Psychological Treatments for Symptoms of Posttraumatic Stress Disorder in Children, Adolescents, and Young Adults: A Meta-Analysis

Jana Gutermann[1] · Franziska Schreiber[1] · Simone Matulis[1] · Laura Schwartzkopff[1] · Julia Deppe[1] · Regina Steil[1]

Abstract Meta-analyses of the treatment of posttraumatic stress disorder (PTSD) in childhood and adolescence are restricted to specific trauma, selected interventions, and methodologically rigorous studies. This large meta-analysis quantifies the effects of psychological treatments for PTSD symptoms in children and adolescents. An extensive literature search yielded a total of 13,040 articles; 135 studies with 150 treatment conditions ($N = 9562$ participants) met the inclusion criteria (psychological interventions with children and/or adolescents with PTSD symptoms that report quantitative measures of symptom change). The mean effect sizes (ESs) for PTSD symptoms ranged from large to small, depending on the control condition. Cognitive behavioral therapy (CBT) yielded the highest ESs. Age and caretaker involvement were identified as moderators. CBT, especially when conducted in individual treatment with the inclusion of parents, is a highly effective treatment for trauma symptoms. Psychological treatments need to be modified to address younger patients' specific needs.

Keywords Posttraumatic stress disorder · Children · Adolescents · Psychological treatment · Meta-analysis · Childhood

✉ Jana Gutermann
gutermann@psych.uni-frankfurt.de

[1] Department of Clinical Psychology and Psychotherapy, Goethe University, Varrentrappstr. 40-42, 60486 Frankfurt am Main, Germany

Introduction

Traumatic events are highly prevalent in childhood and adolescence (Copeland et al. 2007). Approximately 15 % of youth who have been exposed to traumatic events meet the diagnostic criteria for posttraumatic stress disorder (PTSD) (Giaconia et al. 1995).

There is an ongoing debate about whether the symptoms used to diagnose PTSD adequately capture posttraumatic stress in children (Scheeringa et al. 2006; Scheeringa et al. 2011). In the past, the inadequacy of the diagnostic criteria may have led to an underestimation of the number of young patients with PTSD (D'Andrea et al. 2012). Therefore, subclinical or differing forms of PTSD should be included in research on the effects of treatment in children. PTSD is often chronic and has immense personal and social costs, and the prognosis for recovery without adequate treatment is poor (Kessler 2000; Marciniak et al. 2005). Therefore, early and effective treatment is important.

Existing Meta-Analyses and Empirical Reviews for Posttraumatic Stress Symptoms in Children and Adolescents

In the following paragraphs, recently conducted meta-analyses and reviews within the field of PTSD treatment for children and adolescents are summarized.[1] Usually, studies on youth up to 18 years of age are included. The number of studies included is given as NS, next to further information about the studies included.

---

[1] For the sake of comparability, pre-post ESs (rather than pre-follow-up effects) are reported.

Treatment of Posttraumatic Stress Symptoms After Non-interpersonal Trauma

Newman et al. (2014) analyzed studies on the treatment of children with PTSD symptoms after disasters, accidents, and terrorism (NS = 24, uncontrolled and controlled studies) and reported a pre-post mean effect size (ES) for PTSD symptom reduction (mean Cohen's $d = 1.13$) as well as a controlled mean ES (mean Cohen's $d = .74$). Although several interventions (eye movement desensitization and reprocessing (EMDR), exposure-based interventions, and cognitive behavioral therapy (CBT)) yielded high ESs, the authors conclude that CBT has the strongest evidence. Moderator analyses revealed that older children benefited more from treatment, that studies with a more rigorous methodology yielded larger ESs, and that longer therapies (above 9 h) had smaller treatment effects than shorter therapies did.

Treatment of Posttraumatic Stress Symptoms after Childhood Sexual Abuse

All types of treatments in which a minimum of 50 % of the included children were victims of childhood sexual abuse (CSA) were included in an analysis conducted by Harvey and Taylor (2010a, b) (NS = 39, quasi-experimental, experimental, and uncontrolled trials). Thus, this meta-analysis also included data on survivors of other types of trauma. The researchers found a large pre-post mean ES for PTSD reduction (mean Hedges' $g = 1.12$). Several moderators for PTSD symptom reduction were identified, including the type of treatment (with CBT and insight-oriented therapies yielding high ESs and eclectic and other therapies yielding small to medium ESs).

Another meta-analysis (NS = 33, randomized-controlled trials (RCTs) and uncontrolled studies) (Sanchez-Meca et al. 2011) reported only on symptoms of depression and anxiety, not on PTSD symptoms. For depressive symptoms, the mean pre-post ES for the treatment group was small ($d = .41$), and for symptoms of anxiety, the mean pre-post ES was medium ($d = .53$). The authors also performed a subgroup analysis of different types of treatments that was restricted by the small number of studies with separate treatment groups. The researchers concluded that trauma-focused CBT combined with supportive therapy and psychodynamic elements provided the best treatment results. Interventions with more and longer sessions yielded larger ESs. Their analysis lacked ESs for PTSD symptoms, which impedes comparisons with other meta-analyses.

A third meta-analysis found medium mean ESs for PTSD symptoms ($d = .51$ for uncontrolled studies, $d = .63$ for controlled studies, NS = 35, uncontrolled and controlled studies with no-treatment or attention-placebo CG) (Trask et al. 2011). Within controlled studies, longer interventions were more effective; studies with no-treatment comparison groups reported larger ESs, with older children benefiting more from treatment, and studies with predominately male participants had larger ESs than those with predominately female participants. Both controlled and uncontrolled ESs were larger for CBT interventions than for other treatments.

A fourth meta-analysis focused on the effect of parent-involved treatments compared to child-only groups or other control groups (CGs) for victims of CSA (Corcoran and Pillai 2008) (NS = 7, controlled studies). The authors reported small controlled ESs for internalizing behavior, externalizing behavior, sexualized behavior, and posttraumatic stress (hedges $g = .41, .32, .31, .37$). The inclusion of caretakers led to slightly higher effects; however, the results are limited by the fact that some parent-involved treatments were within the control condition as well.

In a review restricted to survivors of CSA and the use of CBT versus treatment as usual (TAU) or placebo intervention (NS = 10 RCTs or quasi-RCTs) (Macdonald et al. 2012), the authors concluded that CBT may have a small, positive effect on PTSD (decrease in standard deviation = .44) and anxiety symptoms (.23). Small effects were also found for depression.

CBT in the Treatment of Posttraumatic Stress Symptoms

In a meta-analysis including only studies of CBT versus active CGs, small mean effects from pre- to post-treatment ($d = .33$) were found for internalizing and externalizing problems (NS = 8, RCTs) (Kowalik et al. 2011). Studies were included only if symptom changes were measured with the Child Behavior Checklist (CBCL; Achenbach 1991), a non-specific outcome measure. Thus, specific PTSD measures were lacking.

In a systematic review of CBT studies (Leenarts et al. 2012) (NS = 27 RCTs and uncontrolled trials, age 6–18 years), all types of trauma, with the exception of "war-related violence" and "traumatic grief," were assessed. Here, studies were also included if only the parents received therapy for their children with PTSD symptoms. The authors concluded that CBT, especially trauma-focused CBT, is the best empirically supported treatment for children and adolescents with PTSD.

In a systematic review analyzing studies comparing trauma-focused CBT (TF-CBT) with other treatments for all types of trauma (NS = 10 RCTs, below 18 years of age) (Cary and McMillen 2012), the researchers differentiated between "branded TF-CBT," which included *all* elements of the treatment (Cohen et al. 2006), and TF-CBT, which did *not* include all components. The authors report that relative to control interventions, TF-CBT is

moderately to highly effective ($g = .67$) for the treatment of PTSD symptoms, but is less effective for treating depression ($g = .38$) and behavior problems ($g = .25$).

Meta-Analysis of School-Based Intervention Programs for Posttraumatic Stress Symptoms

In a meta-analysis of school-based intervention programs (including different approaches such as CBT or EMDR; NS = 19 RCTs or quasi-randomized trials) (Rolfsnes and Idsoe 2011), a medium mean pre-post ES for PTSD symptom reduction ($d = .68$) was found. The sample was highly restricted by excluding studies aiming to treat complex type II reactions resulting from CSA, childhood physical abuse (CPA), or other forms of ongoing maltreatment.

Comprehensive Reviews and Meta-Analyses

Two separate publications reported the results of a comprehensive review of PTSD symptom reduction (Forman-Hoffman et al. 2013; Fraser et al. 2013). The authors aimed to conduct a meta-analysis, but refrained from doing so because of data heterogeneity and insufficient outcome reporting. One publication (NS = 22, uncontrolled and controlled trials, up to 17 years of age) focused on treatment studies for youth exposed to traumatic events other than maltreatment and concluded that only a few psychological interventions that include CBT elements are effective for reducing PTSD symptoms. The other publication (NS = 17, RCTs and cohort study, up to 14 years of age) on children who were exposed to maltreatment concluded that the evidence for the effectiveness of PTSD interventions is limited. Because the authors did not provide a quantitative synthesis of the data, their results are not comparable with those of other meta-analyses.

