Systematic Review and Meta-Analysis: Imputing Response Rates for First-Line Psychological Treatments for Posttraumatic Stress Disorder in Youth

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Objective: Meta-analyses assessing psychological therapies for posttraumatic stress disorder (PTSD) in youth have demonstrated their effectiveness using standardized mean differences. Imputation of response rates (ie, 50% or greater reduction in symptoms) may facilitate easier interpretation for clinicians.

Method: We searched 4 databases (MEDLINE, PsycINFO, PTSDPubs, and Web of Science) and screened 1,654 records to include 60 randomized controlled trials (52 trauma-focused cognitive behavioral therapy [TF-CBT], 8 eye movement desensitization [EMDR]) with a total of 5,113 participants, comparing psychological therapies for PTSD against control conditions in youth. Data from randomized controlled trials of EMDR and TF-CBT for PTSD were used to impute response rates, establishing how many patients display 50% reduction, 20% reduction, and reliable improvement and deterioration (using reliable change indices) in PTSD and depression.

Results: The proportion of youth exhibiting a 50% reduction in PTSD symptoms was 0.48 (95% CI = 0.41-0.55) for TF-CBT, 0.30 (0.24-0.37) for EMDR, and 0.46 (0.39-0.52) for all psychological therapies, compared to 0.20 (0.16-0.24) for youth in control conditions. Reliable improvement was displayed by 0.53 (0.45-0.61; TF-CBT 0.55 [0.46-0.64], EMDR 0.42[0.30-0.55]) of youth receiving psychological therapies, compared to 0.25 (0.20-0.30) of youth in control conditions. Reliable deterioration was seen in 0.01 (0.01-0.02) of youth receiving psychological therapies, compared to 0.13 (0.08-0.20) of youth in control conditions. There was a high degree of heterogeneity in the included studies.

Conclusion: Psychological therapies, in particular TF-CBT, for young people with PTSD are effective and unlikely to cause deterioration, with around half of youth receiving TF-CBT exhibiting 50% symptom reduction.

Plain language summary: In this study, the authors analyzed data from 57 randomized controlled trials involving over 5,000 youth assessing psychological therapies for posttraumatic stress disorder (PTSD). Forty-eight percent of youth with PTSD who received trauma-focused cognitive behavioral therapy (TF-CBT) and 30% of youth who received eye movement desensitization and reprocessing (EMDR) exhibited 50% symptom reduction after treatment, compared to 20% of youth in control conditions. Deterioration was seen in 1% of youth receiving TF-CBT or EMDR, compared to 13% of youth in control conditions.

Clinical guidance

● Psychological therapies for posttraumatic stress disorder (PTSD) in youth, like trauma-focused cognitive behavioral therapy and eye movement desensitization and reprocessing, can be helpful in symptom reduction and have low likelihood of causing deterioration of symptoms.

Study registration information: Imputing response rates from randomised controlled trials of first-line psychological treatments for PTSD in children and adolescents; a systematic review and meta-analysis; https://www.crd.york.ac.uk/PROSPERO/view/CRD42022304592

Key words: PTSD; youth; meta-analysis; review; therapy

T rauma exposure is common in childhood, with previous research estimating that 61% of youth 13 to 17 years of age in the United States are exposed to trauma,[1] and that 31.1% of youth in England and Wales experience a traumatic event before the age of 18 years.[2] Exposure to traumatic events is associated with negative outcomes, including posttraumatic stress disorder (PTSD)[2] and comorbid difficulties such as mood and anxiety disorders[3] and substance abuse.[4] PTSD symptoms include re-experiencing (trauma-related intrusions), avoidance of trauma-related memories, and hyperarousal (a sense of heightened current threat).[5,6] Effective treatment of PTSD is important to reduce the burden of these symptoms, as well as associated negative outcomes such as comorbid mental health difficulties.[2]

Psychological interventions are recommended by multiple treatment guidelines, including the International Society for Traumatic Stress Studies,[7] the American Academy for Child and Adolescent Psychiatry,[8] the Australian National Health and Research Guidelines,[9] and the UK National Institute for Health and Care Excellence guidelines[10] as the first-line treatment for children and adolescents

presenting with PTSD. Trauma-focused cognitive behavioral therapy (TF-CBT) in particular has been assessed by previous meta-analyses that have demonstrated its effectiveness in treating children and adolescents with PTSD compared to active and passive control conditions.[11,12] Eye movement desensitization and reprocessing (EMDR) has also been endorsed by these guidelines, albeit less strongly; there are fewer trials concerning this treatment, particularly trials that have used an active control condition and medium- or long-term follow up.[11]

Meta-analyses typically report results in terms of standardized mean differences, such as the Hedges g statistic,[13] which denotes the effect size for the standardized mean difference between 2 groups, with adjustment for sample size. These statistics can be difficult to interpret; therefore, Furukawa et al.[14] developed a method to impute response rates, namely, dichotomous outcomes defined as the absolute number of participants meeting a specified criteria, such as a 50% reduction in symptoms, from continuous outcomes (reported as means and standard deviations). This dichotomization reduces statistical power but produces results that are more easily interpreted by clinicians and service users in the form of absolute response rates and risk ratios, providing clear data regarding the proportions of people who experience symptom reduction in response to a specific intervention. A further benefit is that calculating absolute response rates reduces inflation of effect sizes when psychological interventions are compared with a waitlist rather than an active control condition, as response rates are calculated separately for the participants allocated to the experimental and control conditions. Beyond symptom reduction thresholds, reliable change can also be calculated. This is a psychometric measure assessing whether change in symptoms (improvement or deterioration) from one timepoint to another can be considered statistically significantly different from normal deviation on that measure.

The imputation method has been used by researchers investigating the effectiveness of treatments for mental health disorders such as depression and schizophrenia.[15,16] In addition, Cuijpers et al.[17] conducted a systematic review and meta-analysis examining absolute response rate for psychotherapies across 8 mental disorders in adults and found a response rate of 38% for PTSD. This demonstrated the feasibility and utility of this analysis technique. However, similar analyses have not yet been conducted for the treatment of PTSD in young people.

To address this, we conducted a systematic review and meta-analysis to impute response rates for children and adolescents receiving TF-CBT or EMDR in a randomized controlled trial (RCT). We calculated response rates for 50% improvement, 20% improvement, and reliable improvement and deterioration in PTSD symptoms for experimental and control groups at posttreatment and follow-up, as well as calculating risk ratios. These cut-off rates were selected to be consistent with those in previous meta-analyses,[17,18] with the addition of 20% improvement to add sensitivity and to capture mild/moderate symptom improvement. Reliable deterioration was included as well as the metrics for symptom improvement to address concerns regarding retraumatization during psychological therapy for PTSD.[19]

A range of moderators were investigated to determine whether response rate was influenced by study characteristics. This included treatment type (TF-CBT vs EMDR) and format (group vs individual), control condition (passive vs active), trauma characteristics (single vs multiple incidence; exclusively sexual trauma vs other type of trauma), symptom measure (questionnaire vs interview), country (high-income country vs low-to-middle–income country), and risk of bias (low vs high). We also repeated analyses with depression symptom data where these were reported, consistent with previous meta-analyses,[20] to assess the transdiagnostic effects of treatment.

