trauma; full diagnosis (interview or self-report) and elevated symptoms (self-report)
<i>Narrative Exposure Therapy</i>										
Jericho 2022	5 (322)	* –2020 (2008–2014)	PCC	1.12 (0.52; 1.72)	n.r.	n.r.	n.r.	38.33	62.38	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Raeder 2023	8 (n.r.)	n.r. (2011–2021)	PCC	1.55 (0.67; 2.43)	0.29	4.00	82.8	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; > 75 % diagnosis (method n.r.)
Wei 2021	7 (278)	* –2018 (2010–2014)	PCC	1.03 (0.44; 1.62)	0.25	4.01	79.0	38.05	56.10	3–12 sessions; mixed trauma; session format n.r.; > 80 % diagnosis (interview & self-report)
Dossa 2012	5 (323)	n.r. (2004–2011)	PCC, ACC	0.72 (0.12; 1.33)	–0.02	1.41	79.0	n.r.	n.r.	4–17 sessions; session format n.r.; war- and conflict-related trauma in refugees, asylum-seekers or internally displaced individuals; full and partial diagnosis (method n.r.)
Lewis 2020	8 (241)	* –2018 (2008–2014) ^b	PCC, ACC	1.06 (0.52; 1.61)	n.r.	n.r.	n.r.	n.r.	54.36	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
Nosè 2017	5 (187)	* –2016 (2010–2014)	PCC, ACC	0.78 (0.38; 1.18)	0.27	1.80	37.0	n.r.	n.r.	3–12 individual sessions; refugee population; full and partial PTSD (interview or self-report)
McLean 2022	13 (649)	* –2020 (2004–2019)	PCC, ACC, non-TF, TF-non-CBT	1.30 (0.73; 1.87)	–0.61	4.19	n.r.	38.80	43.77	4–11 sessions; group & individual; mixed trauma; full diagnosis (method n.r.)
Raeder 2023	11 (n.r.)	n.r. (2004–2022)	ACC, non-TF, TF-non-CBT	0.79 (0.04; 1.54)	–0.77	3.78	91.9	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; > 75 % diagnosis (method n.r.)
Wei 2021	11 (599)	* –2018 (2004–2018)	ACC, non-TF, TF-non-CBT	0.34 (0.02; 0.65)	–0.02	1.41	67.0	32.38	45.24	4–11.9 sessions; session format n.r.; mixed trauma; > 80 % diagnosis (interview & self-report)
<i>Cognitive Processing Therapy</i>										
Lenz 2014	5 (262)	2000–2013 (2002–2006)	PCC	1.79 (1.50; 2.08)	1.00	2.65	n.r.	n.r.	58.00 ^a	group & individual; 8–27 sessions; including one trial on youth; mixed trauma; full and partial PTSD (interview or self-report)
Forman-Hoffman 2018	5 (399)	* –2017 (2002–2012)	PCC, ACC	1.35 (0.94; 1.77)	0.92	2.32	71.1	39.44	34.65	number of sessions & format n.r.; sexual abuse/assault & military-related trauma; > 50 % full diagnosis (method n.r.)
Lewis 2020	4 (298)	* –2018 (2002–2012) ^b	PCC, ACC	1.03 (0.61; 1.45)	n.r.	n.r.	n.r.	n.r.	63.00	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
K. Tran 2016	6 (627)	1946–2016 (2002–2013)	PCC, ACC	0.89 (0.62; 1.15)	0.64	1.56	53.0	37.54	83.58	group & individual; 12–27 sessions; sexual abuse and military-related trauma; full diagnosis (interview or self-report)

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Table 1 (continued)