In their comprehensive review and meta-analysis (NS = 21, controlled studies with random assignment to active and CG, up to 17 years of age), Silverman et al. (2008) presented data on treatment studies for youth who had been exposed to traumatic events (not all of them meeting PTSD criteria). The authors reported small positive controlled effects on posttraumatic stress ($d = .43$), depressive symptoms ($d = .24$), anxiety symptoms ($d = .09$), and externalizing behavior problems ($d = .22$). Results were differentiated for studies comparing treatment groups versus waitlist (WL) CG ($d = .34, .22, .01, .37$) or versus active CG ($d = .33, .25, .09, .18$). Furthermore, the authors investigated moderators of treatment effects and showed that CBT was more effective than non-CBT treatments. Treatments for children after sexual abuse were more effective at reducing posttraumatic stress symptoms and depression than for children after other types of traumatization, whereas for other types of traumatization, the reduction in externalizing symptoms was greater. Parent involvement in the treatment showed similar effects compared with child-only treatment.

To date, the most comprehensive analysis of all types of PTSD treatment in children and adolescents (NS = 14, RCTs or quasi-randomized trials, 3–18 years) was conducted by Gillies and colleagues (Gillies et al. 2012). In contrast to the above analyses, it included only studies in which patients met the criteria for full PTSD diagnosis and studies in which the improvement in PTSD symptoms was measured using diagnostic instruments that have demonstrated reliability and validity. For controlled studies (all CGs are WLs), standardized mean differences (SMDs) of 1.05 (based on 6 studies) for PTSD symptom reduction, .57 (based on 3 studies) for anxiety, and .74 (based on 5 studies) for depression were reported. The authors differentiated among different types of interventions, such as CBT, psychodynamic therapy, and EMDR. The distinction between CBT and behavioral therapy (including exposure-based and narrative therapy) was notable. The authors concluded that the treatment effects were significantly higher for CBT than for other types of treatment. The authors did not analyze potential moderators.

Summary of Previous Meta-Analyses and the Need for a Comprehensive Analysis

Overall, psychological interventions are effective with medium to large ESs for PTSD symptom reduction in both uncontrolled and controlled trials (Cary and McMillen 2012; Gillies et al. 2012; Harvey and Taylor 2010a, b; Kowalik et al. 2011; Newman et al. 2014; Rolfsnes and Idsoe 2011; Trask et al. 2011). CBT yields the highest effectiveness (Gillies et al. 2012; Leenarts et al. 2012; Macdonald et al. 2012; Newman et al. 2014; Sanchez-Meca et al. 2011; Silverman et al. 2008; Trask et al. 2011).

The inclusion of (non-offending) caretakers in the treatment [mostly in analyses of victims of CSA] leads to higher (Corcoran and Pillai 2008; Harvey and Taylor 2010a, b), similar (Silverman et al. 2008) or—presumably due to methodological reasons—lower treatment effects with regard to PTSD symptom reduction (Trask et al. 2011). For adult PTSD patients, some evidence suggests that group treatment is less effective than individual treatment (Taylor and Harvey 2010; Watts et al. 2013).

Existing meta-analyses and reviews are restricted by their choices regarding the type of trauma [e.g., CSA only (Harvey and Taylor 2010a, b; Trask et al. 2011)] or the type of intervention [e.g., CBT only (Cary and McMillen 2012; Kowalik et al. 2011; Macdonald et al. 2012) or school-based interventions only (Rolfsnes and Idsoe 2011)]. They are restricted by either methodological rigor [i.e., accepting only RCTs, leading to small sample sizes, e.g., in 14 studies (Gillies et al. 2012)], thereby impeding moderator analyses or by refraining from

conducting meta-analyses (Forman-Hoffman et al. 2013; Fraser et al. 2013; Leenarts et al. 2012). Furthermore, they overlook a considerable amount of studies that treat older adolescents or young adults, especially in the context of trauma following war, in populations of students or in studies conducted in countries where patients older than 18 years of age are treated within the children and adolescent healthcare system. These restrictions make comparing different treatments with respect to their effectiveness for different types of trauma impossible. Many analyses examine only controlled studies and thus exclude the considerable number of pre-post studies conducted in this area of research. The existing meta-analyses are based on very different study samples due to the use of divergent inclusion criteria with regard to PTSD diagnoses [full (Gillies et al. 2012) vs. subclinical diagnoses] or the diagnostic instruments used [i.e., PTSD measures vs. other measures (Kowalik et al. 2011; Sanchez-Meca et al. 2011)]. In summary, the effectiveness of psychological treatments in reducing PTSD symptoms in children and adolescents and the factors that mediate that effectiveness remain unclear. An up-to-date, comprehensive analysis is needed to gain knowledge on treatment effects and influencing moderators for all traumatized children and adolescents. We conducted a large meta-analysis with two primary goals: (1) to quantify the size of controlled and uncontrolled treatment effects of psychological treatments on PTSD symptoms and (2) to identify treatment moderators.

Method

Search Procedure

The meta-analysis was performed according to the PRISMA guidelines (Liberati et al. 2009) (see Electronic supplementary material 8 for the PRISMA checklist). Studies were identified by searching PubMed, PsycINFO/Psyndex, Web of Science, Cochrane Library, and PILOTs. Searches were conducted for studies published between January 1, 1980, the year of the first classification of PTSD in the DSM-III, and April 28, 2014, using all possible combinations of search terms in the title and/or abstract. The search terms were as follows:

1. treatment OR therapy OR intervention OR psychotherapy
2. youth OR child* OR adolescen* OR pediatric OR young OR teen*
3. PTSD OR posttrauma* OR post-trauma* OR "post trauma*" OR trauma*
4. fire OR explosion OR "domestic violence" OR "physical violence" OR "physical* neglect*" OR "physical* abuse*" OR maltreat* OR mistreat* OR

punishment OR incest OR "child* abuse*" OR "sexual* abuse*" OR refugee OR war OR hurricane OR tsunami OR tornado OR earthquake OR flood OR "natural disaster" OR terroris* OR shooting OR massacre OR kidnapp* OR witnes* OR victim.

Children and adolescents often do not meet all criteria for PTSD diagnosis, even if they exhibit PTSD symptoms (Scheeringa et al. 2006). Consequently, in many studies of the treatment of PTSD symptoms in children and adolescents, the term "Posttraumatic Stress Disorder" is not used in the title or abstract. Because one goal of this meta-analysis was to identify studies on the treatment of PTSD symptoms in children and adolescents, the search term "trauma*" was also used. To avoid identifying studies on trauma considered solely in a medical sense, such as injuries, a fourth level of search terms related to different types of psychological trauma was added. These search terms were derived from the Clinician-Administered PTSD Scale, Child and Adolescent Version (CAPS-CA) (Nader et al. 1996), the gold standard for clinician-administered PTSD diagnosis in children and adolescents for all relevant types of trauma. For trauma involving "death OR loss OR accident OR plane crash," the search had to be conducted without the word "trauma*" for the third level because including "trauma*" in the search yielded studies on medical trauma only.

Screening of Articles

The search process yielded 12,867 articles. The title and abstract of each article were screened. All relevant articles were further examined by independent and extensively trained raters for potential inclusion in the meta-analysis by reading the full text and by screening for inclusion and exclusion criteria. An a priori decision was made to search only for published work (including dissertations) in English. Additionally, manual searches in the references of relevant studies and published meta-analyses and reviews were conducted. A total of 26 researchers in the field of PTSD treatment in youths were contacted regarding additional unpublished studies. These additional searches yielded 173 studies, leading to a total of 13,040 studies for review.

Study Selection (Inclusion and Exclusion Criteria)

Studies needed to (1) include patients with PTSD symptoms, (2) include a sample of children and/or adolescents up to a maximum of 25 years old, (3) employ a psychological treatment aiming to reduce PTSD symptoms, excluding non-interactive interventions, (4) investigate psychological treatments that were applied directly to the child or adolescent for at least 50 % of the treatment time

in cases of parent–child interventions, and (5) report quantitative measures of PTSD symptoms (and potentially depression and anxiety disorder symptoms) both pre- and post-intervention. Studies were excluded if (1) the study constituted a case study or included fewer than eight patients, (2) the sample overlapped (partially or completely) with the sample of another included study, (3) the full text was unavailable (even after the use of an international electronic document delivery service and attempts to contact the articles' authors), or (4) the study provided insufficient data to perform an analysis of ES and additional data could not be obtained from the author.

Inclusion of Control Groups

For studies that included a WL CG and an active CG other than a psychological treatment group, the data for the active CG were included. Studies comparing two groups with two relevant psychological interventions were analyzed twice within the analysis of uncontrolled (pre-post) studies. In studies with more than two groups along with a CG, both relevant interventions were tested separately against the CG. If two or more groups received similar psychological interventions [e.g., a group vs. individual setting with the same treatment or additional sessions with parents in one of the both groups (neither of which was suitable as a CG) within one study], all groups were independently included and analyzed from pre- to post-intervention.