METHOD

This meta-analysis was preregistered on PROSPERO (CRD42022304592) and follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines.
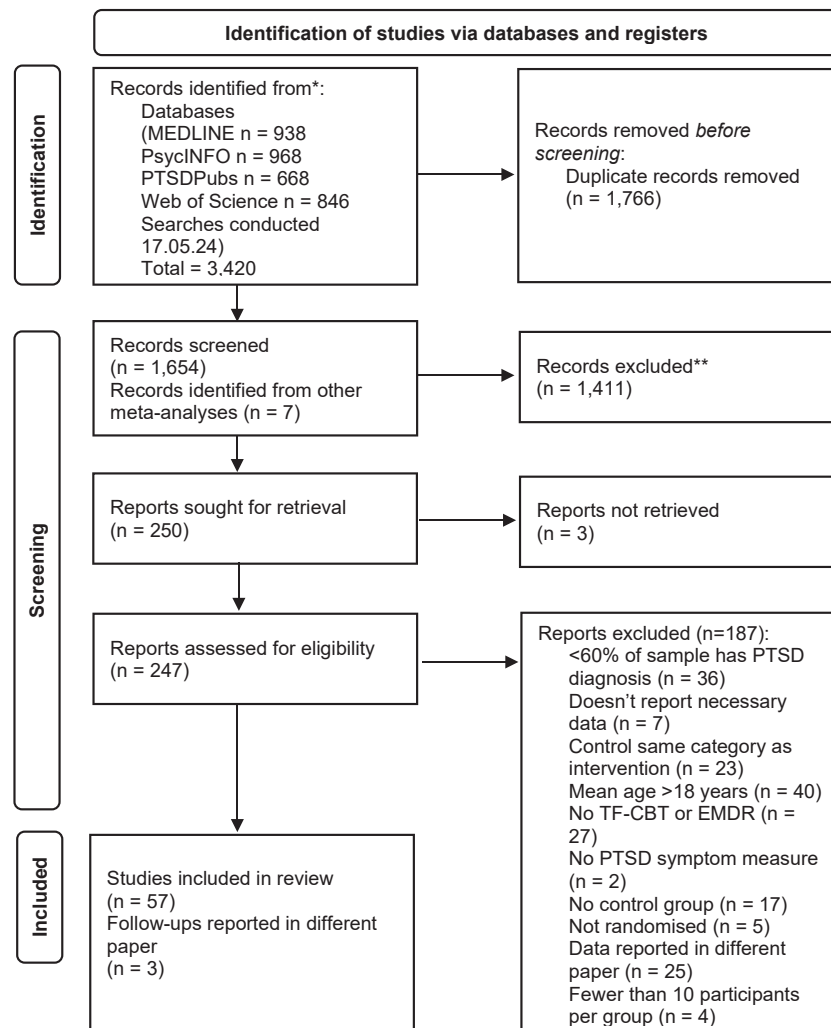
Search Strategy

Relevant studies were identified through systematic searches of MEDLINE, PubMed, PsycINFO, and PTSDPubs. The final search was carried out on May 17, 2024. The search strategy contained terms relating to PTSD, children and adolescents, treatment, and randomized controlled trials (Supplement 1, available online). We also checked reference lists of recent reviews. Figure 1 provides the PRISMA diagram.

Selection Criteria

To be included in the analysis, studies were required to meet the following inclusion criteria: mean age of participants 18 years or less; at least 60% of participants had a PTSD diagnosis or scored above cutoff on a measure of PTSD symptoms (or the sample mean exceeded the cutoff for a measure of PTSD symptoms where individual participant data was not reported); randomized controlled trial comparing a psychological therapy (TF-CBT or EMDR) to a control condition; at least 10 participants in each arm of the trial; and a PTSD symptom measure reported at pre- and posttreatment.

Screening Process

The first author (KL) screened all titles and abstracts, and a second reviewer (AD) independently screened a random

FIGURE 1 PRISMA Flow Diagram

10%, with 95.5% agreement. Full texts were imported and all were reviewed by KL, with a random 20% independently reviewed by AD, with 94.1% agreement. Disagreements were resolved by a third reviewer (RMS).

Data Extraction

All descriptive and quantitative data were extracted into a spreadsheet by KL and checked by AD.

Descriptive data extracted comprised the following: type of psychological therapy; type of control condition (categorized as active or passive); format of psychological therapy; single or multiple trauma sample; sexual trauma sample; country in which the study was conducted (categorized as high income or low- to-middle income); mean age; percentage of female participants; and PTSD outcome measure (categorized as interview or questionnaire).

Quantitative data extracted comprised the following: means and SDs from PTSD symptom measure at pretreatment, posttreatment, and follow-up timepoints if applicable; number of participants in each arm at each timepoint; and means and SDs from depression symptom measure where this was reported. Follow-ups were categorized as short term (follow-up 1) when they took place from 1 to 5 months after posttreatment assessment or as long term (follow-up 2) when they took place 6 months or more after posttreatment assessment. If there were multiple follow-ups, the first timepoint in each follow-up window was extracted.

Risk of Bias Assessment

Risk of bias was assessed to classify the quality of studies included in the meta-analysis and to conduct a moderator analysis assessing whether this moderated results. Assessment was conducted by the first author (KL) using items recommended by Cuijpers et al.[21] (Supplement 2, available online). A second reviewer (AD) conducted independent assessment of 25% of studies, with an agreement of 100%. Studies were

classified as low risk of bias if they met at least 7 of the 8 risk of bias criteria and as high risk of bias if they did not.

Statistical Analysis

Statistical analyses were conducted using the metafor package[22] in R 4.3.2.[23] The method validated by Furukawa et al.[14] was used to calculate response rates. This method uses pre- and posttreatment means and SDs and the number of participants at posttreatment in the following formula: "Number of participants at endpoint × normal standard distribution corresponding with (50% of the baseline score − endpoint score)/SD."[14] Response rates were reported as the proportion of participants exhibiting 50% reduction, 20% reduction, reliable improvement, and reliable deterioration[15] in symptoms. Reliable change indices are calculated as the change in symptom score divided by the standard error of the difference, using a conservative assumption for Cronbach alpha of 0.75.[18,24] If this value is greater than 1.96, the criterion for reliable change has been met. Both 95% confidence intervals and 95% prediction intervals[25] were calculated for each response rate; 95% CIs are presented in parentheses for all pooled statistics. Risk ratios were also calculated to compare participants receiving psychological therapies with those in control conditions. For completeness, numbers needed to treat were calculated using pooled risk ratio and response rate in the control arm.[15] Because the large majority of included studies addressed TF-CBT, we report in the main body of the text outcomes for this treatment modality, and all psychological treatments (ie, TF-CBT and EMDR) and EMDR alone when there are sufficient studies (ie, ≥4) that consider EMDR; full results are reported in supplementary tables. Complete intent-to-treat data were reported by most trials (n = 42), resulting in posttreatment data for 4,862 participants. Sensitivity analyses were conducted whereby participants who were randomized but not included in the reported posttreatment statistics in the original article were assumed to be nonresponders, consistent with previous meta-analyses,[17,18] resulting in a sample size of 5,113 participants, with missing data comprising 4.91% of the sample. The sensitivity analyses were also conducted for follow-up data. Heterogeneity was assessed using the Cochran Q and the I^2 statistic.

A number of moderator analyses were undertaken to see if different factors (type of trauma or therapy, measure used, setting, trial methodology) had an influence on the pooled effect size estimates. These comprised the following: type of psychological therapy (EMDR vs TF-CBT); trauma frequency (single vs multiple); measure type (questionnaire vs interview); psychological therapy format (group vs individual); country type (high-income country vs low-to-medium–income country); trauma type (exclusively sexual trauma vs other/mixed traumatic experiences); risk of bias (low vs high); and control condition type (active vs passive).

Publication Bias

To evaluate publication bias, funnel plots and results of funnel plot asymmetry tests were inspected alongside the Egger test of intercept[26] and the trim-and-fill procedure[27] were used.

RESULTS

Selection and Characteristics of Included Studies

After deletion of duplicate records, a total of 1,654 records were identified. A further 7 records were identified from reference lists of relevant meta-analyses.[11] In all, 60 articles met inclusion criteria, 3 of which provided follow-up data to other included studies, resulting in a total of 57 included studies yielding 60 comparisons (as 3 studies had multiple comparison arms or split data into age groups). Figure 1 provides the PRISMA flowchart detailing study selection.

The total sample size was 5,113 participants, with sample sizes for each study ranging from 20 to 640 participants. Table 1[28-87] lists characteristics of the included studies. The mean age of participants (where reported) was 12.3 years (range, 2-18 years), and 55% of studies (k = 33) were conducted in high-income countries.

The majority of studies (k = 52; 86.7%) assessed TF-CBT, with the remaining 13.3% (k = 8) assessing EMDR. Treatment was on an individual basis in 56.7% of cases (k = 34), and self-report questionnaires were used to assess PTSD symptoms in 66.7% of studies (k = 40), as opposed to interviews in the remaining studies. Active control conditions were used as the comparator in 51.7% of studies (k = 31). Participants had exposure to multiple traumatic events in 73.3% of studies (k = 44), whereas participants in the remaining studies were recruited after exposure to a single traumatic event. In 11.7% of studies (k = 7), participants had exposure to sexual trauma exclusively. A total of 40 studies reported data on depression symptoms, with a sample size of 1,704 participants.