Meta-analysis	k trials (sample)	search & publication range	Control Group	g (95 % CI)	Smallest effect (g)	Largest effect (g)	I ² (%)	Mean age	% female	Specifications
Asmundson 2018	8 (841)	* –2018 (2002–2015)	PCC, ACC, non-TF	1.24 (0.80; 1.67)	0.32	2.45	87.3	n.r.	72.20	group & individual; 4–18 sessions; mixed trauma; full diagnosis (interview or self-report)
Raines 2024	5 (537)	* –2022 (2012–2021)	ACC, non-TF	0.57 (–0.21; 1.36)	n.r.	n.r.	93.1	n.r.	39.84	number of sessions & format n.r.; military personnel & veterans; diagnosis & method n.r.
Belsher 2019	4 (471)	* –2019 (2013–2018)	PCT	0.29 (0.10; 0.48)	0.20	0.66	9.0	44.56	22.90	group & individual; 12–14 sessions; mixed trauma; ≥ 70 % full diagnosis (clinician or interview)
<i>Cognitive Therapy</i> Jericho 2022	4 (204)	* –2020 (2003–2014)	PCC	1.12 (0.48; 1.74)	n.r.	n.r.	n.r.	40.55	48.93	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Lewis 2020	4 (189)	* –2018 (2003–2014)	PCC, ACC	1.33 (0.86; 1.79)	n.r.	n.r.	n.r.	n.r.	51.20	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
van Dis 2020	4 (218)	1980–2019 (1998–2014)	PCC, ACC, non-TF	0.87 (0.50; 1.23)	0.47	1.37	n.r.	n.r.	62.18	2–12 individual sessions; mixed trauma, full diagnosis (interview)
EMDR										
Bradley 2005	4 (142)	1980–2003 (1995–1998)	PCC	1.24 (–0.96; 3.46)	0.31	3.08	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Jericho 2022	10 (599)	* –2020 (1994–2017)	PCC	1.17 (0.76; 1.58)	n.r.	n.r.	n.r.	36.75	39.11	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Morina 2021	7 (396)	* –2020 (1994–2020)	PCC	1.19 (0.76; 1.62)	0.62	1.88	71.9	n.r.	n.r.	2–10 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
Cuijpers 2020	22 (834)	* –2017 (1994–2017)	PCC, ACC	0.85 (0.55; 1.15)	–0.12	2.31	73.0	n.r.	n.r.	1–12 sessions; session format n.r.; including 2 trials on youth; mixed trauma; full diagnosis (method n.r.)
Forman-Hoffman 2018	8 (449)	* –2017 (1997–2016)	PCC, AAC	1.08 (0.35; 1.82)	–0.12	2.94	92	38.33	61.41	number of sessions & format n.r.; mixed trauma; > 50 % full diagnosis (method n.r.)
Karatzias 2019	4 (197)	* –2018 (2002–2015)	PCC, ACC	1.26 (0.51; 2.01)	0.61	2.33	79.0	38.72	42.09	5–10 individual sessions; including patients ≥ 16 years; mixed trauma; full diagnosis + at least on additional cPTSD criterion (interview or self-report)
Kitchiner 2019	4 (92)	* –2018 (1994–2015)	PCC, ACC	0.82 (–0.10; 1.74)	0.03	2.24	76.0	n.r.	0	2–12 individual sessions; military-related trauma; ≥ 70 % with full diagnosis (clinician or interview)
Lewis 2020	11 (415)	* –2018 (1997–2016) ^b	PCC, ACC	1.23 (0.76; 1.69)	n.r.	n.r.	n.r.	n.r.	55.07	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
Bradley 2005	4 (141)	1980–2003 (1994–2003)	ACC	0.75 (–0.16; 1.64)	0.06	0.84	n.r.	n.r.	n.r.	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Morina 2021	11 (449)	* –2020 (1994–2020)	ACC	0.42 (0.22; 0.62)	0.03	0.97	7.3	n.r.	n.r.	2–12 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
McLean 2022	17 (794)	* –2020 (1994–2019)	PCC, ACC, non-TF, TF-non-CBT, MED	1.06 (0.59; 1.53)	0.06	3.06	n.r.	38.73	57.55	2–14.7 individual sessions; mixed trauma; full diagnosis (method n.r.)
Chen 2014	18 (n.r.)	1991–2013 (1994–2011)	PCC, ACC, TF-non-CBT, TF-CBT	0.68 (0.43; 0.93)	0.10	2.42	n.r.	36.67	n.r.	1–12 individual sessions; mixed trauma; full diagnosis (method n.r.)
Rasines-Laudes 2023	20 (926)	1991–2022 (1998–2021)	PCC, ACC, TF-non-CBT, TF-CBT, MED	0.33 (0.12; 0.54)	–0.63	1.66	56.0	37.38	60.40	1–16 sessions; format n.r.; mixed trauma; full diagnosis (method n.r.)
Cuijpers 2020	15 (619)	* –2017 (1999–2016)	TF-non-CBT, TF-CBT	0.27 (0.04; 0.50)	–0.53	1.04	44.0	n.r.	n.r.	1–12 sessions; session format n.r.; mixed trauma; full diagnosis (method n.r.)
Hudays 2022	7 (569)	2010–2020 (2011–2020)	TF-non-CBT, TF-CBT	0.14 (–0.21; 0.48)	–0.05	0.91	75.0	30.19	55.21	4–16 sessions; format n.r.; mixed trauma; full diagnosis (method n.r.)
Chen 2015	11 (424)	1989–2013 (1994–2013)	TF-CBT	0.43 (0.01; 0.86)	–0.71	1.48	75.0	43.34	57.80	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Gerger 2014	6 (186)	1980–2010 (1994–2006)	Exposure	0.27 (–0.08; 0.62)	n.r.	n.r.	n.r.	n.r.	n.r.	1–9 individual sessions (both EMDR & Exposure); mixed trauma, full and subclinical PTSD (interview or self-report)

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Table 1 (continued)