CGs were classified into the following categories: (1) CGs without the possibility of treatment, (2) waitlist (WL) CGs, (3) active CGs (patients in CGs receiving a non-specific treatment, e.g., CBT vs nondirective counseling), and (4) treatment-as-usual (TAU) CGs. In the final analyses, groups 1 and 2 as well as groups 3 and 4 were merged because they included comparable interventions.

Outcome Data

For the outcome data, clinical interviews were used if available; otherwise, self-report measures from children or adolescents were considered. In cases in which no self-report measure was available, we used other assessments, such as parent-reported measures. If no well-known measure was used, the study was nonetheless included if the authors attempted to assess PTSD symptoms by following the DSM criteria. Furthermore, we included studies reporting data on PTSD symptom clusters (re-experiencing, avoidance, and hyperarousal) to analyze combined outcome data. In studies reporting several cohorts or data for boys and girls separately, we also analyzed combined data. We proceeded similarly for data on depressive and anxiety symptoms.

Validity Assessment

To control for possible confounders of ESs (Glass 1976) that result from differences in methodological quality across studies, the quality of each study was rated on a validity scale (GGK quality score, see Electronic supplementary material 7) (Glombiewski et al. 2010) and analyzed as a moderator. This scale accounts for relevant aspects of internal, external, and construct validity and consists of 20 dichotomous items, yielding a maximum validity score of 20. The GGK includes questions such as "Were adequate inclusion and exclusion criteria described and justified?" and "Was the intervention manualized/standardized?" The GGK was developed by adapting Jadad criteria for pharmacological trials (Jadad et al. 1996) and by following PRISMA recommendations (Liberati et al. 2009). PRISMA recommendations include the description of all necessary steps of a meta-analysis (e.g., search procedure, study selection process, results for each study). Jadad criteria were developed for pharmacological trials and are partly suitable for psychological treatment studies, with questions such as "Was the study described as randomized?", "Was there a description of withdrawals and dropouts?", and "Was the study described as double blind?". For 25 % of the studies, the interrater reliability of the GGK was measured.

We adopted a quality hierarchy and calculated the pre-post treatment differences (within-group differences) for all studies (pooled ES for the intragroup and between-group design) to obtain the most stable ES. We further calculated between-group differences (controlled ESs) for all studies conducted with CGs and within controlled studies. In an additional analysis, RCTs only were analyzed.

Data Extraction

For each study, measures of PTSD symptom severity, depression, and anxiety were selected. Numerical data were extracted from the studies to analyze changes from pre- to post-treatment. We contacted authors for missing data and excluded studies when such data could not be obtained. Studies with missing data for individual moderator variables were only excluded from the analysis of those moderator variables.

Quantitative Data Synthesis

All analyses were performed manually or conducted using the software program Comprehensive Meta-Analysis, version 2 (Borenstein et al. 2005).[2] We analyzed intention-to-treat (ITT) data when available. Separate ESs for the continuous variables—the severity of PTSD symptoms and

---

[2] For detailed information, see Electronic supplementary material 1.

depression and anxiety symptoms—were calculated. ESs were calculated using Hedges' *g* and the associated 95 % confidence interval. The magnitude of Hedges' *g* can be interpreted using Cohen's recommendations. Outliers were identified using graphical analyses of the funnel plot. We determined a priori that single studies with Hedges' $g > 4.0$ were outliers and excluded them from the analyses (see Electronic supplementary material 2). The ES estimates were calculated using a random-effects model because the studies included were not functionally identical; they differed in, for example, treatment modality, sample, and methodology (Hedges and Vevea 1998; Moses et al. 2002). We conducted homogeneity analyses to verify this assumption using the Q statistic and the ratio of true heterogeneity to total observed variation I^2.

Moderator Analyses

Average age, sex (percentage of female patients), and trauma type were identified as potential moderating variables. The following groups of trauma were distinguished: (1) CSA (at least 80 % of patients had experienced CSA), (2) CPA, (3) war/terror, (4) accident, (5) sickness, (6) natural disaster, and (7) loss. Samples with different trauma types were classified as mixed and were excluded from the moderator analyses. Furthermore, treatment dosage (the total number of hours) as well as the study's quality and publication year was used as potential moderators. Moderating effects were examined using meta-regression analyses. To investigate the effects of categorical moderator variables, we examined 95 % confidence intervals.

Subgroup Analyses

We conducted the following subgroup analyses: setting (group, individual, or a combination of the two), treatment type. The studies were divided into the following classes of psychological treatments: (1) CBT, (2) EMDR, (3) primarily psychoeducational interventions, (4) other trauma-focused therapies, (5) relaxation/meditation, (6) supportive therapy, (7) psychodynamic therapy, (8) hypnotherapy, (9) nondirective counseling, and (10) other non-trauma-focused therapies (e.g., non-trauma-focused play therapy, art therapy, animal-supported therapy, and mind–body interventions). In line with the National Institute of Care and Health Excellence (NICE) guidelines (NICE 2005), CBT therapies for PTSD are trauma-focused and include elements of exposure and/or cognitive therapy.

Due to the large number and heterogeneity of CBT studies, we further categorized studies into different groups of CBT treatment by carefully reading the intervention description provided in the publications. Based on this information, we classified studies according to their emphasis on CBT treatment

with (a) primarily cognitive interventions, (b) primarily exposure-based interventions, (c) primarily a focus on skills and coping, and (d) mixed interventions (including a mixture of behavioral and cognitive interventions as well as additional components such as the acquisition of coping skills). From subgroup (d), mixed interventions, we extracted studies using the most prominent and prevalent treatment manual, TF-CBT, following the manual by Cohen et al. (2006) or Deblinger and Heflin (1996).

Furthermore, we conducted a subgroup analysis for caretaker involvement (studies involving parents/caretakers vs. studies conducted with children/adolescents alone) within the largest analysis—a pooled within-group analysis (pre-post). Additionally, within all RCTs, we analyzed whether the effects of studies requiring PTSD diagnoses versus subclinical PTSD symptoms as inclusion criteria differed from one another.

Finally, we further investigated whether the effects of treatments vary across different trauma types. Therefore, we conducted a subgroup analysis for different kinds of traumatization within our largest analysis (pooled within-group analysis).

Results

Study Selection and Characteristics of Included Studies

Our study selection process is illustrated in Fig. 1. Of the 13,040 articles identified as potentially relevant, 135 studies with 150 treatment conditions met our selection criteria and were included (see Tables 3 and 4 in Electronic supplementary materials 4 and 5). Two studies meeting the inclusion criteria had to be excluded because they reported unusually high ESs ($g > 4.0$) for all outcome measures (see Electronic supplementary material 2).

Characteristics of the Study Sample

The characteristics of the included studies and treatment conditions are shown in Table 3 (see Electronic supplementary material 4).

Types of Treatment Included in the Analysis

Our analysis included 84 treatment conditions (56 % of all included treatment conditions, n = 4005 participants) that were identified as CBT, 17 (11 %, n = 2444) as primarily psychoeducative, 12 (8 %, n = 351) as EMDR, 9 (6 %, n = 623) as other trauma-focused interventions, 9 (6 %, n = 312) as other non-trauma-focused interventions, 3 (2 %, n = 258) as relaxation or mediation interventions, 4

Fig. 1 Study selection process

Study selection process

Articles initially identified (*n* = 13040)

Articles excluded (*n* = 12315):
 Medical study (*n* = 2851)
 Qualitative or theoretical studies (*n* = 7949)
 Review/meta-analysis (*n* = 513)
 Treatment study for another disorder (*n* = 164)
 Case studies/n < 8 (*n* = 217)
 No psychological intervention (*n* = 166)
 Adult sample (*n* = 447)
 > 50 % intervention with parents (*n* = 8)

Studies selected for further screening (*n* = 725)

Studies (*n* = 242) excluded for the following reasons:
 Duplicates (*n* = 216)
 Book/book chapter (*n* = 26)

Studies selected for detailed evaluation (*n* = 483)

Studies (*n* = 289) excluded for the following reasons:
 No PTSD symptoms surveyed (*n* = 89)
 < 50 % psychological intervention/no psychological intervention (*n* = 36)
 Data reported elsewhere (*n* = 1)
 Case studies n < 8 (*n* = 11)
 Qualitative or theoretical studies (*n* = 40)
 Review/meta-analysis (*n* = 6)
 Insufficient data (*n* = 13)
 Mean age > 21 (*n* = 27)
 < 50 % intervention with child (*n* = 10)
 Not available in English language (*n* = 10)
 Treatment study for another disorder (*n* = 7)
 Publication could not be obtained (*n* = 18)
 Publication of trial protocol only (*n* = 2)
 Duplicates (*n* = 19)

Studies selected for more detailed evaluation (*n* = 194)

Studies (*n* = 58) excluded for the following reasons:
 No PTSD symptoms surveyed (*n* = 11)
 < 50 % psychological intervention/no psychological intervention (*n* = 4)
 Data reported elsewhere (*n* = 8)
 Case studies n < 8 (*n* = 2)
 Insufficient data (*n* = 19)
 Mean age > 21 (*n* = 2)
 < 50 % intervention with child (*n* = 2)
 Treatment study for another disorder (*n* = 2)
 Duplicates (*n* = 7)
 Book chapter (*n* = 2)

Studies included in the meta-analysis (*n* = 135) with 150 conditions (including 2 outliers)

(3 %, *n* = 731) as supportive therapy, 4 (3 %, *n* = 104 uncontrolled) as psychodynamic, 1 (1 %, *n* = 513) as stress management, and 1 (1 %, *n* = 226) as hypnotherapy.