Risk of Bias

The majority of studies (66.7%; k = 40) were classified as having high risk of bias, with scores ranging from 1 to 8 on the scale used. Risk of bias was included as a potential moderator, and no significant difference was found between studies classified as low vs high risk of bias (p = .61).

Absolute Response Rates

PTSD Symptoms, Posttreatment. Table 2 lists absolute response rates for TF-CBT and EMDR, and Table 3 provides absolute response rates for control conditions. The CIs

TABLE 1 Study Characteristics

Study	Country	Sample size	Age, y, range (mean)	Ethnicity (%)	Psychological therapy	Therapy format	Control condition	Trauma frequency	Exclusively sexual trauma	Follow-up timepoints	PTSD measure	Depression measure
Ahmad et al. (2007a)[28]	Sweden	33	6-16 (9.94)	Other (42.4), Swedish (57.6)	EMDR	Individual	WL	Multiple	No	—	PTSS-C	—
Ahmadi et al. (2022)[29] CG	Afghanistan	78	12-18 (16)	Afghan (Hazara) (100)	TF-CBT	Group	CG	Single	No	3 mo	CRIES-13	—
Ahmadi et al. (2023a)[30]	Afghanistan	96	11-19 (15.96)	Afghan (100)	TF-CBT	Group	TAU	Multiple	No	3 mo	CRIES-13	MFQ-SF
Ahmadi et al. (2023b)[31]	Afghanistan	26	14-19 (16.7)	Afghan (100)	TF-CBT	Group	CG	Single	No	3 mo	CRIES-13	MFQ-SF
Ahrens and Rexford (2002)[32]	US	38	15-18 (16.4)	African American (26.3), Caucasian (60.5), Hispanic (5.3), Native American (5.3), Other (2.6)	TF-CBT	Group	WL	Multiple	No	—	PSS-SR	BDI
Auslander et al. (2017)[33]	US	25	12-18 (14.64)	Black (44.4), Other/ Mixed (33.3), White (22.2)	TF-CBT	Group	TAU	Multiple	No	3 mo	CPSS	CDI
Banoglu et al. (2021)[34]	Turkey	61	6-15 (NR)	Syrian (100)	EMDR	Group	WL	Multiple	No	—	CPTS-RI	MDI
Barron et al. (2016)[35]	Palestine	154	11-15 (13.5)	NR	TF-CBT	Group	WL	Multiple	No	—	CRIES-13	DSRS
Barron et al. (2020)[36]	Brazil	30	8-13 (10.1)	Brazilian (100)	TF-CBT	Group	TAU	Multiple	No	—	CRIES-13	—
Bidstrup et al. (2023)[37]	Denmark	54	2-5 (3.46)	NR	TF-CBT	Individual	TAU	Multiple	No	12 mo	PEDS	—
Catani et al. (2009)[38]	Sri Lanka	31	8-14 (11.94)	NR	TF-CBT	Individual	MED-RELAX	Multiple	No	6 mo	UPID	—
Chen et al. (2014)[39]	China	20	NR (14.5)	Chinese (100)	TF-CBT	Group	General support	Single	No	3 mo	CRIES-13	CES-D
Chen et al. (2014)[39] CG	China	22	NR (14.5)	Chinese (100)	TF-CBT	Group	CG	Single	No	3 mo	CRIES-13	CES-D
Cohen et al. (2004)[40]/ Deblinger et al. (2006)[41]	US	180	8-14 (10.76)	African American (28), Biracial (7), Hispanic American (4), Other (1), White (60)	TF-CBT	Individual	CCT	Multiple	Yes	6 mo	K-SADS-PL	CDI
Cohen et al. (2005)[42]	US	82	8-15 (11.1)	African American (37), Biracial (2), Caucasian (60), Hispanic (1)	TF-CBT	Individual	NST	Multiple	Yes	6 mo	TSC-C	CDI
Cohen et al. (2011)[43]	US	75	7-14 (9.64)	Black (33.1), Biracial (11.3), White (55.6)	TF-CBT	Individual	CCT	Multiple	No	—	K-SADS-PL	CDI

(continued)

TABLE 1 Continued

Study	Country	Sample size	Age, y, range (mean)	Ethnicity (%)	Psychological therapy	Therapy format	Control condition	Trauma frequency	Exclusively sexual trauma	Follow-up timepoints	PTSD measure	Depression measure
Danielson et al. (2012)[44]	US	28	13-17 (14.8)	African American (46), Biracial (8.3), Hispanic (4), Native American (4.2), White (37.5)	TF-CBT	Individual	TAU	Multiple	Yes	3 mo and 6 mo	UPID	CDI
Dawson et al. (2018)[45]	Indonesia	64	7-14 (10.7)	NR	TF-CBT	Individual	PS	Multiple	No	3 mo	UCLA PTSD-RI	CDI
de Roos et al. (2017)[46] TF-CBT WL	Netherlands	60	8-18 (13.06)	NR	TF-CBT	Individual	WL	Single	No	—	CRTI	—
de Roos et al. (2017)[46] EMDR WL	Netherlands	61	8-18 (13.06)	NR	EMDR	Individual	WL	Single	No	—	CRTI	—
Deblinger et al. (1996)[47]	US	68	7-13 (9.84)	African American (20), Caucasian (72), Hispanic (6), Other (2)	TF-CBT	Individual	TAU	Multiple	Yes	—	K-SADS-E	—
Dorsey et al. (2020)[48]	Kenya and Tanzania	640	7-13 (10.62)	NR	TF-CBT	Group	TAU	Single	No	12 mo	CPSS	CBC
Foa et al. (2013)[49]	US	61	13-18 (15.3)	Biracial (3.3), Black (55.7), Hispanic (16.4), Other/No response (6.6), White (18.0)	TF-CBT	Individual	SC	Multiple	Yes	12 mo	CPSS-I	CDI
Gilboa-Schechtman et al. (2010)[50]	Israel	30	12-18 (14.05)	NR	TF-CBT	Individual	TLDP-A	Single	No	6 mo	CPSS	BDI
Goldbeck et al. (2016)[51]	Germany	159	7-17 (13.03)	NR	TF-CBT	Individual	WL	Multiple	No	—	CAPS-CA	CDI
Hitchcock et al. (2021)[52]	UK	28	3-8 (6.26)	NR	TF-CBT	Individual	TAU	Single	No	—	YC-PTSD-C	—
Jensen et al. (2014)[53]/ Jensen et al. (2017)[54]	Norway	122	10-18 (15.1)	African (1.9), Asian (10.9), Eastern European (1.3), Nordic (0.6), Norwegian (73.7), one parent Norwegian (8.3), Other (0.6), South/ Central American (1.3), Western European (1.3),	TF-CBT	Individual	TAU	Multiple	No	9 mo	CPSS	—

(continued)