Meta-analysis	k trials (sample)	search & publication range	Control Group	g (95 % CI)	Smallest effect (g)	Largest effect (g)	I ² (%)	Mean age	% female	Specifications
Ho 2012	8 (227)	n.r. (1994–2006)	TF-CBT	0.23 (−0.03; 0.49)	−0.46	0.53	7.6	35.64	n.r.	4.3–14.5 h individual treatment (both EMDR & TF-CBT); mixed trauma; full diagnosis (clinician or self-report)
Khan 2018	11 (547)	1999–2017 (1999–2017)	TF-CBT	0.43 (0.12; 0.73)	−0.63	1.31	62.0	26.36	57.63	number of sessions & format n.r.; including 4 trials on youth; mixed trauma; full diagnosis (interview or self-report)
Lewis 2020	10 (387)	* –2018 (1994–2016) ^b	TF-CBT	0.17 (−0.21; 0.55)	n.r.	n.r.	n.r.	n.r.	66.04	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
Morina 2021	10 (359)	* –2020 (1994–2020)	TF-CBT	0.06 (−0.35; 0.48)	−0.73	1.54	70.8	n.r.	n.r.	4–12 sessions; session format n.r.; mixed trauma; ≥ 70 % with full diagnosis (interview)
Seidler 2006	7 (209)	1989–2015 (1994–2005)	TF-CBT	0.28 (−0.06; 0.63)	−0.70	1.03	n.r.	35.40	65.00	3–9 sessions (both EMDR & TF-CBT); session format n.r.; mixed trauma; full diagnosis (method n.r.)
U.S. Tran 2016	6 (245)	n.r. (1999–2005)	TF-CBT	0.01 (−0.45; 0.48)	−0.62	0.58	70.0	n.r. (21.5–59.4 ^a)	58.03 ^a	number of sessions & format n.r.; mixed trauma; full diagnosis (method n.r.)
Other Trauma-Focused Interventions										
<i>Imagery Rescripting</i>										
Kip 2023	4 (300)	* –2023 (2013–2022)	EMDR, TF-CBT	−0.15 (−0.38; 0.08)	−0.21	0.07	0.0	41.26	59.65	3–12 individual sessions; mixed trauma; mixed trauma; full diagnosis (method n.r.)
Non-Trauma-Focused Interventions										
<i>Non-Trauma-Focused CBT</i>										
Lewis 2020	7 (318)	* –2018 (1991–2016)	PCC, ACC	1.06 (0.73; 1.39)	n.r.	n.r.	n.r.	n.r.	87.39	number of sessions & format n.r.; mixed trauma; ≥ 70 % with full diagnosis (clinician or interview)
<i>Interpersonal Therapy</i>										
Althobaiti 2020	6 (219)	* –2018 (2008–2015)	PCC, ACC, TF-CBT	0.55 (0.01; 1.09)	−0.25	1.44	72.0	n.r. (19.4–40.1 ^b)	90.00 ^b	4–16 sessions; treatment format n.r.; mixed trauma; full diagnosis (not necessarily primary; interview or self-report)
<i>Mindfulness-based, Meditation and Yoga Interventions</i>										
Cramer 2018	5 (206)	* –2017 (2013–2017)	PCC	1.10 (0.47; 1.71)	0.53	2.65	72.0	44.15	36.14	Yoga; 7–32 group sessions; majority military-related trauma; full diagnosis (interview or self-report)
Sun 2021	4 (107)	2010–2019 (2013–2018)	PCC	0.49 (0.10; 0.88)	0.10	0.74	0.0	46.27	10.00	Mindfulness-meditation; 7–36 group sessions; military-related PTSD (method n.r.)
Gallegos 2017	4 (174)	1946–2016 (2013–2015)	PCC, ACC	0.71 (0.02; 1.44)	−0.11	1.41	80.3	n.r.	n.r.	Yoga; 8–16 group sessions; mixed trauma; full diagnosis (interview or self-report)
van de Kamp et al. (2019)	12 (801)	n.r. – 2017 (2005–2017)	PCC, ACC	0.63 (0.35; 0.92)	0.14	1.93	60.0	46.84	n.r.	body- and movement-oriented interventions (mainly yoga); group & self-administered; mixed trauma; full diagnosis (method n.r.)
Hedman-Lageröf 2018	5 (327) ^d	* –2016 (2013–2016)	ACC	0.05 (−0.21; 0.30)	n.r.	n.r.	n.r.	53.28	13.02	Mindfulness-based & meditation; group & individual; 4–9 sessions; military-related trauma; full diagnosis (interview or self-report)
Yu 2022	7 (395)	* –2021 (2013–2020)	ACC	0.83 (0.30; 1.35)	−0.16	2.28	83.5	44.38	n.r.	Yoga; 6–168 sessions; format n.r.; mixed trauma; full diagnosis (method n.r.)
Gallegos 2017	6 (288)	1946–2016 (1985–2016)	PCC, ACC, non-TF, TF-non-CBT	0.37 (0.13; 0.60)	0.04	0.86	0.0	n.r.	n.r.	Meditation; group & individual; 6–22 sessions; military-related PTSD; full diagnosis (interview or self-report)
Liu 2022	9 (644)	* –2021 (2013–2021)	PCC, ACC, non-TF	0.46 (0.31; 0.62)	0.26	0.93	0.0	52.39	28.22	Mindfulness-based stress reduction; 8 sessions (with or without following day-long retreat); partly applied as daily workshops; mixed trauma; full diagnosis (method n.r.)
Zhu 2022	15 (809)	1980–2020 (2013–2020)	PCC, ACC, non-TF	0.41 (0.19; 0.64)	−0.51	1.37	46.2	47.19	44.87	Mind-body exercises; 4–36 sessions; format n.r.; mixed trauma; full diagnosis (psychiatrist-confirmed)
Hilton 2017	8 (553)	* –2015 (2008–2015)	ACC, non-TF	0.41 (0.01; 0.81)	−0.23	1.23	67.3	52.54	37.21	Mindfulness-based, meditation & yoga; 6–12 sessions; session format n.r.; majority military-related trauma; full diagnosis (clinician, interview or self-report)
Sun 2021	15 (1219)	2010–2019 (2011–2019)	ACC, non-TF	0.33 (0.19; 0.46)	0.01	1.41	24.0	50.94 ^a	12.52 ^a	Mindfulness-meditation; group & individual; 2–16 sessions; military-related PTSD (method n.r.)

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Table 1 (continued)

Meta-analysis	k trials (sample)	search & publication range	Control Group	g (95 % CI)	Smallest effect (g)	Largest effect (g)	I ² (%)	Mean age	% female	Specifications
Gallegos 2017	10 (679)	1946–2016 (2011–2016)	PCC, ACC, non-TF, TF-CBT	0.33 (0.18; 0.48)	0.07	1.21	0.0	n.r.	n.r.	Mindfulness-based interventions; group & individual; 2–9 sessions; majority military-related trauma; full diagnosis (interview or self-report)
Hopwood 2017	17 (1048)	n.r. (2008–2016)	PCC, ACC, non-TF, TF-CBT	0.41 (0.22; 0.60)	0.39	1.31	n.r.	44.41	23.16	Mindfulness-based, meditation & yoga; 2–27 h treatment; including 2 trials on youth; majority military-related trauma; full diagnosis (interview or self-report)
Hypnotherapy Rotaru 2016	4 (144)	* –2014 (1989–2013)	PCC, ACC, MED	1.16 (0.81; 1.53)	0.63	2.64	80.9	35.89	51.70	1–14.4 individual sessions; mixed trauma; full diagnosis (method n.r.)

Note. * refers to database inception; ACC = active control conditions; CI = confidence interval; cPTSD = complex posttraumatic stress disorder; EMDR = eye movement desensitization and reprocessing; MED = medication; MVA = motor vehicle accident; NET = narrative exposure therapy; n.r. = not reported; non-TF = non-trauma-focused interventions; PCC = passive control conditions; PCT = Present-Centered Therapy; PTSD = posttraumatic stress disorder; TF-CBT = trauma-focused cognitive behavior therapy; TF-non-CBT = trauma-focused interventions that are not based on cognitive behavior therapy.

^a data refers to the whole sample, whereas meta-analysis was conducted on a subgroup.

^b included studies are assumptions based on the information in the tables of the respective publication. A confirmed list of included trials could not be obtained from the authors.

^c reported comparison to WL, however, two RCTs included usual care as control condition.