Of the 84 treatment conditions that were identified as CBT, 46 were uncontrolled and 37 were controlled treatment conditions. Within the CBT conditions, three main focuses could be distinguished: a focus on cognitive strategies (3 conditions), a focus on exposure (9 conditions), and a focus on coping skills (10 conditions). CBT studies with a cognitive focus were for example based on cognitive processing therapy (CPT) (Resick and Schnicke 1992, 1993). The main goal of CPT is to identify and modify "stuck points" using Socratic dialog and systematic

worksheets. CBT studies with a focus on exposure can be divided into studies based on narrative exposure therapies (NET) (Ruf et al. 2007) and studies based on prolonged exposure (Foa et al. 2007). A program that serves as a prominent example of CBT with a major focus on coping skills is CBITS (Cognitive Behavioural Intervention for Trauma in Schools). Among other forms of skill-based CBT interventions (seven conditions), we included three conditions with CBITS as the form of intervention.

By contrast, all other CBT studies used a combination of cognitive and behavioral therapeutic strategies. In total, 22 TF-CBT conditions (9 controlled and 13 uncontrolled) were identified. TF-CBT (Cohen et al. 2006; Deblinger and Heflin

[1996]) is a phase-based treatment that includes skill-based components to enhance emotion regulation followed by trauma-specific components with gradual exposure integrated into each component. TF-CBT is provided to children and parents or primary caretakers in parallel individual sessions or in conjoint child–parent sessions. Other CBT conditions included a grief and trauma intervention (GTI) for children (2 conditions), a game-based intervention (3 conditions), and interventions with CBT elements conducted in various group or individual formats (34 conditions).

Trauma Type

In total, 42 studies (31 %) treated children and adolescents after CSA, and 11 (8 %) treated them after CPA. In all, 30 studies (22 %) treated children and adolescents with war-related trauma, 8 (6 %) after accidents, 1 (1 %) after severe sickness, 13 (10 %) after natural disasters, and 6 (4 %) after a loss, and 25 studies (19 %) treated survivors of different types of trauma.

Demographic Variables

The total number of patients across all studies and all treatment groups and CGs was 9621, with 4175 patients in uncontrolled conditions and 5446 patients in controlled conditions. The patients were predominantly female (75.49 % of patients), and the mean age was 12.55 years[3] (SD = 3.18 years).

Therapeutic Variables

In 67 treatment conditions, individual treatment was administered; all other treatment conditions provided group therapy ($n = 66$) or a combination of group and individual therapy ($n = 11$). The number of hours (60 min) spent in psychological interventions ranged from .5 to 45 ($M = 14.34$, SD = 9.43). For 59 of the treatment conditions, follow-up data were reported. The longest available follow-up period ranged from 3 to 192 weeks ($M = 32.83$, SD = 34.06).

Quality and Characteristics of Uncontrolled Studies

The validity scores for each study are presented in Table 3 (see Electronic supplementary material 4). Two independent ratings of validity criteria were performed for 25 % of the studies; the kappa statistic was .44, and the percentage of conformity was 87.6 %. ITT data were reported for 40 treatment conditions post-treatment, and we used ITT data for 32 studies.

In total, 79 treatment conditions (65 studies with $n = 3881$) were *uncontrolled*. In studies reporting dropout

rates, we found a mean dropout rate of 11 % in uncontrolled studies.

Within *uncontrolled studies*, the GGK scores ranged from 4 to 18 points (out of 20; $M = 9.85$, SD = 3.51). A total of 56 (86 %) of the 65 studies (with 79 treatment conditions) sufficiently described their interventions and defined adequate outcome measures. Forty-one studies (63 %) described dropout rates for each group, and 57 (88 %) described relevant baseline characteristics. The inclusion and exclusion criteria in 18 (28 %) of the 65 studies were inadequately described. A total of 56 (71 %) of the 79 treatment conditions involved the implementation of a manualized or otherwise standardized intervention, and only 14 (18 %) treatment conditions involved a blind assessment of the treatment outcome. Ten (16 %) uncontrolled studies reported outcomes based on a clinician-administered PTSD interview; all other data were based on self- or parent-reported measures. Relatively unknown measures were used in 4[4] (6 %) uncontrolled studies. A total of 28 uncontrolled studies (44 %) noted that treatment adherence was supervised.

Quality and Characteristics of Controlled Studies

In total, 71 treatment conditions (70 studies with $n = 7333$) were controlled. Of the studies with controlled treatment conditions, 62 studies included RCTs. In 7 studies ($n = 528$), patients in the CG received no intervention, and in 35 studies ($n = 4536$), a WL CG was included. In 19 studies ($n = 1546$), the patients received an active but unspecific control treatment, and in 10 studies ($n = 723$), patients received TAU. In studies reporting dropout rates, we found a mean dropout rate of 14.35 % in controlled studies. Furthermore, 9.14 % of patients in controlled psychological treatment conditions and 8.03 % of patients in CGs dropped out of the studies; thus, the dropout rates were comparable between the treatment groups and CGs.

Within *controlled studies*, the GGK scores ranged from 7 to 19 points (out of 20; $M = 13.44$, SD = 2.69). A total of 69 (97 %) of the 71 studies (with 74 treatment conditions) sufficiently described their interventions and defined adequate outcome measures. Fifty-two (73 %) studies provided dropout rates for each group, and 69 (97 %) described relevant baseline characteristics. A total of 58 (82 %) studies did not adequately describe the inclusion and exclusion criteria. Sixty-seven of the 74 treatment conditions (91 %) involved the implementation of a manualized or otherwise standardized intervention, and only 25 treatment conditions (34 %) involved a blind assessment of the treatment outcome. In all, 24 controlled studies (34 %) reported outcomes based on a

---

[3] This figure is based on 107 studies that provided data on mean age.

[4] Deblinger et al. (1990), Habigzang et al. (2009), Habigzang et al. (2013), and Ronholt et al. (2013)—see Electronic supplementary material 3 for references.

clinician-administered PTSD interview; all other data were based on self- or parent-reported measures. Three[5] (4 %) controlled studies used relatively unknown measures. A total of 39 controlled studies (56 %) noted that treatment adherence was supervised.

Effect Sizes (ESs)

Pre-post ESs for each treatment condition are displayed in Table 4 (see Electronic supplementary material 5), and mean ESs are presented in Table 1. All mean ESs were significant. The results of sensitivity (fail-safe N, Duval, and Tweedie methods) and heterogeneity (Q and I^2) analyses are reported in Table 1 and are further explained in Electronic supplementary material 1. Sensitivity analysis results suggest that the ES estimates for all considered outcome variables were unbiased. According to the trim-and-fill method, the number of missing studies required to render the plot symmetrical was 0 in all but one case, in which the recalculated ES was reported. The ES distributions were significantly heterogeneous, as indicated by the Q statistic and by the interpretation of I^2 in most cases, indicating that the studies were not functionally identical and that their variability was greater than that expected by sampling error alone, confirming the use of random rather than fixed effects. When ES distributions were not significantly heterogeneous, fixed effects were calculated and reported. For funnel plots, see Electronic supplementary material 6.

ESs

The mean *pre-post ES (a pooled analysis for all studies)* was large for PTSD symptoms ($g = .89$, CI .81–.96) and medium for depression symptoms ($g = .62$, CI .55–.69) and anxiety symptoms ($g = .64$, CI .56–.73). The mean-*controlled ES for studies comparing treatment groups with untreated or WL CGs* was large for PTSD symptoms ($g = .89$, CI .69–1.09) and medium for symptoms of depression ($g = .60$, CI .41–.79) and anxiety ($g = .67$, CI .45–.89). The mean-*controlled ES for studies comparing treatment groups with TAU or active CGs* was small for symptoms of PTSD ($g = .45$, CI .34–.56), depression ($g = .37$, CI .27–.46), and anxiety ($g = .42$, CI .29–.55). The mean-controlled ESs for *RCTs only* were medium for all three outcomes (PTSD: $g = .65$, CI .52–.77; depression: $g = .46$, CI .34–.59; anxiety: $g = .50$, CI .36–.65).