TABLE 1 Continued

Study	Country	Sample size	Age, y, range (mean)	Ethnicity (%)	Psychological therapy	Therapy format	Control condition	Trauma frequency	Exclusively sexual trauma	Follow-up timepoints	PTSD measure	Depression measure
Kameoka et al. (2020)[55]	Japan	30	6-18 (13.9)	NR	TF-CBT	Individual	WL	Multiple	No	—	K-SADS-PL	DSRSC
Kaminer et al. (2023)[56]	South Africa	75	11-19 (14.92)	Black African (17.3), Mixed race (73.3), White (9.3)	TF-CBT	Individual	TAU	Multiple	No	3 mo	CPSS-5	BDI-II
Kemp et al. (2009)[57]	Australia	27	6-12 (8.93)	NR	EMDR	Individual	WL	Single	No	—	CPTS-RI	CDS
King et al. (2000)[58]	Australia	24	5-17 (11.5)	NR	TF-CBT	Individual	WL	Multiple	Yes	3 mo	ADIS-C	CDI
Kramer et al. (2014)[59] 2-6y	Switzerland	49	2-6 (4.27)	NR	TF-CBT	Individual	TAU	Single	No	3 mo	PTSDSSI	—
Kramer et al. (2014)[59] 7-16y	Switzerland	51	7-16 (11)	NR	TF-CBT	Individual	TAU	Single	No	3 mo	CAB	—
Langley et al. (2015)[60]	US	71	5-11 (7.65)	African American (17.57), African American/Hispanic (1.35), Asian (1.35), Asian/Caucasian (1.35), Caucasian (27.03), Hispanic (48.65), Hispanic/Caucasian (2.70),	TF-CBT	Group	WL	Multiple	No	—	UCLA PTSD-RI	CDI
Layne et al. (2008)[61]	Bosnia	127	13-18 (15.9)	NR	TF-CBT	Group	Psycho-education	Multiple	No	4 mo	PTSD-RI	DSRS
Li et al. (2022)[62]	China	87	9-12 (11)	NR	TF-CBT	Group	TAU	Multiple	No	3 mo	UCLA PTSD-RI-5	CDI
Li et al. (2023)[63]	China	234	9-12 (10.41)	NR	TF-CBT	Group	TAU	Multiple	No	3 mo	UCLA PTSD-RI-5	CDI-S
McMullen et al. (2013)[64]	DRC	48	13-17 (15.8)	NR	TF-CBT	Group	WL	Multiple	No	—	UCLA PTSD-RI	AYPA
Meentken et al. (2020)[65]/ Meentken et al. (2021)[66]	Netherlands	65	4-15 (9.6)	Dutch (81.9), Other Western (5.6), Non-Western (12.5)	EMDR	Individual	TAU	Multiple	No	6 mo	CRTI	—
Meiser-Stedman et al. (2017)[67]	UK	26	8-17 (13.3)	Minority ethnicity (13.8), White British (86.2)	TF-CBT	Individual	WL	Single	No	—	CPTSDI	MFQ

(continued)

TABLE 1 Continued

Study	Country	Sample size	Age, y, range (mean)	Ethnicity (%)	Psychological therapy	Therapy format	Control condition	Trauma frequency	Exclusively sexual trauma	Follow-up timepoints	PTSD measure	Depression measure
Molero et al. (2019)[68]	Spain	63	13-17 (16.36)	NR	EMDR	Group	CG	Multiple	No	3m	PCL-5	HADS
Murray et al. (2015)[69]	Zambia	257	5-18 (13.66)	Bemba (31.8), Ngoni (21.6), Other (46.7)	TF-CBT	Individual	TAU	Multiple	No	—	PTSD-RI	—
O'Callaghan et al. (2013)[70]	DRC	46	12-17 (16.02)	NR	TF-CBT	Group	WL	Multiple	Yes	—	UCLA PTSD-RI	—
O'Callaghan et al. (2015)[71]	DRC	50	8-17 (14.69)	NR	TF-CBT	Group	CFS	Multiple	No	6 mo	UCLA PTSD-RI	—
Osorio et al. (2018)[72]	Mexico	23	13-22 (16.71)	NR	EMDR	Group	CG	Multiple	No	3 mo	PCL-5	HADS
Peltonen et al. (2019)[73]	Finland	38	9-17 (13.2)	Afghan (27), Finnish (23), Iraqi (27), Other (20)	TF-CBT	Individual	TAU	Multiple	No	—	CRIES-13	DSRS
Pfeiffer et al. (2018)[74]	Germany	99	13-21 (16.96)	Afghan (45.5), Angolan (2.0), Eritrean (3.0), Ethiopian (2.0), Gambian (10.1), Iranian (7.1), Iraqi (2.0), Other (6.1), Pakistani (2.0), Senegalese (2.0), Somalian (7.1), Syrian (11.1)	TF-CBT	Group	TAU	Multiple	No	—	CATS-S	PHQ-8
Pityaratstian et al. (2015)[75]	Thailand	36	10-15 (12.25)	NR	TF-CBT	Group	WL	Single	No	1 mo	PTSD-RI	—
Robjant et al. (2019)[76]	DRC	88	11-22 (18)	Banyarbwisha (34), Banyarwanda (62), Other (3)	TF-CBT	Individual	TAU	Multiple	No	6 mo	PSS-I-5	PHQ-9
Roque-Lopez et al. (2021)[77]	Colombia	44	13-16 (14.05)	NR	EMDR	Group	TAU	Multiple	No	2 mo	CPSS	—
Rossouw et al. (2018)[78]	South Africa	63	13-18 (15.35)	African (30.2), Mixed parentage (69.8)	TF-CBT	Individual	SC	Single	No	3 mo and 6 mo	CPSS-I	BDI
Ruf et al. (2010)[79]	Germany	26	7-16 (11.45)	Balkan (23.1), Chechen (11.5), Georgian (3.8), German (3.8), Russian (7.7), Syrian (19.2), Turkey (Kurdish) (30.8)	TF-CBT	Individual	WL	Multiple	No	—	UCLA PTSD-RI	—

TABLE 1 Continued

Study	Country	Sample size	Age, y, range (mean)	Ethnicity (%)	Psychological therapy	Therapy format	Control condition	Trauma frequency	Exclusively sexual trauma	Follow-up timepoints	PTSD measure	Depression measure
Santiago et al. (2018)[80]	US	52	6-10 (7.76)	African American/ Black (3.8), Latino (55.8), Latino/ Caucasian (23.1), Latino/Native American (5.9), Missing (5.9), White/ Caucasian (5.9),	TF-CBT	Group	WL	Multiple	No	—	UCLA PTSD-RI	—
Schauer (2008)[81]	Sri Lanka	47	11-15 (13.1)	NR	TF-CBT	Individual	MED-RELAX	Multiple	No	—	CAPS-CA	MINI KID
Scheeringa et al. (2011)[82]	US	28	3-6 (5.3)	Black/African American (59.5), Other (5.4), White (35.1)	TF-CBT	Individual	WL	Multiple	No	—	PAPA	PAPA
Schottelkorb et al. (2012)[83]	US	26	6-13 (9.16)	African (67.7), Asian (9.7), European (6.5), Middle East (16.1)	TF-CBT	Individual	CCPT	Multiple	No	—	UCLA PTSD Index	—
Shein-Szydlo et al. (2016)[84]	Mexico	98	12-18 (14.89)	NR	TF-CBT	Individual	WL	Multiple	No	—	CPTS-RI	BDI
Smith et al. (2007)[85]	UK	24	8-18 (13.69)	Asian British (5.3), Black British (26.3), Other (7.9), White British (60.5)	TF-CBT	Individual	WL	Single	No	—	CAPS-CA	DSRS
Stein et al. (2003)[86]	US	117	10-12 (10.95)	NR	TF-CBT	Group	WL	Multiple	No	—	CPSS	CDI
Tol et al. (2012)[87]	Sri Lanka	397	9-12 (11.03)	NR	TF-CBT	Group	WL	Multiple	No	—	CPSS	DSRS

Note: Ethnicities are reported as stated in respective articles. ADIS–C = Anxiety Disorders Interview Schedule—Child Version; AYPA = African Youth Psychosocial Assessment; BDI = Beck Depression Inventory; BDI-II = Beck Depression Inventory II; CAB = Acute Stress Checklist for Children—German Version; CAPS-CA = Clinician-Administered PTSD Scale For DSM-5-Child/ Adolescent Version; CATS-S = Child And Adolescent Trauma Screen; CBC = Child Behavior Checklist; CDI = Children's Depression Inventory; CDI-S = Children's Depression Inventory— Short Version; CDS = Children's Depression Scale; CES-D = Center For Epidemiologic Studies Depression Scale; CG = control group; CPTSD = Children's PTSD Inventory; CPTS-RI = Child Posttraumatic Stress Reaction Index; CRIES-13 = Child Revised Impact of Events Scale (13-Item Version); CRTI = Revised Children's Responses to Trauma Inventory; CPSS = Child PTSD Symptom Scale; CPSS-I = Child PTSD Symptom Scale—Interview Version; DSRS = Depression Self-Rating Scale; DSRSC = Depression Self-Rating Scale For Children; HADS = Hospital Anxiety and Depression Scale; K-SADS-E = Schedule for Affective Disorders and Schizophrenia for School-Age Children—Epidemiological Version; K-SADS-PL = Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version; MDI = Major Depression Inventory; MFQ-SF = Mood and Feelings Questionnaire—Short Form; MINI KID = Mini-International Neuropsychiatric Interview for Children and Adolescents; NR = not reported; PAPA = Preschool Age Psychiatric Assessment; PCL-5 = Posttraumatic Stress Disorder Checklist for DSM-5; PEDS = Pediatric Emotional Distress Scale; PHQ-8 = Patient Health Questionnaire 8; PSS-I-5 = PTSD Symptom Scale Interview for DSM-5; PSS-SR = PTSD Symptom Scale Self-Report; PTSD-RI = Posttraumatic Stress Disorder Reaction Index; PTSDSSI = PTSD Semi-Structured Interview and Observational Record for Infants and Young Children; PTSS-C = Posttraumatic Stress Symptom Scale for Child; TAU = treatment as usual; TSC-C = Trauma Symptom Checklist for Children; UCLA PTSD-RI = UCLA Posttraumatic Stress Disorder Reaction Index; UPID = UCLA PTSD Index for DSM-IV; WL = waitlist; YC-PTSD-C = Young Child PTSD Checklist.