^d report on a meta-analysis with k = 6, however, only five comparisons were included.

control groups than meta-analyses on mindfulness-based meditation, and the results yielded rather wide 95 % confidence intervals (Cramer et al., 2018; Gallegos et al., 2017; Yu et al., 2022; van de Kamp et al., 2019). Only one meta-analysis reported no significant aggregated effect and this meta-analysis focused on the efficacy of mindfulness-based interventions and meditation for military-related trauma (g = 0.05; 95 % CI -0.21–0.30; Hedman-Lagerlöf et al., 2018). The comparison of mindfulness-based interventions to other treatments (both with and without a trauma focus) yielded very similar small to moderate effects of g's = 0.33–0.46.

Only one meta-analysis was identified on non-TF CBT interventions, interpersonal therapy, and hypnotherapy, each.

3.3. Redundancy of meta-analyses on intervention effects at treatment endpoint

3.3.1. Overlap of research questions according to PICOs

We extracted the reported research questions according to the PICO framework, which includes the elements Population, Intervention, Comparison, and Outcome, for each meta-analysis (Page et al., 2021, see Supplement E). Several meta-analyses focused on broad research questions including adults meeting PTSD diagnosis irrespective of trauma type (P), any kind of (CBT) intervention (I), any type of control (C) and PTSD symptoms as the main outcome (O). Multiple meta-analytic comparisons were obtained from these publications according to intervention type, and considerable redundancy in research questions was observed across the meta-analyses. Yet, their rationale included among others new statistical approaches (i.e., network meta-analyses; Gerger et al., 2014; Jericho et al., 2022), new moderators of treatment effects (e.g., study quality; Morina et al., 2021), or they comprised reports conducted for governmental agencies (e.g., Forman-Hoffman et al., 2018). Other unique features of overall TF-CBT-related meta-analyses included specific populations (i.e., military personnel; Kitchiner et al., 2019) or specific intervention formats, namely internet-based (Küster et al., 2016; Sijbrandij et al., 2016; Simon et al., 2021) and distance-delivered (Olthuis et al., 2016) TF-CBT. Notably, the meta-analyses on internet-delivered TF-CBT exhibited considerable consistency in their research questions, with publications primarily differing in terms of additional outcomes (e.g., depression symptoms, treatment acceptability), intervention approaches (i.e., non-TF-CBT), or control groups (e.g., face-to-face interventions).

This observation further applied to meta-analyses on specific exposure-based interventions, which included research questions focusing on written exposure (Dawson et al., 2021; Gerger et al., 2021) or virtual reality-based exposure (Deng et al., 2019; Fodor et al., 2018), with both meta-analyses exhibiting considerable overlap in research question, respectively. Meta-analytic comparisons on narrative exposure therapy were included from meta-analyses with broader research questions that included distinct populations such as refugees (Dossa and Hatem, 2012; Nosè et al., 2017) or overall narrative-based interventions (Raeder et al., 2023). Research questions across three meta-analyses on cognitive processing therapy overlapped substantially (Asmundson et al., 2019; Lenz et al., 2014; K. Tran et al., 2016), whereas one meta-analysis focused on the specific population of military personnel (Raines et al., 2024). All meta-analytic evidence on cognitive therapy was derived from subgroup analyses in larger meta-analyses. A strong convergence in research questions was observed across meta-analyses on EMDR, with some focusing on comparisons with TF-CBT only (L. Chen et al., 2015; Ho & Lee, 2012; Hudays et al., 2022; Khan et al., 2018; Seidler & Wagner, 2006) and others on all control conditions (Chen et al., 2014; Cuijpers et al., 2020; Rasines-Laudes and Serrano-Pintado, 2023).

3.3.2. Overlap of included primary trials

Overall, the 55 included meta-analytic comparisons at treatment endpoint covered 265 primary RCTs. The number of included RCTs in

specific comparisons ranged from four to 51 (see Fig. 4 and Supplement F for a list of included RCTs for each meta-analysis) and the number of included participants from 89 to 2751. Across all meta-analyses, the proportion of unique RCTs ranged from 0 % to 100 %. A total of 42 meta-analytic comparisons (45.2 %) included no unique RCT. Primary RCTs were included in 3.3 meta-analytic comparisons on average. A total of 114 primary RCTs were only included in one meta-analysis (43.0 %), 41 were included in two meta-analytic comparisons (15.5 %), 28 in three (14.3 %), and 82 in four or more comparisons (30.9 %) with a maximum of 20 comparisons (Rothbaum et al., 2005). It is noteworthy, however, that the majority of primary RCTs included in more than ten meta-analyses (11/14; 78.6 %) were multi-arm trials.

The nine included meta-analytic comparisons on narrative exposure therapy were performed on 24 primary RCTs published between 2004 and 2022 (5–12 trials were included in each meta-analysis) and had a proportion of unique RCTs ranging from 0.0 % to 27.3 %. Each trial on narrative exposure therapy was included on average in 4.0 meta-analyses. The seven included meta-analyses on cognitive processing therapy were performed on 14 primary RCTs published between 2002 and 2021 with a proportion of unique RCTs ranging from 0.0 % to 40.0 %. Trials on cognitive processing therapy were included on average in 2.9 meta-analyses. The three meta-analyses on cognitive therapy were based on only six primary RCTs published between 1989 and 2014 with no meta-analysis including a unique RCT. Furthermore, each trial on cognitive therapy contributed to 6.5 meta-analyses on average. Meta-analyses on EMDR were based on 50 primary RCTs published between 1994 and 2020, which were included in 5.0 meta-analyses on average. The proportion of unique RCTs ranged from 0.0 % to 28.6 %. Regarding the comparison of EMDR and TF-CBT, meta-analyses were based on 20 primary RCTs, which were included in 7.7 meta-analyses on average and no unique RCTs were included in any of the meta-analyses. For mindfulness-based, meditation, and yoga interventions, the 13 meta-analyses were based on 44 primary RCTs published between 1985 and 2021 and the proportion of unique RCTs ranged from 0.0 % to 33.3 %. Primary RCTs were included in 2.7 meta-analyses on average.