In summary, patients showed clinically meaningful improvement in their PTSD symptoms after psychological treatment. The smallest effects were found for therapies conducted in comparison with TAU or active CGs. Comorbid symptoms (depression and anxiety) improved in a small to

medium range, as indicated by pre-post analyses and in controlled trials.

Moderators of PTSD Symptom Reduction

Hedges' g for PTSD symptom reduction in *uncontrolled studies* was moderated by *age*, with studies of older patients reporting larger ESs, and by *study quality,* with higher-quality studies reported larger ESs (Table 2).

Hedges' g for PTSD symptom reduction in *controlled studies comparing treatment groups with untreated/WL CGs* was not moderated by any of the investigated moderators. Hedges' g for PTSD symptom reduction in *controlled studies comparing treatment groups with TAU/active CGs* was moderated by *age* and by *sex,* with studies with a larger percentage of female participants reporting greater ESs. Within RCTs, *age* and *treatment dosage* (with studies with more treatment time reporting larger ESs) were significant moderators.

Subgroup Analyses

Within the pooled analysis (within-group differences), individual treatments showed significantly larger ESs than group treatments. Treatments that involved caretakers showed significantly larger ESs than those involving children/adolescents alone. Concerning different treatment types, CBT, EMDR, and relaxation/meditation showed large ESs in uncontrolled studies. CBT showed large ESs, whereas EMDR showed only small ESs within the analysis of studies testing untreated/WL groups. Within controlled studies testing against TAU or active CGs, CBT and EMDR showed medium ESs. Within RCTs, CBT and psychoeducational interventions showed medium ESs, and EMDR showed small ESs.

When further analyzing CBT studies (within our largest analyses, the pooled dataset of all studies), we showed that primarily cognitive- or exposure-based interventions had the largest ESs. The large set of "mixed" CBT interventions showed large ESs as well. The subgroup of CBT studies focusing on coping and skills showed smaller ESs. When analyzing the subgroup of TF-CBT studies following the manual by Cohen et al. (2006) or Deblinger and Heflin (1996), large ESs were found.

Regarding different trauma types, the results were very similar (high ESs) for all different kinds of traumatization, with the exception of posttraumatic stress symptoms following loss (medium ES).

Discussion

To date, this is the largest meta-analysis of the effectiveness of psychological interventions for PTSD symptoms in children, adolescents, and young adults that arise after

---

[5] Cohen and Mannarino (1997), Lesmana et al. (2009), and Trowell et al. (2002)—see Electronic supplementary material 3 for references.

Table 1 Effect sizes for PTSD, depression, and anxiety for any psychological treatment

Outcome	Type of effect	n	g	95 % CI	SE	z	p	Fail-safe N	Q	I²	Duval and Tweedie
PTSD	Pre-post all studies (intragroup changes, pooled analysis)[a]	144	.89	.81–96	.04	22.396	.000	9119	1720.007***	91.686	0
PTSD	Intervention versus untreated CG/WL	42	.89	.69–1.09	.10	8.824	.000	5089	372.468***	88.992	0
PTSD	Intervention versus TAU/active CG	30	(.46) .45[b]	(.37–.54) .34–56	(.05) .06	(10.243) 7.980	(.000) .000	719	40.792 (p = .072)	28.907	0
PTSD	RCTs only	62	.65	.52–77	.07	9.94	.000	6830	319.343***	80.898	0
Depression	Pre-post all studies (intragroup changes, pooled analysis)[c]	90	.62	.55–69	.04	16.489		3048	595.642***	85.058	0
Depression	Intervention versus untreated CG/WL	23	(.60) .55[d]	(.41–79) .46–64	.10	6.121		846	111.507***	80.270	0
Depression	Intervention versus TAU/active CG	20	(.38) .37[e]	(.26–51) .27–46	.07	5.920		276	30.578 (p = 0.045)	37.863	1
Depression	RCTs only	36	.46	.34–59	.06	7.293		1512	121.089***	71.096	0
Anxiety	Pre-post all studies (intragroup changes, pooled analysis)[f]	57	.64	.56–73	.04	15.459		6684	314.471***	82.192	0
Anxiety	Intervention versus untreated CG/WL	19	.67	.45–89	.11	6.006		756	115.350***	84.395	0
Anxiety	Intervention versus TAU/active CG	11	(.45) .42[g]	(.27–62) .29–55	.09 .07	5.055 6.206		103	15.396 (p = 0.118)	35.049	0
Anxiety	RCTs only	27	.50	.36–65	.07	6.724		1036	101.033***	74.266	0

n number of treatment conditions in the analysis, CI confidence interval; Fail-safe N the number of studies with a treatment effect of 0 that would be needed to lead to a nonsignificant overall result; I² ratio (0–100 %) indicating the proportion of the observed variance that reflects real differences in effect sizes (values of 25, 50, and 75 % can be considered low, moderate, and high, respectively); pre-post all studies (intragroup changes, pooled analysis) = effect size computed for the difference in means between pre-treatment and post-treatment in all studies; intervention versus untreated CG/WL = effect size determined by taking into account the untreated control group or waitlist control group; intervention versus TAU/active CG = effect size determined by taking into account the treatment-as-usual or active control group

** p < .01; *** p < .001

[a] Studies excluded from analysis because of incompatible data: Tourigny et al. (2007), Raider et al. (2008), Cain et al. (2010), and Gupta et al. (2008)—see Electronic supplementary material 3 for references

[b] Hedges' g adjusted due to nonsignificant Q-value that justifies use of a fixed-effects model

[c] Studies excluded from analysis because of incompatible data: Tourigny et al. (2007), Raider et al. (2008), and Schauer (2008)—see Electronic supplementary material 3 for references

[d] Hedges' g adjusted due to Duval and Tweedie's trim-and-fill recalculated effect size

[e] Hedges' g adjusted due to Duval and Tweedie's trim-and-fill recalculated effect size and due to nonsignificant Q-value that justifies use of a fixed-effects model

[f] Studies excluded from analysis because of incompatible data: Tourigny et al. (2007) and Raider et al. (2008)—see Electronic supplementary material 3 for references

[g] Hedges' g adjusted due to nonsignificant Q-value that justifies use of a fixed-effects model

Table 2 Moderator and subgroup analyses of the reduction in PTSD symptoms

Subgroup/moderator	n	g	SE	95 % CI	p^a	Q_b	p^aQb	B	SE	p^aB
Pooled analysis[a]										
Involvement of parents						6.084	.014			
Parents	57	1.01	.06	.88–1.13	.000					
No parents	87	.81	.05	.71–.90	.000					
Type of treatment[b]						54.509	.000			
CBT	85	.99	.05	.89–1.08	.000					
EMDR	12	1.18	.04	.91–1.45	.000					
Psychoeducational	17	.56	.10	.36–.75	.000					
Other trauma-focussed therapies	9	.51	.14	.22–.80	.000					
Relaxation/meditation	3	1.90	.25	1.42–2.39	.000					
Supportive	4	.40	.20	.01–.79	.047					
Psychodynamic	4	.72	.22	.29–1.15	.001					
Other non-trauma-focussed therapies	9	.52	.15	.22–.82	.000					
Type of CBT intervention						6.313	.097			
Cognitive	3	1.27	.32	.65–1.89	.000					
Exposure	11	1.29	.15	.99–1.58	.000					
Coping/Skills	10	.79	.15	.50–1.09	.000					
Mixed	61	.97	.06	.85–1.10	.000					
TF-CBT	18	1.15	.12	.92–1.38	.000					
Setting						22.297	.000			
Group	66	.71	.06	.61–.82	.000					
Individual	67	1.09	.06	.97–1.20	.000					
Combined	11	.81	.14	.54–1.07	.000					
Type of trauma						4.17	.841			
CSA	47	.88	.07	.73–1.02	.000					
CPA	11	.83	.15	.55–1.12	.000					
War	31	.92	.09	.75–1.09	.000					
Accident	9	.91	.17	.58–1.24	.000					
Sickness	1	.41	.46	−.50–1.31	.376					
Nature	13	1.00	.14	.74–1.27	.000					
Loss	7	.65	.18	.30–1.01	.000					
Quality								.04	.01	.00
Year								.01	.01	.29
Age[c]								.04	.02	.02
Dosage[d]								.00	.00	.27
Type of trauma[e]								−.01	.02	.69
Sex[f]								.00	.00	.80
Intervention versus untreated CG/WL										
Type of treatment[g]						22.790	.002			
CBT	17	1.39	.16	.08–1.69	.000					
EMDR	4	.38	.33	−.26–1.01	.025					
Psychoeducational	10	.77	.19	.40–1.15	.000					
Other trauma-focussed therapies	3	.24	.34	−.41–.090	.472					
Supportive	3	.22	.33	−.43–.87	.50					