TABLE 2 Absolute Proportion of Participants Showing Improvement and Reliable Change in Posttraumatic Stress Disorder (PTSD) Symptoms at Posttreatment

Analysis	K	n	Proportion	95% CI	95% PI	Cochran Q	I² (%)	95% CI	Moderator p
TF-CBT and EMDR									
50% Improvement									
All	59	2,480	0.46	0.39, 0.52	0.09, 0.86	482.3***	89.1	84.3, 92.7	
All, dropouts as nonresponders	59	2,608	0.43	0.37, 0.49	0.08, 0.82	469.4***	88.8	83.9, 92.6	
TF-CBT vs EMDR									.08
TF-CBT	51	2,270	0.48	0.41, 0.55	0.09, 0.88	450.8***	90.3	85.7, 93.8	
EMDR	8	210	0.30	0.24, 0.37	0.24, 0.37	6.7	0.02	0.0, 78.9	
20% Improvement									
All	59	2,480	0.75	0.70, 0.80	0.34, 0.99	472.9***	88.6	83.5, 92.4	
All, dropouts as nonresponders	59	2,608	0.71	0.65, 0.76	0.30, 0.98	465.1***	88.4	83.4, 92.4	
TF-CBT vs EMDR									.16
TF-CBT	51	2,270	0.77	0.71, 0.82	0.33, 1.00	458.0	90.1	85.4, 93.7	
EMDR	8	210	0.67	0.60, 0.73	0.59, 0.75	6.5	5.7	0.0, 73.2	
Reliable change									
Improvement									
All studies	58	2,437	0.53	0.45, 0.61	0.05, 0.98	823.8***	93.7	91.1, 95.9	
TF-CBT vs EMDR									.25
TF-CBT	50	2,227	0.55	0.46, 0.64	0.04, 0.99	797.1***	94.5	92.0, 96.5	
EMDR	8	210	0.42	0.30, 0.55	0.14, 0.74	21.4*	70.7	29.1, 93.7	
Deterioration									
All studies	58	2,437	0.01	0.01, 0.02	0.00, 0.07	106.5***	47.7	24.3, 68.8	
TF-CBT vs EMDR									.64
TF-CBT	50	2,227	0.01	0.01, 0.02	0.00, 0.07	98.2***	52.6	28.2, 72.2	
EMDR	8	210	0.01	0.00, 0.03	0.00, 0.03	8.01	0.0	0.0, 85.1	
Control conditions									
50% Improvement									
All	60	2,372	0.20	0.16, 0.24	0.01, 0.51	307.6***	81.8	73.7, 88.2	
All, dropouts as nonresponders	60	2,495	0.19	0.15, 0.23	0.01, 0.50	343.0***	83.2	75.6, 88.9	
Active vs passive									<.0001
Active	31	1,421	0.28	0.22, 0.34	0.06, 0.58	125.9***	81.1	69.3, 90.5	
Passive	29	951	0.12	0.08, 0.16	0.01, 0.33	133.9***	66.8	42.5, 78.6	
20% Improvement									
All	60	2,372	0.48	0.42, 0.53	0.14, 0.83	357.4***	85.0	78.2, 90.0	
All, dropouts as nonresponders	60	2,495	0.45	0.40, 0.51	0.11, 0.82	411.0***	86.7	80.7, 91.1	
Reliable change									
Improvement									
All studies	59	2,340	0.25	0.20, 0.30	0.01, 0.64	362.6***	86.6	80.7, 91.3	
Active conditions	30	1,389	0.32	0.23, 0.41	0.01, 0.78	255.9***	91.2	85.6, 95.3	
Passive conditions	29	951	0.19	0.15, 0.23	0.05, 0.39	67.2***	61.3	34.0, 79.8	
Deterioration									
All studies	59	2,340	0.13	0.08, 0.20	0.00, 0.77	836.5***	95.0	93.0, 96.7	
Active conditions	30	1,389	0.07	0.02, 0.14	0.00, 0.57	281.4***	93.8	90.1, 96.8	
Passive conditions	29	951	0.21	0.11, 0.34	0.00, 0.89	484.3***	94.7	91.4, 97.1	

Note: EMDR = eye movement desensitization and reprocessing; TF-CBT = trauma-focused cognitive behavioral therapy.
***p < .0001, **p < .001, *p < .05.

for all assessed levels of response did not overlap when comparing TF-CBT and EMDR with control conditions. At posttreatment, pooled 50% improvement response rates for TF-CBT alone (k = 51) were 0.48 (95% CI = 0.41-0.55), EMDR alone (k = 8) 0.30 (0.24-0.37), and for all psychological therapies (k = 59; TF-CBT and EMDR combined) were 0.46 (0.39-0.52); for all control conditions combined, the pooled response rate was 0.20 (0.16-0.24).

TABLE 3 Risk Ratio for Improvement and Reliable Change in Posttraumatic Stress Disorder (PTSD) Symptoms at Posttreatment, Psychological Therapy (TF-CBT or EMDR) vs Control

Analysis	k	N	Risk ratio	95% CI	95% PI	Risk ratio p	Cochran Q	I² (%)	95% CI	Moderator p	NNT
50% Improvement											
All	59	4,840	1.55	1.44, 1.67	0.98, 2.44	<.0001	379.1***	88.4	83.4, 92.4		9.1
All, dropouts as nonresponders	59	5,091	1.51	1.40, 1.63	0.96, 2.39	<.0001	383.6***	83.7			10.3
TF-CBT vs EMDR										.16	
TF-CBT	51	4,463	1.60	1.47, 1.75	0.97, 2.65	<.0001	369.0***	90.1	85.5, 93.8		8.3
EMDR	8	377	1.32	1.21, 1.45	1.21, 1.45	<.0001	6.74	16.6	0.0, 78.0		15.6
Active vs passive[a]										.64	
Active control	29	2,867	1.62	1.46, 1.81	1.01, 2.60	<.0001	104.1***	79.0	60.6, 90.6		5.8
Passive control	21	1,596	1.61	1.37, 1.89	0.87, 2.96	<.0001	156.6***	97.6	92.1, 99.2		13.7
20% Improvement											
All	59	4,840	2.81	2.40, 3.29	1.07, 7.41	<.0001	265.6***	83.1	72.8, 90.7		1.2
All, dropouts as nonresponders	59	5,091	2.47	2.14, 2.84	1.03, 5.93	<.0001	255.2***	83.5	73.7, 90.6		1.5
TF-CBT vs EMDR										.33	
TF-CBT	51	4,463	2.97	2.47, 3.58	1.02, 8.65	<.0001	254.8***	86.1	77.0, 92.5		—
EMDR	8	377	2.33	1.84, 2.94	1.52, 3.57	<.0001	9.4	38.1	0.0, 85.4		—
Active vs passive[a]										.97	
Active control	30	2,867	2.97	2.36, 3.74	1.04, 8.51	<.0001	146.9***	82.0	68.5, 91.5		—
Passive control	21	1,596	3.05	2.20, 4.24	0.91, 10.24	<.0001	93.1***	90.2	75.1, 97.0		—
Reliable change											
Improvement											
All	58	4,765	1.43	1.29, 1.57	0.80, 2.55	<.0001	223.7***	83.3	71.4, 91.3		9.3
TF-CBT vs EMDR										.66	
TF-CBT	50	4,388	1.45	1.30, 1.63	0.77, 2.74	<.0001	208.4***	86.1	74.9, 93.3		—
EMDR	8	377	1.34	1.10, 1.62	0.87, 2.04	<.01	15.1*	43.5	0.0, 86.5		—
Active vs passive[a]										.69	
Active control	29	2,792	1.42	1.23 1.64	0.77, 2.62	<.0001	115.6***	81.7	64.3, 92.5		7.4
Passive control	21	1,596	1.54	1.25, 1.90	0.72, 3.30	<.0001	85.4***	90.2	74.4, 97.4		9.7
Deterioration											
All	58	4,765	1.00	1.00, 1.01	0.99, 1.01	.88	186.1***	99.4	98.7, 99.7		N/A
TF-CBT vs EMDR										.53	
TF-CBT	50	4,388	1.00	1.00, 1.01	1.00, 1.01	.74	147.0***	99.3	98.1, 99.7		—
EMDR	8	377	0.73	0.57, 0.93	0.40, 1.35	.01	38.8***	97.9	85.6, 99.7		—
Active vs passive[a]										.85	
Active control	29	2,792	1.00	0.99, 1.01	0.99, 1.01	.83	55.5*	97.7	80.3, 99.5		N/A
Passive control	21	1,596	0.84	0.76, 0.94	0.55, 1.29	<.01	91.5***	99.1	97.2, 99.7		N/A