Importantly, discrepancies in the classification of different interventions were observed. This discrepancy related to interventions being trauma-focused vs. non-TF, CBT-based vs. non-CBT-based, or following vs. not following a specific treatment protocol. For example, the only meta-analysis on non-TF CBT (Lewis et al., 2020) yielded an overall proportion of unique RCTs of 12.5 %, suggesting that other authors had classified the interventions of primary trials to one of the remaining treatments.

3.4. Meta-analyses on mid- and long-term efficacy

Follow-up data (i.e., assessments conducted at least one month after treatment endpoint) were included in 28 meta-analytic comparisons. The review of meta-analyses on follow-up data is displayed in Fig. 5, details on the included comparisons are presented in Supplement G. Only five meta-analyses explicitly focused on long-term follow-up and results for mid-term vs. long-term efficacy appeared similar. Overall TF-CBT interventions (11 comparisons) and EMDR (eight comparisons including comparisons with TF-CBT) were most frequently investigated. Results from Kitchiner et al. (2019) stand out with a very large effect of TF-CBT vs. passive and active control condition. This meta-analysis was the only one that focused on a specific trauma population, namely military-related trauma. It furthermore only included four primary trials with very heterogeneous findings. Despite variance in effect sizes, all comparisons for overall or specific TF-CBT interventions suggest superiority of TF-CBT compared to control conditions except one meta-analysis. The only non-significant effect was reported by Simon et al. (2021) that focused on internet-based interventions with participants older than 16 years of age.

Two of the meta-analyses on cognitive processing therapy were conducted with survivors of sexual assault and military-related trauma.

While Cusack et al. (2016) reported an aggregated effect sizes almost twice as large as the one reported by K. Tran et al. (2016) ($g = 1.40$ vs. 0.75), it is noteworthy that these meta-analyses differed only by one study. One of the differing studies contributed a very large effect size of $d = 2.35$ (Chard, 2005) to the first meta-analysis, whereas the other one contributed a moderate effect size of $d = 0.58$ with a large sample size of 313 (Bass et al., 2013) to the second meta-analysis. This difference highlights the impact that individual studies may have on meta-analytic results.

Finally, no differences between TF-CBT and EMDR emerged in any of the meta-analysis at follow-up and EMDR appeared effective at follow-up compared to passive and active control conditions. The meta-analysis on seeking safety (Cusack et al., 2016) found no significant long-term treatment effect compared to active control conditions.

3.5. Reporting quality of included meta-analyses

The AMSTAR 2 domains and ratings for each included meta-analysis are included in Figs. 3 and 5 (see Supplement H for details). The majority of meta-analyses had no comprehensive underlying pre-registered protocol (64 %). Accuracy of the search strategy was mixed with most meta-analyses having conducted a sufficient, however, not comprehensive literature search (51 %). The research question contained all relevant details in the vast majority of meta-analyses (93 %). Only a limited number of reviews explained their decision regarding inclusion of different study designs in their analyses (18 %) and provided a list of excluded studies (27 %). About half of the meta-analyses performed study selection and data extraction in duplicate (47 % and 69 %). Characteristics of included RCTs were adequately described in 88 % of meta-analyses. Funding sources of included studies were only listed in one meta-analysis. Although most meta-analyses performed a risk of bias (RoB) assessment (77 %), the results were less frequently incorporated in further analyses (46 %). General limitations were described in most meta-analyses, however, only 60 % of them discussed results from the RoB assessment. Publication bias was assessed in the majority of meta-analyses (62 %), although only a few went beyond the report of funnel plots and Egger's tests.

Heterogeneity was frequently investigated by means of subgroup analyses, however, the extent to which results were discussed varied and 22 % did not discuss heterogeneity at all. Finally, most authors of meta-analyses reported on their own funding sources and conflicts of interest (67 %). On average, meta-analyses fulfilled 7.4 out of the 16 quality criteria. The maximum number of fulfilled criteria was 14, which was accomplished by a Cochrane review. The minimum number of fulfilled criteria was 1, which concerned a meta-analysis on cognitive processing therapy. It is noteworthy that the current AMSTAR 2 guidelines have been published in 2017 (Shea et al.), which may be one reason why earlier meta-analyses yielded lower reporting quality.

The intraclass correlation coefficient of all items and studies combined among the two raters was 0.70 (89 % agreement rate), indicating good inter-rater reliability.

4. Discussion

The present work aimed at providing a comprehensive overview of the meta-analytic evidence concerning the short-, mid-, and long-term efficacy of psychological interventions for adult PTSD. The research field on PTSD can be regarded as substantial given the 55 meta-analyses included, half of which were published in the last decade.

TF-CBT interventions appeared to be by far the most researched treatment approach for both short- and long-term treatment efficacy. The vast majority of meta-analytic results showed significant short-term treatment effects. Yet, some considerable variation in effect sizes existed, which may be explained by the differences in research questions and accordingly the differences in inclusion criteria. Discrepancies mainly comprised the focus on specific subgroups such as military personnel or