Table 2 continued

Subgroup/moderator	n	g	SE	95 % CI	p^a	Q_b	p^aQb	B	SE	p^aB
Other non-trauma-focussed therapies	3	.68	.38	−.07–1.42	.075					
Setting						2.703	.259			
Group	26	.77	.13	.52–1.025	.000					
Individual	12	1.05	.20	.64–1.45	.000					
Combined	4	1.26	.33	.62–1.91	.000					
Quality								−.01	.04	.84
Year								−.02	.02	.36
Sex								.00	.00	.80
Age								.08	.04	.06
Trauma type								−.01	.07	.08
Dosage								.02	.01	.07
Intervention versus TAU/active CG										
Type of treatment[h]						9.763	.045			
CBT	21	.52	.06	.40–.63	.000					
EMDR	3	.72	.21	.31–1.13	.001					
Other trauma-focussed therapies	3	.06	.16	−.25–.38	.697					
Setting						.380	.537			
Group	8	.40	.11	.19–.62	.000					
Individual	22	.48	.07	.35–.61	.000					
Quality								.02	.02	.41
Year								.00	.01	.62
Sex								.01	.00	.00
Age								.03	.01	.02
Trauma type								−.07	.04	.05
Dosage								.01	.00	.11
RCT										
Type of treatment[i]						15.140	.034			
CBT	34	.79	.09	.62–.96	.000					
EMDR	7	.49	.20	.09–.89	.016					
Psychoeducational	9	.56	.15	.27–.85	.000					
Other trauma-focussed therapies	5	.19	.21	−.22–.60	.373					
Supportive	3	.22	.26	−.28–.72	.387					
Setting						.198	.906			
Group	24	.64	.10	.44–.84	.000					
Individual	34	.64	.09	.46–.82	.000					
Combined	4	.76	.25	.26–1.26	.003					
PTSD full spectrum						.856	.355			
PTSD	12	.77	.15	.47–1.07	.000					
Subclinical	50	.61	.07	.48–.76	.000					
Quality								.03	.03	.26
Year								.01	.01	.60
Sex								.00	.00	.96
Age								.04	.02	.05

Table 2 continued

Subgroup/moderator	n	g	SE	95 % CI	p^a	Q_b	p^aQb	B	SE	p^aB
Trauma type								−.09	.05	.10
Dosage								.12	.01	.01

The references of all primary studies included in the meta-analysis can be found in the supplementary material

Moderator analyses were conducted for studies that reported the specific data (mean age, percentage of female participants, dosage of therapy, trauma type); otherwise, they were excluded from the analysis (see pooled pre-post analysis); 95 % confidence intervals were used for moderator analyses

n number of treatment conditions, *SE* standard error, *CI* confidence interval, *Qb* difference between groups (combined effect for different subgroups), *pQb* statistical significance of the Qb statistic, *B* regression coefficient, *pB* statistical significance of the regression coefficient, *CBT* cognitive behavioural treatment, *EMDR* eye movement desensitization and reprocessing

*** $p < .05$

[a] Studies excluded from analysis because of incompatible data: Tourigny et al. (2007), Raider et al. (2008), Cain et al. (2010), and Gupta et al. (2008)—see Electronic supplementary material 3 for references

[b] We conducted sub-analyses for each group of treatments that had at least $n = 3$ studies for either uncontrolled or controlled studies

[c] Conducted without studies with missing data on average age: Ahmadet al. (2007), Berger and Gelkopf (2009), Berger et al. (2007), Catani et al. (2009), Cohen et al. (2007), Cohen et al. (2005), Coulter (2000), de Roos et al. (2011), Ehntholt et al. (2005), Farkas et al. (2010), Gordon et al. (2004), Habigzang et al. (2009), Hamama et al. (2011), Jaberghaderi et al. (2004), Jarero et al. (2008), Linning (2007), McClatchey et al. (2009), Odell (2014), Pifalo (2002); Pifalo (2006), Pfeffer et al. (2002), Raider et al. (2008), Rivera (2008), Ronholt et al. (2013), Sakai et al. (2010), Salloum and Overstreet (2008), Shechtman and Mor (2010), Simmer-Dvonch (1998), Sinclair et al. (1995), Thabet et al. (2005), Truppi (2001), Wolmer et al. (2011), and Zehnder et al. (2008)—see Electronic supplementary material 3 for references

[d] Conducted without studies with missing data on treatment dosage: Chemtob et al. (2002), CATS (2010), Deblinger et al. (1990), Dietz et al. (2012), Ellis et al. (2013), Grefe (2012), Jarero et al. (2008), Jaycox et al. (2010), Jensen et al. (2013), Kolko et al. (2003), Lange and Ruwaard (2010), McClatchey et al. (2009), McMullen et al. (2013), Möhlen et al. (2005), Oras et al. (2004), Reyes and Asbrand (2005), Rivera (2008), Salloum (2008), Salloum et al. (2001), Sinclair et al. (1995), Truppi (2001), Scheeringa et al. (2011), Shechtman and Mor (2010), Smith et al. (2007), Stallard et al. (2006), Stein et al. (2003), Thabet et al. (2005), and Tol et al. (2012, 2014)—see Electronic supplementary material 3 for references

[e] Conducted without studies with mixed traumatization or missing data for the trauma types: Ahmad et al. (2007), Ahrens and Reford (2002), Cohen et al. (2011), Cohen et al. (2005), Coulter (2000), Ford et al. (2012), Farkas et al. (2010), Glodich (2000), Gilboa-Schechtman et al. (2010), Hamama et al. (2011), Jensen et al. (2013), Kataoka et al. (2003), Kolko et al. (2003), Lytle et al. (2002), Nixon et al. (2012), Odell (2014), Ormhaug et al. (2014), Rivera (2008), Rosenberg et al. (2011), Schauer (2008), Scheeringa et al. (2011), Scheck et al. (1998), Smith et al. (2007), Taussig and Culhane (2010), and Salloum and Overstreet (2012)—see Electronic supplementary material 3 for references

[f] Conducted without studies with missing data on the percentage of female participants: Catani et al. (2009), Deblinger et al. (1990), Dietz et al. (2012), Ehntholt et al. (2005), Ertl et al. (2011), Lange and Ruwaard (2010), Layne et al. (2008), and Thabet et al. (2005)—see Electronic supplementary material 3 for references

[g] We conducted sub-analyses for each group of treatments that had at least $n = 3$ studies for either uncontrolled or controlled studies

[h] We conducted sub-analyses for each group of treatments that had at least $n = 3$ studies for either uncontrolled or controlled studies

[i] We conducted sub-analyses for each group of treatments that had at least $n = 3$ studies for either uncontrolled or controlled studies

different types of trauma. In line with previous meta-analyses on uncontrolled trials, mean pre-post ESs (pooled analysis including 144 studies) were large for PTSD symptoms and medium for depression and anxiety symptoms (Harvey and Taylor 2010a, b; Newman et al. 2014; Rolfsnes and Idsoe 2011; Trask et al. 2011). Our results regarding controlled trials are also in line with previous research and show medium to large ESs for PTSD symptom reduction (Cary and McMillen 2012; Gillies et al. 2012; Newman et al. 2014; Trask et al. 2011).

In conclusion, children and adolescents suffering from PTSD can be effectively treated with psychological intervention, which improves not only PTSD symptoms but also depression and anxiety symptoms. However, we found significantly smaller ESs in studies using TAU and active CGs than in studies using untreated or WL CGs, and we found only medium ESs for all symptoms when including only RCTs. These results leave room for treatment improvements. A recent meta-analysis of PTSD in adults (Frost et al. 2014) showed that even if the treatment is non-specific (present-centered psychotherapy), active CGs can exhibit large mean ESs; hence, achieving high between-group effects in studies using comparisons with active CGs is difficult. Consistent with our results, another recently conducted meta-analysis of studies on PTSD in adults (Watts et al. 2013) found that studies with WL CGs report larger effects than studies with active CGs.

Moderator Analyses

In both controlled and uncontrolled studies, studies with older participants reported larger ESs. This result is consistent with previous analyses (Newman et al. 2014; Trask et al. 2011), which concluded that effective treatments may

rely on cognitive components and that younger children may not be able to fully grasp such treatments. Another possible explanation is that the assessment variables or instruments may not adequately capture the symptoms and progress made by younger children. This explanation would be consistent with research showing that younger children's PTSD symptoms are less distinct (Scheeringa et al. 2006), often constituting general behavioral problems following traumatization (D'Andrea et al. 2012). From a statistical perspective, if children present fewer pre-treatment symptoms (measured), then the potential for symptom reduction is smaller. Furthermore, older children and adolescents may have experienced more or longer-lasting traumatic events than younger children and may therefore show more severe symptoms, leading, in turn, to a greater symptom reduction. Hence, both PTSD treatments and assessments should be adapted to account for younger children's special needs.

