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Research Review: Psychological and psychosocial interventions for children and adolescents with depression, anxiety, and post-traumatic stress disorder in low- and middle-income countries – a systematic review and meta-analysis

Cansu Alozkan-Sever,[1] Jana R. Uppendahl,[2] Pim Cuijpers,[1] Ralph de Vries,[3] Atif Rahman,[4] Ellenor Mittendorfer-Rutz,[5] Aemal Akhtar,[5] Zhuoli Zheng,[6] and Marit Sijbrandij[1]

[1]Department of Clinical, Neuro- and Developmental Psychology, WHO Collaborating Center for Research and Dissemination of Psychological Interventions, Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands; [2]Chair of Social Pediatrics, TUM School of Medicine, Technical University of Munich, Munich, Germany; [3]Medical Library, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands; [4]Department of Primary Care and Mental Health, Institute of Population Health, University of Liverpool, Liverpool, UK; [5]Division of Insurance Medicine, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden; [6]Faculty of Psychology and Educational Sciences, KU Leuven, Leuven, Belgium

Background: The incidence of depression, anxiety, and post-traumatic stress disorder (PTSD) among children and adolescents residing in low- and middle-income countries (LMICs) poses a significant public health concern. However, there is variation in the evidence of effective psychological interventions. This meta-analysis aims to provide a complete overview of the current body of evidence in this rapidly evolving field. **Methods:** We conducted searches on PubMed, Embase.com, and EBSCO/APA PsycInfo databases up to June 23, 2022, identify randomized controlled trials (RCTs) investigating the effectiveness of psychological interventions in LMICs that targeted children and adolescents with elevated symptoms above a cut-off score for depression, anxiety, and PTSD, comparing a psychological or psychosocial intervention with other control conditions. We conducted random effects meta-analyses for depression, anxiety, and PTSD symptoms. Sensitivity analysis for outliers and high-risk studies, and analyses for the publication bias were carried out. Subgroup analyses investigated how the intervention type, intervention format, the facilitator, study design, and age group of the participant predicted effect sizes. **Results:** Thirty-one RCTs (6,123 participants) were included. We found a moderate effect of interventions on depression outcomes compared to the control conditions (g = 0.53; 95% CI: 0.06–0.99; NNT = 6.09) with a broad prediction interval (PI) (−1.8 to 2.86). We found a moderate to large effect for interventions on anxiety outcomes (g = 0.88; 95% CI: −0.03 to 1.79; NNT = 3.32) with a broad PI (−3.14 to 4.9). Additionally, a moderate effect was observed on PTSD outcomes (g = 0.54; 95% CI: 0.19–0.9; NNT = 5.86) with a broad PI (−0.64 to 1.72). **Conclusions:** Psychological and psychosocial interventions aimed at addressing depression, anxiety, and PTSD among children and adolescents in LMICs have demonstrated promising results. However, future studies should consider the variation in evidence and incorporate long-term outcomes to better understand the effectiveness of these interventions. **Keywords:** Children; adolescents; depression; anxiety; post-traumatic stress disorder (PTSD); low- and middle-income countries (LMICs); psychological interventions; meta-analysis.

Introduction

Worldwide, approximately 8% of young children (5–9 years) and 14% of adolescents (10–19 years) are estimated to be living with various mental disorders, such as depression, anxiety, and post-traumatic stress disorder (PTSD; WHO, 2022). Most of the world's population lives in low- and middle-income countries (LMICs), defined by World Bank based on their yearly Gross National Income (GNI; World Bank, 2022), resulting in a higher burden of disease in LMICs than in high in income settings. In addition, LMICs are disproportionately affected by various conflicts, disasters, as well as other challenging living conditions (Kieling et al., 2011) which have a detrimental impact on mental health and well-being. Reported prevalence rates among children and adolescents in LIMCs range from 0% to 28% for depression and 8% to 27% for anxiety, and 0.2% to 87% for PTSD symptoms (Yatham, Sivathasan, Yoon, da Silva, & Ravindran, 2018), and similar rates have been found in meta-analyses in the Sub-Saharan region (Jörns-Presentati et al., 2021) and child and adolescent refugee populations (Blackmore et al., 2020). Mental health problems in children and adolescents have far-reaching consequences for children, their families, and society. They do not only impact their overall quality of life, but also increase the risk of development and persistence of health and mental health conditions

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in adulthood (Otto et al., 2021). Despite the need for mental health services, service utilization remains lower in LMICs when compared to high-income countries (Rathod et al., 2017).

The evidence of child mental health intervention trials in LMICs still lags behind. By 2007, only 7% of global mental health trials were conducted in LMICs, with only 1% focusing on child and adolescent mental health (Patel & Rahman, 2015). In addition, only 17 (18%) out of 95 studies on task-shifting interventions conducted in LMICs specifically targeted children and adolescents (van Ginneken et al., 2021). Thus, considering the prevalence rates and the disproportionate burden of mental health problems in LMICs, it is crucial to examine the effectiveness of psychological and psychosocial interventions specifically tailored to these regions.