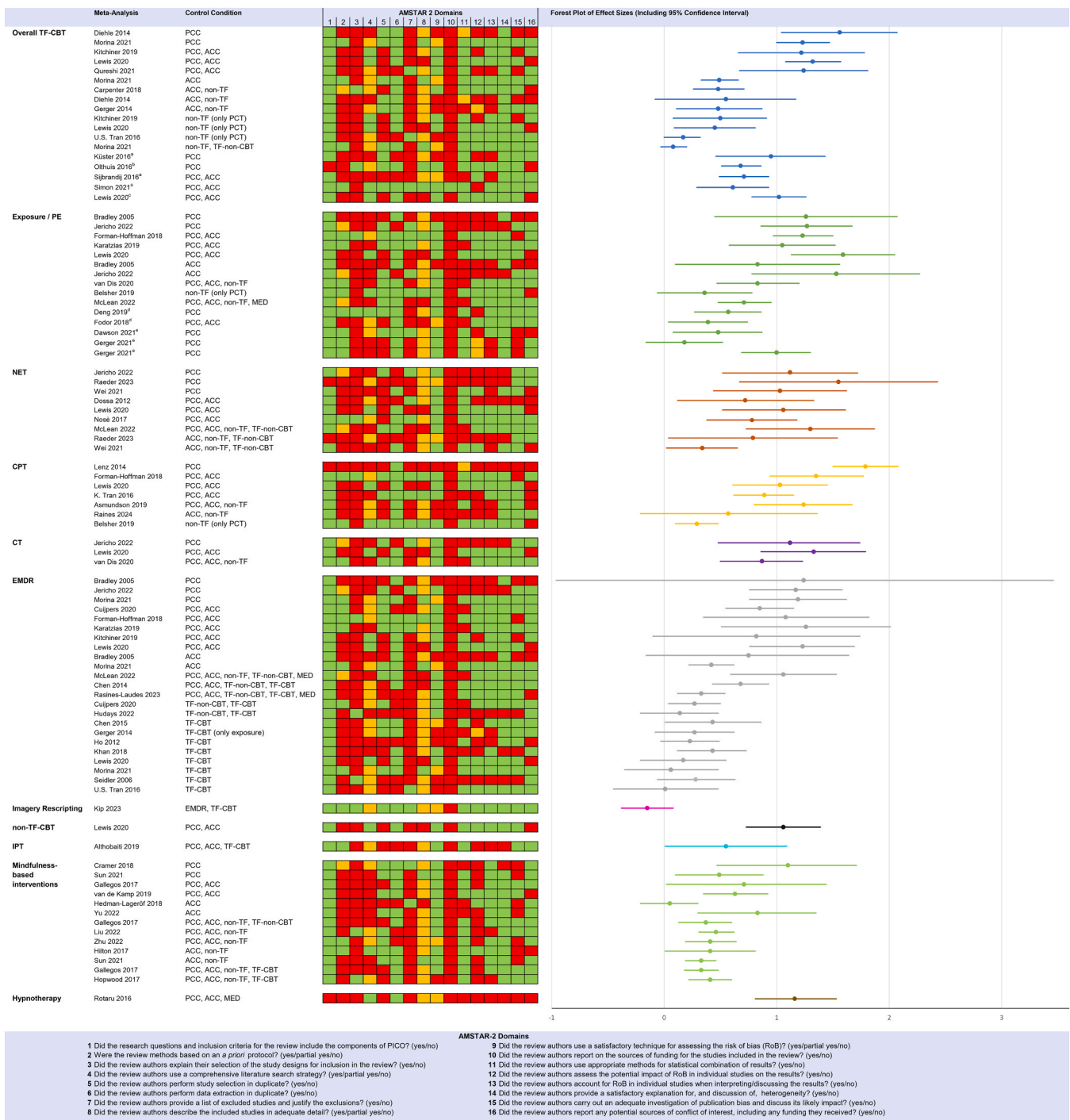


Fig. 3. Evidence Map of Meta-Analytic Comparisons at Post-Treatment (Ordered by Intervention and Control Condition From Passive to Active). Note. ACC = active control conditions; CPT = cognitive processing therapy; CT = cognitive therapy; EMDR = eye movement desensitization and reprocessing; IPT = interpersonal psychotherapy; MED = medication; NET = narrative exposure therapy; non-TF-CBT = non-trauma-focused cognitive behavior therapy; non-TF = non-trauma-focused interventions; PCC = passive control condition; PCT = Present-Centered Therapy; PE = prolonged exposure; TF-CBT = trauma-focused cognitive behavior therapy; TF-non-CBT = trauma-focused interventions that are not based on cognitive behavior therapy. ^a internet-based delivery ^b distance-delivery. ^c only group format. ^d virtual-reality. ^e written exposure.

refugees, the in- or exclusion of trials with adolescents, the requirement of full vs. partial PTSD diagnosis, and the focus on specific control groups. Similarly, most meta-analyses found EMDR and mindfulness-based interventions to be superior compared to passive and active control conditions or non-trauma-focused interventions at treatment endpoint. Whereas some meta-analyses further showed the mid-term efficacy of EMDR, no long-term meta-analytic evidence was available

and results for mindfulness-based interventions were limited to treatment endpoint effects only. Apart from one meta-analysis on internet-based TF-CBT (Simon et al., 2021), all meta-analyses found significant mid- and long-term efficacy of TF-CBT and no meta-analysis found a significant difference between TF-CBT and EMDR efficacy at either treatment endpoint or later. Other more recently developed interventions are often lacking an adequate number of RCTs to provide

thorough meta-analytic evidence. This is exemplified by the meta-analysis on imagery rescripting with only four included RCTs (Kip et al., 2023), meta-analyses on meta-cognitive therapy mainly including non-RCTs (Normann & Morina, 2018), or missing meta-analyses on the efficacy of acceptance and commitment therapy for PTSD. Although having a long history, psychodynamic interventions are still lacking meta-analytic evidence.

It is noteworthy that the included meta-analyses focused on manual-based treatments. Modular psychotherapy and process-based therapy are promising alternatives to traditional diagnosis-specific manuals for PTSD, offering greater flexibility and personalization (Hofmann and Hayes, 2019; Karatzias and Cloitre, 2019). Modular approaches allow therapists to tailor treatment by selecting intervention modules based on individual needs, which has been shown to improve outcomes and engagement, particularly in complex PTSD cases (Karatzias et al., 2023).

Meta-analyses displayed a considerable overlap of both addressed research questions and included primary RCTs. RCTs contributed on average to 3.3 meta-analytic comparisons, with some studies contributing to up to 21 comparisons. Furthermore, some meta-analyses, particularly those on cognitive processing therapy and narrative exposure therapy, overlap with other meta-analyses by 100 %. These results indicate limited increment value of some meta-analyses and possible redundancy, a problem that has been pointed to in literature (Ioannidis, 2016). This redundancy may be partly attributed to the existence of several comprehensive meta-analyses that encompass numerous subgroup analyses across different intervention types (e.g., Cusack et al., 2016; Jericho et al., 2022; Lewis et al., 2020; Morina et al., 2021). An imbalanced ratio of primary trials to meta-analyses is observed for example for cognitive therapy. Three meta-analyses from the past four years focused on only six trials on cognitive therapy and included no unique RCTs. In the same time frames, we are aware of only one newly published RCT on cognitive therapy (Ehlers et al., 2023). A high research interest was particularly observed for mindfulness-based interventions with ten meta-analytic publications between 2017 and

2022. Although research questions varied partly (e.g., focusing on meditation vs. yoga only), there was considerable overlap between meta-analyses. Yet, it is essential to consider additional information before drawing firm conclusions on redundancy of meta-analyses. Meta-analyses displaying a large overlap of studies may still add value to the state of research, for example by focusing on a specific trauma population (Kitchiner et al., 2019; Nosè et al., 2017). Given the potential barriers that treatment providers may face in offering care to specific trauma populations, these meta-analyses can be beneficial.