Note: EMDR = eye movement desensitization and reprocessing; TF-CBT = trauma-focused cognitive behavioral therapy; N/A = not available (ie, could not be calculated as rates of reliable deterioration were too low); NNT = number needed to treat.
[a]Using only the TF-CBT studies.
**p < .0001, **p < .001, *p < .05.

The 20% improvement pooled response rates were 0.77 (0.71-0.82) for TF-CBT alone, 0.67 (0.60-0.73) for EMDR alone, and 0.75 (0.70-0.80) for all psychological therapies; the 20% improvement rate was 0.48 (0.42-0.53) for control conditions.

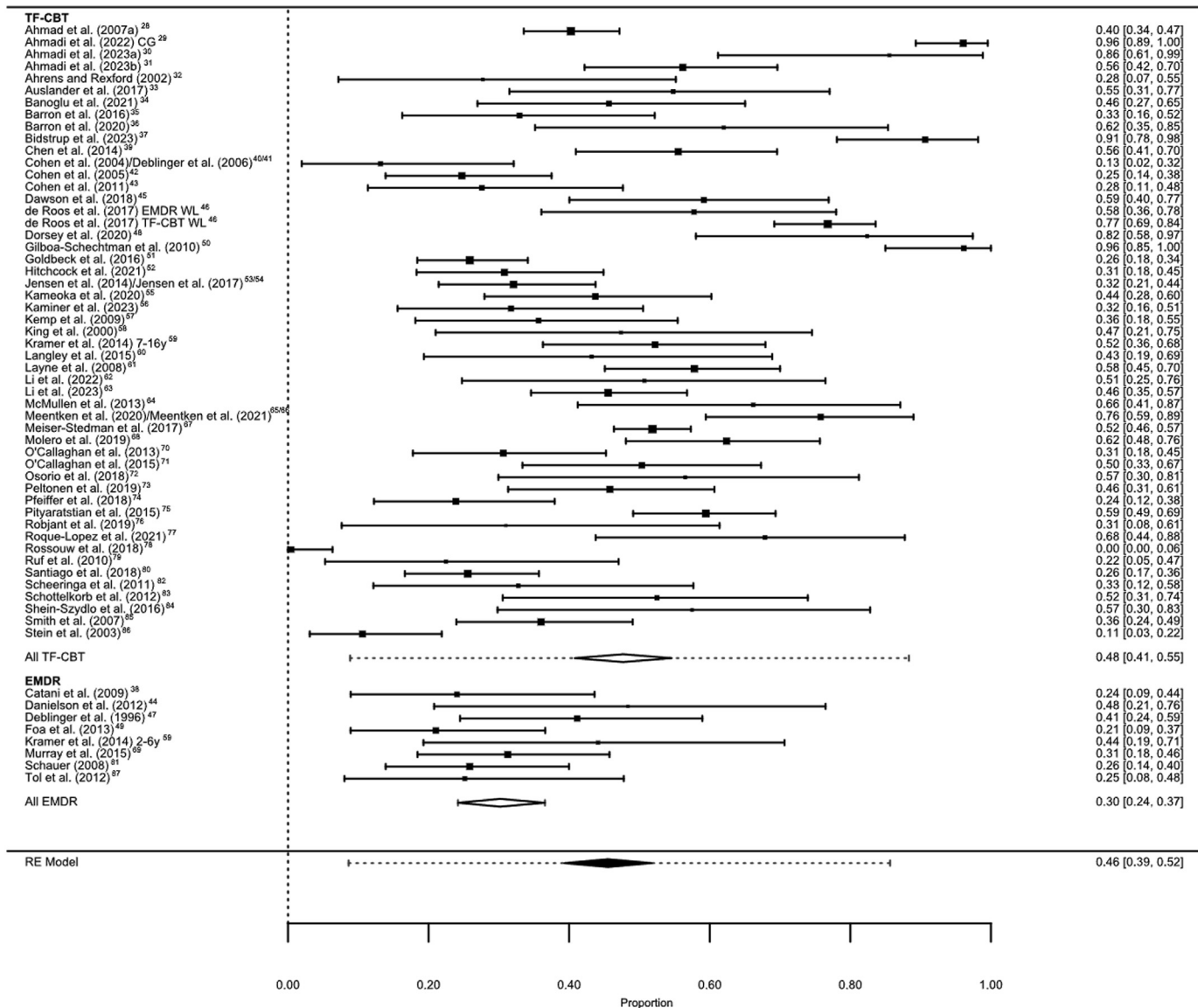Reliable improvement pooled response rates were 0.55 (0.46-0.64) for TF-CBT alone, 0.42 (0.30-0.55) for EMDR alone, and 0.53 (0.45-0.61) for all psychological therapies; the response rate was 0.25 (0.20-0.30) for control conditions. Reliable deterioration rates were 0.01 (0.01-0.02) for TF-CBT alone, 0.01 (0.00-0.03) for EMDR alone, and 0.01 (0.01-0.02) for all psychological therapies; the reliable deterioration rate was 0.13 (0.08-0.20) for control conditions. Sensitivity analyses were conducted whereby dropouts were assumed to be nonresponders; this resulted in a small reduction in absolute response rates (Tables 2 and 3). Figure 2 provides a forest plot and Figure S1, available online, a the funnel plot for 50% improvement response rates.

PTSD Symptoms, Follow-Up. Table S2, available online, lists absolute response rates for TF-CBT and EMDR, and Table S3, available online, provides absolute response rates for control conditions. Data for follow-up window 1 (1-5 months after the posttreatment assessment) showed that the pooled absolute response rate for 50% improvement was similar to that at posttreatment: 0.44 (0.32-0.56; k = 16) for TF-CBT, and 0.44 (0.34, 0.55; k = 19) for all psychological therapies; the 50% improvement rate was 0.22 (0.15-0.31) for control conditions, with no overlap of CIs between psychological therapies and controls.

At follow-up window 2 (at least 6 months after posttreatment assessment), the pooled response rate for 50% improvement was 0.62 (0.44-0.78; k = 12) for TF-CBT alone (only one study was available for EMDR in this time window) and 0.43 (0.29-0.57) for control conditions. The overlapping CIs suggest that there may be no significant difference between the arms at this timepoint.

Depression Symptoms, Posttreatment. Table S5, available online, lists absolute response rates for TF-CBT and EMDR, and Table S6, available online, provides absolute response rates for control conditions. At posttreatment, pooled 50% improvement response rates for TF-CBT were 0.33 (0.25-0.41, k = 35), for EMDR were 0.33 (0.09-0.63; k = 5) and for all psychological therapies 0.33 (0.26-0.41; k = 40); for all control conditions combined, the pooled response rate was 0.18 (0.13-0.23).

Pooled 20% improvement response rates were 0.60 (0.52-0.68) for TF-CBT alone, 0.58 (0.30-0.82) for EMDR alone, and 0.60 (0.52-0.68) for all psychological therapies; the 20% improvement response rate was 0.37 (0.31-0.43) for control conditions.