Study quality was a significant moderator within the pooled analysis (pre-post effects for all studies), with higher-quality studies reporting larger ESs, in line with previous research (Newman et al. 2014). We expected study quality to be an important moderator in uncontrolled studies. Most previous meta-analyses did not assess (Harvey and Taylor 2010a, b; Kowalik et al. 2011; Trask et al. 2011) or assessed but did not analyze (Cary and McMillen 2012; Gillies et al. 2012; Macdonald et al. 2012) study quality. One previous analysis found no relationship between study quality and ES (Sanchez-Meca et al. 2011). The finding that treatment effects in controlled studies do not appear to vary with differences in study quality suggests the reliability of the reported effects. However, the study quality was rather low for uncontrolled studies and medium for controlled studies. Therefore, study quality in the field should be improved.

Both dosage and sex were significant moderators in only one of the four analyses; thus, they must be interpreted cautiously. We found no moderating effects for publication year or trauma type. However, a substantial number of studies did not enter the moderator analysis on trauma type because these studies included mixed types or did not specify the trauma types considered.

Subgroup Analyses

Within the pooled analysis (within-group differences), individual treatments showed significantly larger ESs than group treatments, which is in line with previous research on adult PTSD (Taylor and Harvey 2010; Watts et al. 2013). Furthermore, therapies involving caretakers showed significantly larger ESs than those treating only children/adolescents, which also replicates previous findings (Harvey and Taylor 2010a, b).

Concerning different treatment types, CBT showed medium (in controlled trials) to large (in uncontrolled analyses) ESs and provided the largest data set (56 % of the included studies). EMDR showed large effects within the uncontrolled analysis but only small to medium effects in controlled studies based on only 8 % of the included studies. These sub-analyses showed that CBT is the most promising treatment, as shown in previous research (Gillies et al. 2012; Harvey and Taylor 2010a, b; Leenarts et al. 2012; Macdonald et al. 2012; Newman et al. 2014; Sanchez-Meca et al. 2011; Silverman et al. 2008; Trask et al. 2011). Our definition of CBT was broader than in previous analyses (Gillies et al. 2012), including studies that only consisted of selected CBT strategies; therefore, the reported results may underestimate its effects. In a more detailed analysis, CBT treatments with primarily cognitive- or exposure-based interventions, as well as TF-CBT following the treatment manual by Cohen et al. (2006) or Deblinger and Heflin (1996), all showed larger effects than therapies focusing on coping and skills and other CBT treatments. In line with this result, in a large meta-analysis on adult PTSD research, CBT was found effective, and within primarily cognitive CBT therapies, primarily exposure-based therapies as well as a mixture of both strategies were highly effective (Watts et al. 2013).

Within RCTs, we found no significant differences between the ESs reported for studies treating only full PTSD and those treating subthreshold PTSD. We found that treatment effects were similar across different kinds of trauma (in line with the insignificant moderator analysis on this issue), with the exception of symptoms following loss, which showed lower effects. When looking more closely at the studies treating children with symptoms following loss (usually of a parent), the children are younger than the mean of our whole data set, and treatment is typically administered in groups. Because group treatments and younger children showed smaller effects, this might explain the lower effect sizes. Also notable is that treatments differ from other interventions, as they are mostly adapted to grief and trauma symptoms.

Strengths of the Current Study

This study extends previous research. To adequately address the problem that children often do not fulfill the full criteria for a PTSD diagnosis (Scheeringa et al. 2006), we focused on studies that administered psychological interventions to children, adolescents, and young adults with PTSD symptoms rather than focusing on patients with a full PTSD diagnosis.

In contrast to previous meta-analyses (Harvey and Taylor 2010a, b; Trask et al. 2011), we included all possible trauma types, thus generating a large set of studies

with different treatments after diverse types of trauma. Studies on the treatment of the sequelae of CSA (31 % of the studies) and studies on the use of CBT techniques (56 % of studies) were the most frequent. In contrast to previous analyses (Gillies et al. 2012), we decided a priori to include uncontrolled studies to account for the considerable number of those studies in the field. Furthermore, we included studies with patients up to 25 years of age, whereas most analyses include only studies with patients up to 18 years, thereby overlooking studies conducted with adolescents and young adults in specific contexts (e.g., war regions, student populations). Thus, our sample consists of many more studies than previous analyses [e.g., 135 studies compared with 14 studies (Gillies et al. 2012)], allowing us to investigate many possible treatment moderators.

Limitations

First, despite our complex search strategy, we may have missed studies because of our combination of search terms. Second, we used liberal study inclusion criteria to obtain a comprehensive study sample and to investigate potential moderators, which resulted in a heterogeneous study sample. For example, we included patients with symptoms of PTSD, which led to a sample of patients ranging from those with some subclinical symptoms to those with full PTSD. Future meta-analyses might define a set of core symptoms as study inclusion criteria. Furthermore, we included a few studies measuring PTSD symptoms with non-standardized measures. Moreover, the inclusion of a wide age range of patients makes the results more difficult to interpret. Additionally, we did not analyze follow-up effects because such data were often not reported and highly heterogeneous.

To limit possible biases, we adopted a rather conservative approach. We eliminated the possibility of publication bias in two different sensitivity analyses. We quantified the quality of the included studies using the modified Jadad (Jadad et al. 1996) scale, which also served as a moderator.

Scientific and Clinical Implications

This meta-analysis emphasizes the need for more and higher-quality RCTs on the efficacy of psychological treatments for PTSD in youth. Only 30 of the 135 sampled studies included an active or TAU CG. Thus far, CBT seems to be the most promising treatment for the studied age group, especially in studies that focus on cognitive techniques or exposure-based therapies. Treatments following the TF-CBT manual by Cohen et al. (2006) or Deblinger and Heflin (1996) were also highly effective. For EMDR for youths, more research on treatment

effectiveness is needed. Further research on the effectiveness of other treatments widely used in clinical practice (e.g., play therapy) is necessary.

Future RCTs in the field should comply with current methodological standards (Boutron et al. 2008). Within the included studies, the lack of a blind assessment for the treatment outcome (used in only 17 and 31 % of uncontrolled and controlled studies, respectively) and the lack of clinician-rated diagnoses (established in only 16 and 33 % uncontrolled and controlled studies, respectively) were especially notable. Treatment adherence was supervised in only 44 and 56 % uncontrolled and controlled studies, respectively, and most studies did not describe how such adherence was assured. Reports on attrition rates were often lacking (rates were reported in only 63 and 73 % uncontrolled and controlled studies, respectively). The use of adequate age-appropriate measures (i.e., following the new DSM-5 criteria) as well as clear reports on attrition and treatment integrity should be mandatory.

Because our knowledge of moderators and mediators of treatment effects for PTSD in childhood remains limited, future research should not only focus on process measures, but also assess and clearly report data on symptom severity, comorbidity diagnoses, and trauma characteristics. The amount of caretaker involvement should be reported more precisely to allow for more detailed analyses. All of this information can help to tailor interventions to patients' needs.

We conclude that young PTSD patients can be treated successfully with psychological interventions. Comorbid symptoms also improved. Individual treatment and caretaker involvement should be administered whenever possible. Consistent with international treatment guidelines, trauma-focused interventions, especially CBT, appear to be the most helpful (NICE 2005). Treatments focusing on cognition, treatments using exposure, and TF-CBT treatments following the protocol by Cohen et al. (2006) or Deblinger and Heflin (1996) showed especially good results. The lack of research on other treatments impedes direct comparisons among them. More research on the treatment of younger children is necessary because this population seems to benefit less from the given interventions.

Compliance with Ethical Standards

Conflict of interest All other authors declare that they have no conflicts of interest.

Human and Animal Rights This article does not contain any studies with human participants or animals performed by any of the authors.

References

Achenbach, T. M. (1991). *Integrative guide for the 1991 CBCL/4-18, YSR, and TRF profiles*. Burlington, VT: University of Vermont, Department of Psychiatry.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2005). *Comprehensive meta-analysis (Version 2)*. Englewood, NJ: Biostat.

Boutron, I., Moher, D., Altman, D. G., Schulz, K. F., Ravaud, P., & Group C. (2008). Extending the CONSORT statement to randomized trials of nonpharmacologic treatment: Explanation and elaboration. *Annals of Internal Medicine, 148*(4), 295–309.

Cary, C., & McMillen, J. (2012). The data behind the dissemination: A systematic review of trauma-focused cognitive behavioral therapy for use with children and youth. *Children and Youth Services Review, 34*(4), 748–757. doi:10.1016/j.childyouth.2012.01.003.

Cohen, J. A., Deblinger, E., & Mannarino, A. P. (2006). *Treating trauma and traumatic grief in children and adolescents*. New York: Guilford Press.

Copeland, W. E., Keeler, G., Angold, A., & Costello, E. J. (2007). Traumatic events and posttraumatic stress in childhood. *Archives of General Psychiatry, 64*(5), 577–584. doi:10.1001/archpsyc.64.5.577.

Corcoran, J., & Pillai, V. (2008). A meta-analysis of parent-involved treatment for child sexual abuse. *Research on Social Work Practice, 18*(5), 453–464. doi:10.1177/1049731507313980.