None of the included meta-analyses fulfilled all 16 AMSTAR 2 quality criteria and 7.4 were fulfilled on average. It is important to consider that some meta-analyses were published before the publication of AMSTAR 2 (Shea et al., 2017). Shortcomings may be partially due to inadequate methodological rigor; however, items were frequently downgraded because of insufficient reporting. The results highlight the need to improve the reporting quality of meta-analyses, especially for those independently produced outside of the Cochrane Collaboration. Nonetheless, the AMSTAR 2 criteria are only one suggestion for high reporting quality and criticism may be suitable. The criterion that was least frequently met concerned the reporting of funding sources of included studies. While this is a crucial criterion regarding meta-analyses on psychopharmacotherapy, biased funding is less common in psychotherapy research. Instead, accounting for allegiance bias might be more important by separately examining trials that involved authors from the respective treatment manual (Munder et al., 2013).

Umbrella review criteria are most commonly applied to existing meta-analyses based on the number of included studies or publication date (Andersson et al., 2019; Barbui et al., 2020). As reported above, we believe that our approach has several strengths. A large number of included RCTs do not necessarily reflect the most comprehensive meta-analysis but may be the result of broad inclusion criteria that in turn may be less adequate to answer the research question at hand. Related, we observed several included primary RCTs that are arguably inappropriate to answer the question on the efficacy of PTSD treatment.

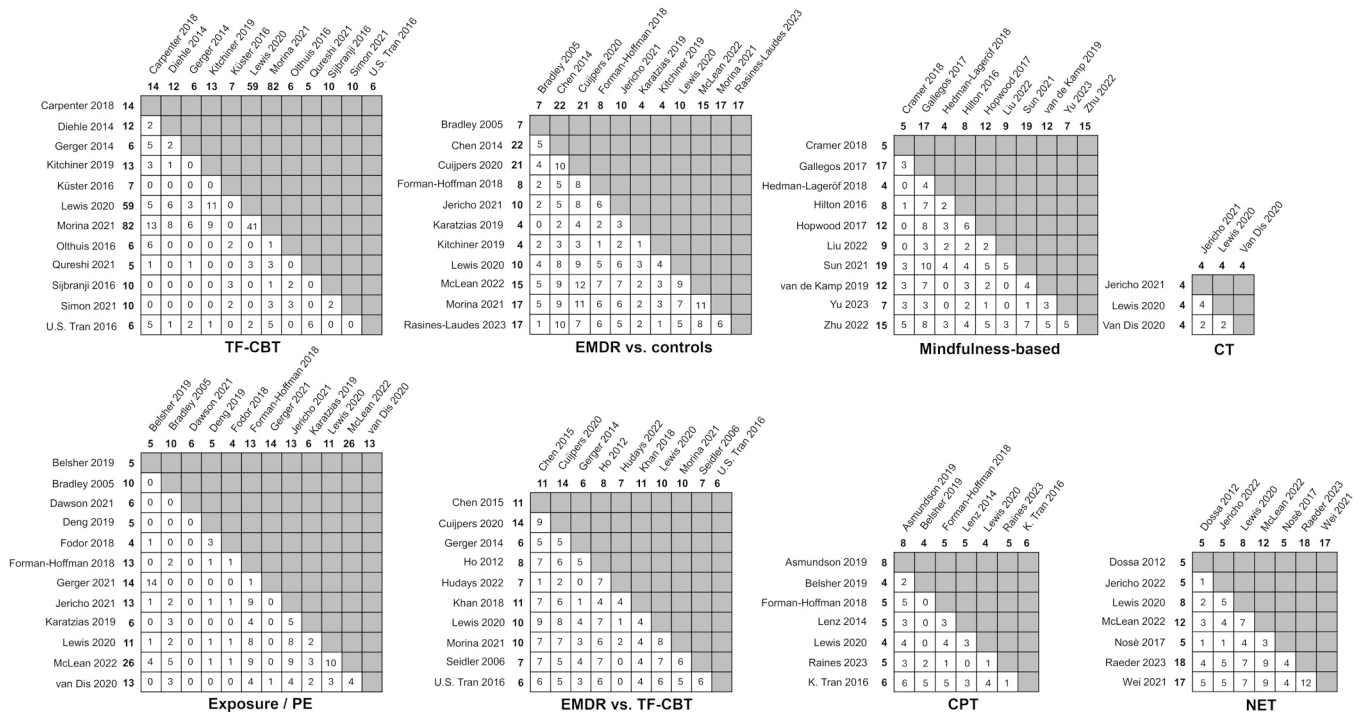


Fig. 4. Overlap of Primary Trials Across Meta-Analyses According to Treatment. Note. Bold numbers outside of matrix display number of included trials in meta-analyses on the respective treatment, numbers inside the matrix the number of trials that overlap between two meta-analyses. CPT = cognitive processing therapy; CT = cognitive therapy; EMDR = eye movement desensitization and reprocessing; NET = narrative exposure therapy; PE = prolonged exposure; TF-CBT = trauma-focused cognitive behavior therapy.

Some of these trials for example focused on patients with complicated grief (e.g., Wagner et al., 2006, included in Gerger et al., 2021; Sijbrandij et al., 2016) or acute distress after a major life event (e.g., Owen et al., 2005, included in Küster et al., 2016). Besides, the study by Ironson et al. (2002) was included in ten meta-analytic comparisons although the authors violated randomization procedures due to high drop-out rates. In some meta-analyses, these questionable trials contributed the largest effect sizes to the respective meta-analyses. Thus, a major strength of the review is its ability to inform researchers and clinicians by providing a comprehensive and critical overview of available evidence.