Pooled reliable improvement response rates were 0.25 (0.19-0.31) for TF-CBT alone, 0.24 (0.05-0.50) for EMDR alone, and 0.25 (0.19-0.31) for all psychological therapies. The rate was 0.13 (0.10-0.17) for control conditions. Pooled reliable deterioration rates were 0.02(0.01-0.03) for TF-CBT alone, 0.01 (0.00-0.04) for EMDR alone, and 0.02 (0.01-0.03) for all psychological therapies; the rate was 0.10 (0.02-0.21) for control conditions. CIs were nonoverlapping between psychological therapies and control conditions, apart from for reliable deterioration. Sensitivity analyses were conducted whereby dropouts were assumed to be nonresponders, resulting in a small reduction in absolute response rates (Tables S5 and S6, available online).

Depression Symptoms, Follow-Up. Table S8, available online, gives absolute response rates for TF-CBT and EMDR, and Table S9, available online, lists absolute response rates for control conditions. Data for follow-up window 1 (1-5 months after posttreatment assessment) showed that absolute response rate for 50% improvement was 0.26 (0.10-0.46; k = 13) for TF-CBT (only 2 trials reported data for EMDR) and 0.19 (0.10-0.29) for control conditions. At follow up window 2 (at least 6 months after posttreatment assessment), response rate for 50% improvement was 0.48 (0.29-0.68; k = 6) for TF-CBT (only 2 trials reported data for EMDR) and 0.36 (0.26-0.46) for control conditions. Overlapping confidence intervals indicate that there may be no significant difference between response rates for depression symptoms for psychological therapies and control conditions at follow-up.

Risk Ratio
PTSD Symptoms. Table 3 provides pooled risk ratio data comparing psychological therapies with control conditions at posttreatment. The pooled risk ratio for 50% improvement for TF-CBT alone was 1.60 (1.47-1.75), for EMDR alone was 1.32 (1.21-1.45) and for all psychological therapies was 1.55 (CI = 1.44-1.67); for 20% improvement, the pooled ratio for TF-CBT alone was 2.97 (2.47-3.58), for EMDR alone was 2.33 (1.84, 2.94), and all psychological therapies was 2.81 (2.40-3.29). The pooled risk ratio for reliable improvement for TF-CBT alone was 1.45 (1.30, 1.63), for EMDR alone was 1.34 (1.10, 1.62), and for all psychological therapies was 1.43 (1.29-1.57). For reliable deterioration, the pooled risk ratio TF-CBT alone was 1.00 (1.00, 1.01), for EMDR alone was 0.73 (0.57-0.93), and for all psychological therapies was 1.00 and nonsignificant (1.00-1.01).

Table S4, available online, provides risk ratio data comparing psychological therapy with control conditions at

FIGURE 2 Forest Plot for 50% Improvement in Posttraumatic Stress Disorder (PTSD) Symptoms, Trauma-Focused Cognitive Behavioral Therapy (TF-CBT), and Eye Movement Desensitization and Reprocessing (EMDR)

follow-up. At follow-up window 1 (1-5 months after post-treatment assessment), the pooled risk ratio for 50% improvement for TF-CBT was 1.20 (1.08-1.33, k = 16; only 3 EMDR trials). For 20% improvement, the pooled risk ratio for TF-CBT was 1.30 (1.06-1.60, k = 16; only 3 EMDR trials). The pooled risk ratio for reliable improvement for TF-CBT was 1.25 (1.08-1.46, k = 16) and for all psychological therapies was 1.37 (1.16-1.61, k = 19); for reliable deterioration, the pooled risk ratio for TF-CBT was 1.00 and nonsignificant (0.97-1.03, k = 16), and for all psychological treatments was 0.97 and nonsignificant (0.92-1.01, k = 19).

At follow-up window 2 (at least 6 months after post-treatment assessment), the risk ratio for 50% improvement was 1.38 (1.10-1.73) and for 20% improvement was 2.13 (1.32-3.44). The risk ratio for reliable improvement was 1.63 (1.15-2.30) and for reliable deterioration was 1.00 (0.99-1.01).

Sensitivity analyses were conducted whereby dropouts were assumed to be nonresponders, resulting in a small reduction in risk ratios, ALthough they remained statistically significant (results shown in tables).

Figures S3 and S4, available online, show the funnel plot and forest plot for 50% improvement risk ratio data.

Depression Symptoms. Table S7, available online, provides risk ratio data comparing psychological therapy with

control conditions at posttreatment. The risk ratio for 50% improvement was 1.18 (1.10-1.25) and for 20% improvement was 1.39 (1.25-1.55). The risk ratio for reliable improvement was 1.11 (1.06-1.16) and for reliable deterioration was 1.01 and nonsignificant (1.00-1.02).

Table S10, available online, provides risk ratio data comparing psychological therapy with control conditions at follow-up. At follow-up window 1 (1-5 months after posttreatment assessment), the risk ratio for 50% improvement was 1.01 and nonsignificant (0.97-1.04) and for 20% improvement was 1.25 (1.04-1.52). The risk ratio for reliable improvement was 1.16 (1.05-1.29) and for reliable deterioration was 1.02 and nonsignificant (0.97-1.08). At follow-up window 2 (at least 6 months after posttreatment assessment), the risk ratio for 50% improvement was 1.29 (1.06-1.58) and for 20% improvement was 1.58 (1.21-2.06). The risk ratio for reliable improvement was 1.29 (1.07-1.54) and for reliable deterioration was 1.00 and nonsignificant (0.99-1.02).

Sensitivity analyses were conducted whereby dropouts were assumed to be nonresponders, resulting in a small reduction in risk ratios; the tables show results.

Moderator Analysis
PTSD Symptoms. Moderator and subgroup analyses were conducted; the results are reported in Tables 2 and 3 for posttreatment and in Tables S1 to S3, available online, for follow-up data. No moderation effects were significant for response rates in psychological therapy conditions at posttreatment. A significant difference was found for the 50% improvement response rates in control conditions at posttreatment: active control conditions yielded a higher response rate (0.28) than passive control conditions (0.12; $p < .0001$), as would be expected. No significant differences were found for subgroup analyses of risk ratios for psychological therapies vs control conditions at posttreatment.

At follow-up, there were too few studies (<5 per subgroup[88]) to assess the difference between the subgroups in most cases but the significant difference for 50% improvement response rates in control conditions was replicated in follow-up window one (one to five months after posttreatment assessment): active control conditions yielded a higher response rate (0.29) than passive control conditions (0.10; $p = .010$).

Depression Symptoms. Subgroup analyses were conducted and reported in Tables S4 to S6 for posttreatment and in Tables S7 to S9, available online, for follow-up data. No significant differences were found for the response rates in psychological therapy conditions or control conditions at posttreatment or for subgroup analyses of risk ratios for psychological therapies vs control conditions at posttreatment.

At follow-up, groups became too small to assess the difference between subgroups.

Publication Bias
Funnel plots were inspected, and the Egger test of funnel plot asymmetry was implemented for main analyses at posttreatment.

PTSD. The Egger test result was not significant for absolute response rates (50%, 20%, and reliable improvement) for TF-CBT and EMDR or control conditions, and for absolute rates of reliable deterioration for TF-CBT and EMDR. The Egger test suggested significant funnel plot asymmetry for absolute rates of reliable deterioration in control conditions, but the trim-and-fill procedure did not indicate that any studies were missing.

The Egger test also suggested significant funnel plot asymmetry for 50% improvement risk ratio data. The trim-and-fill procedure calculated 21 missing studies on the left side, reducing the reported risk ratio from 1.54 (1.42-1.66) to 1.33 (1.21-1.47). The Egger test was significant for 20% improvement risk ratio data as well; the trim-and-fill procedure calculated 19 missing studies on the left side, reducing the risk ratio from 2.76 (2.34-3.25) to 2.18 (1.82-2.62).

The Egger test indicated significant funnel plot asymmetry for reliable improvement and deterioration risk ratio data. For reliable improvement, the trim-and-fill procedure indicated 8 missing studies on the left side, reducing the risk ratio from 1.43 (1.29-1.57) to 1.38 (1.25-1.52). For reliable deterioration, the trim-and-fill procedure indicated 21 missing studies on the right side, which did not alter the calculated risk ratio or 95% CIs.

Depression. The Egger test was not significant for absolute response rates (50%, 20%, and reliable improvement) or reliable deterioration for TF-CBT and EMDR or control conditions.