Previous meta-analyses that examined psychological and psychosocial interventions among children exposed to trauma or mass violence showed benefits for reducing symptoms of depression (Morina, Malek, Nickerson, & Bryant, 2017) and PTSD (Morina et al., 2017; Purgato et al., 2018; Purgato, Gross, et al., 2018). A meta-analysis among children and adolescents in LMICs with elevated levels of depression, anxiety, and/ or PTSD on psychological and psychosocial interventions for PTSD, depression, and anxiety, showed medium effect sizes for improving symptoms of depression and PTSD and a small effect for improving anxiety symptoms (Uppendahl, Alozkan-Sever, Cuijpers, de Vries, & Sijbrandij, 2020). Furthermore, interventions delivered by nonprofessionals to children and adolescents in LMICs with mental disorders and distress have demonstrated small effects on depression and PTSD when compared to control conditions (van Ginneken et al., 2021). Since these meta-analyses contained relatively few studies, heterogeneity was high (e.g., Purgato, Gastaldon, et al., 2018), and only a few conducted subgroup analyses (e.g., Purgato, Gross, et al., 2018; Uppendahl et al., 2020). These subgroup analyses showed that focused psychosocial interventions showed better outcomes on PTSD scores for older children (15–18 years), non-displaced children, and children living in smaller households (Purgato, Gross, et al., 2018). Other factors that are found to influence the effectiveness of interventions are type of control condition (less effect size for waitlist) and designed of the study (less effect size for cluster RCT; Uppendahl et al., 2020).

Recently, a number of new RCTs among children and adolescents in LMICs have been published (e.g., Jibunoh & Ani, 2021; Omkarappa, Rentala, & Nattala, 2022; Osborn et al., 2021). This increase in studies provided the opportunity to further strengthen the evidence base for psychological and psychosocial interventions for children in LIMCs, and to identifying sources of heterogeneity and relevant subgroups that benefit more from these interventions.

Hence, the main of this current study was to conduct a systematic review and meta-analysis that examines the effectiveness of psychological interventions in LMICs for children and adolescents with depression, anxiety, and PTSD compared to control conditions. Additionally, we will carry out subgroup analyses on intervention types (CBT-based vs. others), intervention formats (group, individual, or others), facilitator (specialist vs. non-professional helper), study design (individual or cluster RCT), and the target age group (children vs. adolescents). With this updated meta-analysis, we aim to contribute to improving the mental health outcomes of children and adolescents in LMICs.

Methods

Protocol and registration

The present review constitutes an update of a PROSPERO registered systematic review and metanalysis (ID: CRD42019111558). Without changing anything about the inclusion criteria and research questions we updated our previous meta-analysis (Uppendahl et al., 2020).

Information sources and search

We previously carried out a comprehensive search in the bibliographic databases PubMed, Embase.com and EBSCO/APA PsycInfo for the same research question up to December 14, 2018 (Uppendahl et al., 2020). To identify the relevant publications, we provided an update of the searches of this systematic review in the bibliographic databases PubMed, Embase.com and EBSCO/APA PsycInfo from inception up to June 23, 2022, in collaboration with a medical information specialist (RV). Engaging an independent medical librarian/ information specialist to conduct the systematic search is advised by the Cochrane Handbook since it minimizes the risk of bias during the search procedures (Lefebvre et al., 2022). The following terms were used (including synonyms and closely related words) as index terms or free-text words: 'Developing countries', 'Low- and middle-income countries', 'Anxiety disorders', 'Depressive disorders', 'Children', 'Adolescents'. References of the identified articles were searched for relevant publications. All languages were accepted. Duplicate articles were excluded by a medical information specialist using Endnote X20.0.1 (ClarivateTM), following the Amsterdam Efficient Deduplication (AED)-method (Otten, Vries, & Schoonmade, 2019), and the Bramer-method (Bramer, Giustini, de Jonge, Holland, & Bekhuis, 2016). Full search strategies for each database can be found in Appendix S1.

Eligibility criteria

We formulated our research question in line with the preferred reporting items for systematic reviews and meta-analysis (PRISMA) statement (Moher, Liberati, Tetzlaff, & Altman, 2009) regarding population, intervention, comparison, outcome, and study (PICOS). Full-text and peer-reviewed studies were eligible for inclusion if: (a) the sample consists of children and adolescents with ages below 18, (b) the study design is either an RCT or cluster RCT (cRCT), (c) the study was conducted in an LMIC, as defined by World Bank classifications (World Bank, 2022), (d) the study sample was selected based on diagnostic criteria for depression, anxiety, and/or PTSD symptoms or by using assessment tools with cut-off

scores that measures these symptoms, and (e) the study included one or more psychological or psychosocial intervention arm and an active or non-active comparison group.

Outcome measures

Outcome measures included in the study are the measures of symptoms of depression, anxiety, or PTSD measures, which were assessed either by self-report instruments or clinical interviews. By using raw data, the measure of effect sizes (Hedges' *g*) was calculated as the standardized mean differences (Hedges & Olkin, 1985). There were studies where multiple measures were available for one outcome. By using the 'combined' method of metapsyTools, all effect sizes in the studies were combined for separate outcomes.