D'Andrea, W., Ford, J., Stolbach, B., Spinazzola, J., & van der Kolk, B. (2012). Understanding interpersonal trauma in children: Why we need a developmentally appropriate trauma diagnosis. *American Journal of Orthopsychiatry, 82*(2), 187–200. doi:10.1111/j.1939-0025.2012.01154.x.

Deblinger, E., & Heflin, A. H. (1996). *Treating sexually abused children and their nonoffending parents: A cognitive behavioral approach* (1st ed.). Thousand Oaks: SAGE Publications Inc.

Foa, E., Hembree, E., & Rothbaum, B. (2007). *Prolonged exposure therapy for PTSD: therapist guide*. New York: Oxford University Press.

Forman-Hoffman, V. L., Zolotor, A. J., McKeeman, J. L., Blanco, R., Knauer, S. R., Lloyd, S. W., & Viswanathan, M. (2013). Comparative effectiveness of interventions for children exposed to nonrelational traumatic events. *Pediatrics, 131*(3), 526–539. doi:10.1542/peds.2012-3846.

Fraser, J. G., Lloyd, S., Murphy, R., Crowson, M., Zolotor, A. J., Coker-Schwimmer, E., & Viswanathan, M. (2013). A comparative effectiveness review of parenting and trauma-focused interventions for children exposed to maltreatment. *Journal of Developmental and Behavioral Pediatrics, 34*(5), 353–368. doi:10.1097/DBP.0b013e31828a7dfc.

Frost, N. D., Laska, K. M., & Wampold, B. E. (2014). The evidence for present-centered therapy as a treatment for posttraumatic stress disorder. *Journal of Traumatic Stress, 27*(1), 1–8. doi:10.1002/jts.21881.

Giaconia, R. M., Reinherz, H. Z., Silverman, A. B., Pakiz, B., Frost, A. K., & Cohen, E. (1995). Traumas and posttraumatic stress disorder in a community population of older adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 34*(10), 1369–1380. doi:10.1097/00004583-199510000-00023.

Gillies, D., Taylor, F., Gray, C., O'Brien, L., & D'Abrew, N. (2012). Psychological therapies for the treatment of post-traumatic stress disorder in children and adolescents. *Cochrane Database of Systematic Reviews, 12*, CD006726. doi:10.1002/14651858.CD006726.pub2.

Glass, G. V. (1976). Primary, secondary and meta-analysis of research. *Educational Research, 5*, 3–8.

Glombiewski, J. A., Sawyer, A. T., Gutermann, J., Koenig, K., Rief, W., & Hofmann, S. G. (2010). Psychological treatments for fibromyalgia: A meta-analysis. *Pain, 151*(2), 280–295. doi:10.1016/j.pain.2010.06.011.

Harvey, S. T., & Taylor, J. E. (2010a). A meta-analysis of the effects of psychotherapy with sexually abused children and adolescents. *Clinical Psychology Review, 30*(5), 517–535. doi:10.1016/j.cpr.2010.03.006.

Harvey, S. T., & Taylor, J. E. (2010b). A meta-analysis of the effects of psychotherapy with sexually abused children and adolescents: Erratum. *Clinical Psychology Review, 30*(8), 1049–1050.

Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random-effects models in meta-analysis. *Psychological Methods, 3*(4), 486–504.

Jadad, A., Moore, R., Carroll, D., Jenkinson, C., Reynolds, D., Gavaghan, D., & McQuay, H. (1996). Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Controlled Clinical Trials, 17*(1), 1–12. doi:10.1016/0197-2456(95)00134-4.

Kessler, R. C. (2000). Posttraumatic stress disorder: The burden to the individual and to society. *Journal of Clinical Psychiatry, 61*(Suppl 5), 4–14.

Kowalik, J., Weller, J., Venter, J., & Drachman, D. (2011). Cognitive behavioral therapy for the treatment of pediatric posttraumatic stress disorder: A review and meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry, 42*(3), 405–413. doi:10.1016/j.jbtep.2011.02.002.

Leenarts, L. E., Diehle, J., Doreleijers, T. A., Jansma, E. P., & Lindauer, R. J. (2012). Evidence-based treatments for children with trauma-related psychopathology as a result of childhood maltreatment: A systematic review. *European Child and Adolescent Psychiatry,.* doi:10.1007/s00787-012-0367-5.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gotzsche, P. C., Ioannidis, J. P. A., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: Explanation and elaboration. *British Medical Journal, 339*, 37. doi:10.1136/bmj.b2700.

Macdonald, G., Higgins, J. P., Ramchandani, P., Valentine, J. C., Bronger, L. P., Klein, P., Taylor, M. (2012). Cognitive-behavioural interventions for children who have been sexually abused. *Cochrane Database of Systematic Reviews, 5*, CD001930. doi:10.1002/14651858.CD001930.pub3.

Marciniak, M. D., Lage, M. J., Dunayevich, E., Russell, J. M., Bowman, L., Landbloom, R. P., & Levine, L. R. (2005). The cost of treating anxiety: The medical and demographic correlates that impact total medical costs. *Depression and Anxiety, 21*(4), 178–184. doi:10.1002/da.20074.

Moses, L. E., Mosteller, F., & Buehler, J. H. (2002). Comparing results of large clinical trials to those of meta-analyses. *Statistics in Medicine, 21*(6), 793–800. doi:10.1002/sim.1098.

Nader, K., Kriegler, J. A., Blake, D. D., Pynoos, R. S., Newman, E., & Weather, F. W. (1996). *Clinician administered PTSD scale, child and adolescent version*. White River Junction, VT: National Center for PTSD.

Newman, E., Pfefferbaum, B., Kirlic, N., Tett, R., Nelson, S., & Liles, B. (2014). Meta-analytic review of psychological interventions for children survivors of natural and man-made disasters. *Current Psychiatry Reports,.* doi:10.1007/s11920-014-0462-z.

Nice. (2005). *Post-traumatic stress disorder (PTSD): The management of PTSD in adults and children in primary and secondary*

care CG26. London: National Institute for Health and Care Excellence.

Resick, P. A., & Schnicke, M. K. (1992). Cognitive processing therapy for sexual assault victims. *Journal of Consulting and Clinical Psychology, 60*(5), 748–756.

Resick, P. A., & Schnicke, M. K. (1993). *Cognitive processing therapy for rape victims: A treatment manual*. Newbury Park, CA: Sage.

Rolfsnes, E. S., & Idsoe, T. (2011). School-based intervention programs for PTSD symptoms: A review and meta-analysis. *Journal of Traumatic Stress, 24*(2), 155–165. doi:10.1002/jts. 20622.

Ruf, M., Schauer, M., Neuner, F., Schauer, E., Catani, C., & Elbert, T. (2007). KIDNET—Narrative Expositionstherapie (NET) für Kinder. In M. Landolt & T. Hensel (Eds.), *Traumatherapie bei Kindern und Jugendlichen* (pp. 84–109). Göttingen: Hogrefe.

Sanchez-Meca, J., Rosa-Alcazar, A. I., & Lopez-Soler, C. (2011). The psychological treatment of sexual abuse in children and adolescents: A meta-analysis. *International Journal of Clinical and Health Psychology, 11*(1), 67–93.

Scheeringa, M. S., Wright, M. J., Hunt, J. P., & Zeanah, C. H. (2006). Factors affecting the diagnosis and prediction of PTSD symptomatology in children and adolescents. *American Journal of Psychiatry, 163*(4), 644–651. doi:10.1176/appi.ajp.163.4.644.

Scheeringa, M. S., Zeanah, C. H., & Cohen, J. A. (2011). PTSD in children and adolescents: Toward an empirically based algorithm. *Depression and Anxiety, 28*(9), 770–782. doi:10.1002/da. 20736.

Silverman, W. K., Ortiz, C. D., Viswesvaran, C., Burns, B. J., Kolko, D. J., Putnam, F. W., & Amaya-Jackson, L. (2008). Evidence-based psychosocial treatments for children and adolescents exposed to traumatic events. *Journal of Clinical Child and Adolescent Psychology, 37*(1), 156–183. doi:10.1080/15374410701818293.

Taylor, J. E., & Harvey, S. T. (2010). A meta-analysis of the effects of psychotherapy with adults sexually abused in childhood. *Clinical Psychology Review, 30*(6), 749–767. doi:10.1016/j.cpr.2010.05. 008.

Trask, E. V., Walsh, K., & Dilillo, D. (2011). Treatment effects for common outcomes of child sexual abuse: A current meta-analysis. *Aggression and Violent Behavior, 16*(1), 6–19. doi:10. 1016/j.avb.2010.10.001.

Watts, B. V., Schnurr, P. P., Mayo, L., Young-Xu, Y., Weeks, W. B., & Friedman, M. J. (2013). Meta-analysis of the efficacy of treatments for posttraumatic stress disorder. *Journal of Clinical Psychiatry, 74*(6), e541–e550. doi:10.4088/JCP.12r08225.