4.1. Limitations

The scope of our systematic review was limited by the inconsistent methodological and reporting standards of published meta-analyses. To maintain high internal validity, we strictly adhered to our predefined inclusion criterion, including only meta-analyses that focused on participants with clinically relevant PTSD symptoms as defined by their research question or inclusion criteria. Several meta-analyses were excluded because they lacked information on the target population (e.g., Lely et al., 2019; Siehl et al., 2021) or their inclusion criteria comprised trauma survivors irrespective of the presence of PTSD symptoms (Escudero and Navarro, 2023; Raghuraman et al., 2021). Therefore, these meta-analyses were not included in the review, even though clinically relevant PTSD symptoms may have been present at study-level. This limitation particularly affected additional meta-analyses on narrative exposure therapy. Furthermore, using the proportion of unique RCTs as an indicator of overlap and potential redundancy has inherent limitations. For instance, some meta-analyses might have included a higher proportion of unique RCTs not due to identifying additional relevant RCTs, but rather because they applied less strict inclusion criteria or mistakenly included non-eligible RCTs (e.g., Lenz et al., 2014).

4.2. Implications for clinical practice and research

The meta-analytic evidence indicates a high efficacy of TF-CBT interventions and EMDR for both short- and mid-term treatment outcomes, despite varying effect sizes and reporting quality across included meta-analyses. For longer follow-ups, meta-analytic evidence is only available for TF-CBT protocols compared to controls, although several

meta-analyses found no difference between the outcomes of TF-CBT and EMDR in the long-term. Notably, all meta-analyses that reported on significant long-term effects examined trauma-focused interventions, whereas no meta-analytic long-term evidence was available for non-trauma-focused interventions. These long-term results should reassure treatment providers about addressing traumatic memories in treatment and reinforce the status of TF-CBT as first-line treatment for PTSD. Only one meta-analysis focused on patients suffering from complex PTSD, which yielded significant short-term efficacy for exposure and EMDR. Numerous meta-analyses have demonstrated the short-term efficacy of mindfulness-based interventions, but long-term effects remain largely unknown. It should be considered that methodological differences may only account for some of the variations in reported effect sizes. The large heterogeneity within different treatment approaches indicates the presence of additional influencing variables, such as population or trauma characteristics. This is exemplified by the smaller (but significant) pooled effect sizes in meta-analyses on narrative exposure therapy that exclusively focused on refugees or military-related trauma. Furthermore, comorbid depression and higher symptom severity at baseline have been associated with reduced treatment effects (Barawi et al., 2020). To enhance treatment response, it is essential to develop additional treatment approaches and further refine evidence-based treatments, as exemplified by the recent developments in modular and process-based therapy. Additionally, low threshold interventions such as Problem Management Plus (World Health Organization, 2018) or digital interventions are needed to improve access to mental health services.

Given the limited long-term evidence for many interventions and the imbalance between the number of RCTs and meta-analyses on certain interventions, increased efforts should be placed toward conducting additional large RCTs to investigate long-term treatment effects. Future research should prioritize identifying gaps in knowledge as well as focusing on new approaches. Building on the extensive meta-analytic datasets established by various research groups, collaborative efforts in future meta-analyses can aid in conserving resources. Furthermore, comprehensive guidelines on when new meta-analyses are appropriate and needed (e.g., based on methodological shortcomings, more recent primary trials or new research questions) are warranted. The extent of overlap in primary trials across existing meta-analyses, along with the accumulation of identical research questions, highlights the importance of pre-registrations. Pre-registrations not only enhance the scientific rigor of publications by preventing data dredging, but also inform other researchers about planned projects, avoiding redundancy. Identified



Fig. 5. Evidence Map of Meta-Analytic Comparisons at Follow-up (Ordered by Intervention, Follow-up, and Control Condition From Passive to Active). Note. Follow-up 1 ≤ 5 months post-treatment, follow-up 2 ≥ 6 months post-treatment. ACC = active control conditions; CPT = cognitive processing therapy; CT = cognitive therapy; EMDR = eye movement desensitization and reprocessing; non-TF = non-trauma-focused interventions; NET = narrative exposure therapy; PCC = passive control conditions; PCT = Present-Centered Therapy; PE = prolonged exposure; TF-CBT = trauma-focused cognitive behavior therapy; TF-non-CBT = trauma-focused interventions that are not based on cognitive behavior therapy. ^a internet-based delivery.

gaps in meta-analytic evidence include long-term effects for non-TF-CBT interventions, the efficacy of interventions such as meta-cognitive therapy, acceptance and commitment therapy, or process-based and modular approaches.

4.3. Conclusions

Our systematic review of meta-analyses on the treatment efficacy of specific PTSD interventions demonstrates an extensive research field. However, meta-analytic quality is moderate at best. Considerable overlap between included meta-analyses indicates a high rate of potential redundancy. Researchers may use pre-registrations or registered reports to ensure high scientific rigor of their work and avoid redundancy. They should also ensure high reporting quality, for example by adhering to established quality criteria. Finally, there is a need for more high-quality, large RCTs with long-term assessments.

Data statement

All data were extracted from published journal articles. Extracted data of included meta-analyses can be found in Table 1 and Supplement F.

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CRediT authorship contribution statement

Hoppen Thole H.: Writing – review & editing, Data curation. **Ritter Linnea:** Writing – review & editing, Visualization, Investigation, Data curation, Conceptualization. **Kip Ahlke:** Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Morina Nexhmedin:** Writing – original draft, Supervision, Conceptualization. **Barbui Corrado:** Writing – review & editing, Supervision. **Ostuzzi Giovanni:** Writing – review & editing, Investigation. **Papola Davide:** Writing – review & editing, Methodology, Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.janxdis.2025.103017](https://doi.org/10.1016/j.janxdis.2025.103017).

Data Availability

All data were extracted from published journal articles. Extracted data of included meta-analyses can be found in Table 1 and Supplement E.

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