The Egger test suggested significant funnel plot asymmetry for 50% improvement risk ratio data. The trim-and-fill procedure calculated 18 missing studies on the left side, reducing the reported risk ratio from 1.18 (1.10-1.25) to 1.05 (0.97-1.14). The Egger test was significant for 20% improvement risk ratio data as well; the trim-and-fill procedure calculated 16 missing studies on the left side, reducing the risk ratio from 1.39 (1.25-1.55) to 1.20 (1.06-1.37).

The Egger test indicated significant funnel plot asymmetry for reliable improvement and deterioration risk ratio data. For reliable improvement, the trim-and-fill procedure indicated 8 missing studies on the left side, reducing the risk ratio from 1.11 (1.06-1.16) to 1.04 (0.98-1.11). For reliable

deterioration, the trim-and-fill procedure indicated 11 missing studies on the right side, which did not alter the calculated risk ratio or 95% CIs.

DISCUSSION

This systematic review and meta-analysis imputed rates of response, reliable improvement, and reliable deterioration for psychological therapies used to treat children and adolescents with PTSD. The results have shown that an average of 48% of young people receiving TF-CBT and 30% of those receiving EMDR (46% for the combined all psychological therapies class) show 50% improvement in PTSD symptoms at posttreatment, compared to 20% of young people in control conditions. The risk ratio of 50% improvement comparing TF-CBT to control conditions was 1.60 and for EMDR relative to control conditions was 1.32 (1.55 for the combined all psychological therapies class). These patterns were consistent (albeit with higher percentages showing response) for 20% improvement in PTSD symptoms. They were also consistent (but with slightly lower percentages) in showing response when dropouts were included as non-responders in sensitivity analyses. When considering reliable change, 55% of young people receiving TF-CBT (42% of youth receiving EMDR and 53% of those receiving any psychological therapy) exhibited reliable improvement, compared to 25% of young people in control conditions. Of the young people receiving psychological therapy, 1% exhibited reliable deterioration, compared to 13% of young people in control conditions; the risk ratio when comparing TF-CBT or EMDR conditions to control conditions was nonsignificant, however. The comparison between TF-CBT and EMDR was nonsignificant for 50% symptom reduction, despite TF-CBT resulting in a greater proportion (0.48, 95% CI = 0.41-0.55) exhibiting response than EMDR (0.30, 95% CI = 0.24-0.37).

These results are consistent with findings in the recent meta-analysis by Cuijpers et al.,[17] who calculated a response rate of 38% showing a 50% reduction in symptoms in adults receiving psychotherapy for PTSD. The results support the use of psychological therapies as a first-line gold-standard treatment for children and adolescents presenting with PTSD, and demonstrate their effectiveness over and above control conditions, even when dividing into active and passive control conditions. In addition, the rate of reliable deterioration was very low for psychological therapies, further supporting their implementation and addressing concerns regarding retraumatization.[89]

However, the results also demonstrate that a large proportion (over half) of young people do not show 50% improvement in their PTSD symptoms at posttreatment

following psychological therapy. Although this is concerning, it is important to note that there may be a floor effect whereby participants with mild-to-moderate symptoms do not show 50% improvement because their symptom score was relatively low to begin with, thereby reducing the scope for improvement. This is somewhat supported by the inclusion of 20% improvement as a threshold; the present research found that 75% of young people receiving TF-CBT or EMDR at least met this threshold for symptom improvement. It is also possible that some participants may experience barriers outside of therapy that reduce their response. However, there is scope for further research and consideration as to how psychological therapies could be made more effective for the treatment of PTSD in youth.

A further consideration is the lack of difference between psychological therapies and control conditions at long-term follow up (6 months or more). This may indicate some level of naturalistic recovery occurring in a proportion of youth with a PTSD diagnosis, as suggested by previous trajectory research.[90,91] Nevertheless, the present research supports the use of psychological therapies to facilitate a faster recovery than may be achieved naturally.

As a sufficient number of studies reported depression data, we were also able to impute response rates for depression symptoms. Of those youth receiving psychological therapies, 33% experienced a 50% reduction in depression symptoms, compared to 18% in control conditions; the risk ratio comparing psychological therapies to control conditions for 50% reduction in symptoms was small (1.18) but statistically significant. This shows that psychological therapies for PTSD go some way to improving depression symptoms, but again do not provide improvement for a large proportion of young people. Cuijpers et al.[18] imputed response rates for psychological treatments of depression in children and adolescents and found 39% of young people exhibited 50% symptom reduction. As the results from the present study are broadly comparable to this figure, this suggests that psychological therapies for PTSD may have important transdiagnostic effects with regard to treating depression symptoms. There is also the potential for presence of depression symptoms to reduce response to therapy for PTSD, as depression has previously been identified as a risk factor for nonresponse to cognitive behavioral treatments for PTSD.[92]

Publication biases for risk ratio data suggested that some studies were missing, but the effect sizes remained significant after implementing the trim-and-fill procedure. As noted in the *Cochrane Handbook for Systematic Reviews*,[88] this may be an artifactual effect as risk ratios are correlated with standard errors.[93,94] This is further supported by the lack of missing studies in previous meta-analyses using the Hedges *g*.[95]

The limitations of this research must be considered. Heterogeneity was found to be high, consistent with similar meta-analyses of psychological treatments.[96] However, moderator analyses did not identify any significant differences between subgroups. As a result of the high degree of heterogeneity, our findings should be considered with caution. This is particularly true for the response rate data, in which methodological features of a trial are not controlled for and heterogeneity therefore tends to be very high. Although response data may be useful for clinicians, we acknowledge that pooling response rates is not without debate.[15] A further consideration is that the pooled response rates are estimates as opposed to measured rates, which would require individual participant data. In addition, dichotomization of the data to impute response rates does require the selection of arbitrary response rates. However, we chose 50% improvement as the main outcome, to be consistent with previous research.[17,18] This limitation was further ameliorated by exploring different levels of response (50% and 20%), as well as reliable improvement and deterioration. Similarly, the use of reliable change indices requires the application of assumptions, although a conservative assumption for the Cronbach alpha was used and the relevant assumptions would affect all extracted data equally. Furthermore, results suggest that there may have been a floor effect for reliable deterioration, given the low numbers reported for psychological therapies. This may have reduced the accuracy of the normal distribution assumption, as these values were likely at the tail end of the theoretical distribution. Finally, we note that there may be issues with pooling TF-CBT and EMDR when considering the evidence for "psychological therapies" as a broad class of intervention. Although there were no differences between these 2 treatment approaches at the conventional level of significance, the bulk of the evidence gathered here pertains to TF-CBT, and the 95% CIs for both absolute prevalences and risk ratios when comparing to control conditions were nonoverlapping, showing some evidence for the superiority of TF-CBT.

The present research also had a considerable number of strengths. It is the first systematic review and meta-analysis of its kind to impute response rates for young people receiving psychological therapy for PTSD, and the use of different levels of symptom improvement as well as reliable improvement and deterioration allow a comprehensive view of how TF-CBT and EMDR compare to control conditions. A range of subgroup analyses were conducted to assess whether any study characteristics influenced results, and extraction and analysis of depression data allowed calculation of response rates for depression symptoms, an important metric given its common comorbidity with PTSD.[2]

The clinical implications of this research are that psychological therapies are appropriate as first-line treatment for children and adolescents with a diagnosis of PTSD. It is also important to note that a proportion of young people may not show large improvements in symptom reduction at posttreatment (although a majority [75%] were found to exhibit at least 20% symptom reduction). This study provides easily interpretable response rates for clinicians and service users to consider, and showcases the very low rates of deterioration in symptoms for young people receiving TF-CBT or EMDR for PTSD.

In conclusion, this meta-analysis has imputed response rates at a range of levels for psychological therapies for PTSD in children and adolescents. The results support the use of psychological therapies to treat PTSD in youth, and show that these are also effective for symptoms of depression and have very low rates of reliable deterioration. However, they also show that a proportion of young people do not exhibit a 50% reduction in their symptoms at posttreatment, warranting further research.

CRediT authorship contribution statement

Katie Lofthouse: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Alana Davies:** Writing – review & editing, Validation, Data curation. **Joanne Hodgekins:** Writing – review & editing, Supervision. **Richard Meiser-Stedman:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

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