Data extraction and quality assessment

Two researchers (CAS and JU) independently extracted the following information from each study: (a) characteristics of the studies (title, authors, year), (b) country, (c) characteristics of the interventions (name, theoretical background, number of sessions, format), (d) study design (type of control, inclusion/exclusion criteria, number of assessments, recruitment), (e) characteristics of the sample (mean age, gender composition, scores above a cut-off or with a diagnosis), and (f) outcomes regarding depressive, anxiety, and post-traumatic stress symptomatology.

We used the revised Cochrane risk-of-bias tool for randomized trials (RoB 2) (Sterne et al., 2019) to carry out the quality assessments. Two researchers (CAS and ZZ) independently reviewed all studies and compared their ratings. Discrepancies were discussed and consulted with the senior researchers (MS and PC) when necessary. All included studies were evaluated by using the five domains of RoB 2 tool: (a) bias arising from the randomization process; (b) bias due to deviations from intended interventions; (c) bias due to missing outcome data; (d) bias in the measurement of the outcome; and (e) bias in the selection of the reported result (Sterne et al., 2019). Each study received a rating (low risk, some concerns, or high risk) in each domain and at the end overall risk was calculated. The Cochrane tool provides an internal algorithm which helps to decide on the level of risk for each study. For included cRCTs, a separate RoB 2 tool was used, which adds a subdomain for the randomization process and examines bias arising from the timing of identification and recruitment of individual participants to the trial.

Data analysis

Analyses were carried out in R (version 4.1.1) and RStudio (version 2022.12.0+353 for Mac) with metapsyTools package (Harrer, Kuper, Sprenger, & Cuijpers, 2022). The metapsyTools package, which is incorporated in R, is developed explicitly for the Metapsy project (Cuijpers & Karyotaki, 2020). This package carries out the necessary analyses for the meta-analysis studies by importing the functionality of three other packages for meta-analytic studies in R, which are mainly: 'meta' (Balduzzi, Rücker, & Schwarzer, 2019), 'metafor' (Viechtbauer, 2010), and 'dmetar' (Harrer, Cuijpers, Furukawa, & Ebert, 2021).

Since we expected a high degree of heterogeneity, a random effects model was assumed for all analyses. Meta-analyses were conducted by taking the combined models as the main analysis. In this model, all effect size data available for a comparison in a specific study were aggregated within that comparison first. These aggregated effects were then pooled across studies and comparisons. An intra-study correlation coefficient of $\rho = .5$ was assumed to aggregate effects within comparisons. We performed sensitivity analysis for risk of bias by only including the low risk of bias studies as well as the outliers. The prediction intervals (PIs) were reported besides I^2 and the 95% confidence interval (CI) statistics. PIs estimate the range within which future individual treatment effects are likely to fall, capturing the uncertainty associated with making predictions and providing valuable insights for assessing potential outcomes (IntHout, Ioannidis, Rovers, & Goeman, 2016). The follow-up effects were also analyzed where available.

In addition to the primary analyses, we conducted subgroup analyses to investigate the effects of psychological interventions in different subgroups (containing at least three studies for a subgroup). Subgroup analysis was performed between the intervention types. We distinguished between those based on cognitive behavioral therapy (CBT; e.g., including strategies to unhelpful change thinking patterns or behaviors such as behavioral activation, exposure, and cognitive restructuring) and other interventions. Other subgroup analyses investigated the effects of the format of the intervention (group, individual, or others), design of the study (individual or cluster RCT), and target age group (children younger than 13 or adolescents older than 13), and the facilitator (specialists vs. nonspecialists). Specialists were facilitators with formal mental health training, while nonspecialists were facilitators without formal mental health training but who had received specific training for the intervention protocol they were delivering. Finally, publication bias was examined using three methods, including Duval and Tweedie's Trim-and-fill procedure (Duval & Tweedie, 2000), limit meta-analysis method and the selection model. Additionally, we examined the funnel plots on three different outcomes and conducted Egger's test of the intercept (Egger, Smith, Schneider, & Minder, 1997) to assess publication bias.

Results

Selection and inclusion of studies

A total of, 3,676 titles were identified through the systematic search. Following the removal of the duplicates, 2,404 studies were screened based on the titles and abstracts by two researchers (CAS and JU) independently. Total number of studies included in the full text review was 186 and out of these, 31 RCTs were included in the meta-analysis (See PRISMA flow diagram, Figure 1).

Characteristics of included studies

Table 1 depicts the main characteristics of the included studies. Total number of participants were 6,123, of which 3,132 of them were randomized into a psychological intervention and 2,991 in the control conditions. The number of participants randomized in studies ranged from 21 to 640. The age of the participants across studies ranged from 6 to 18. Seven of the included trials were cluster RCT (cRCT) whereas the others were individual RCTs. Most of the studies recruited participants via schools (23 studies) whereas the others used community, clinics, or other methods. Twenty-two studies examining the effectiveness of psychological interventions included depression outcomes, 20 included anxiety

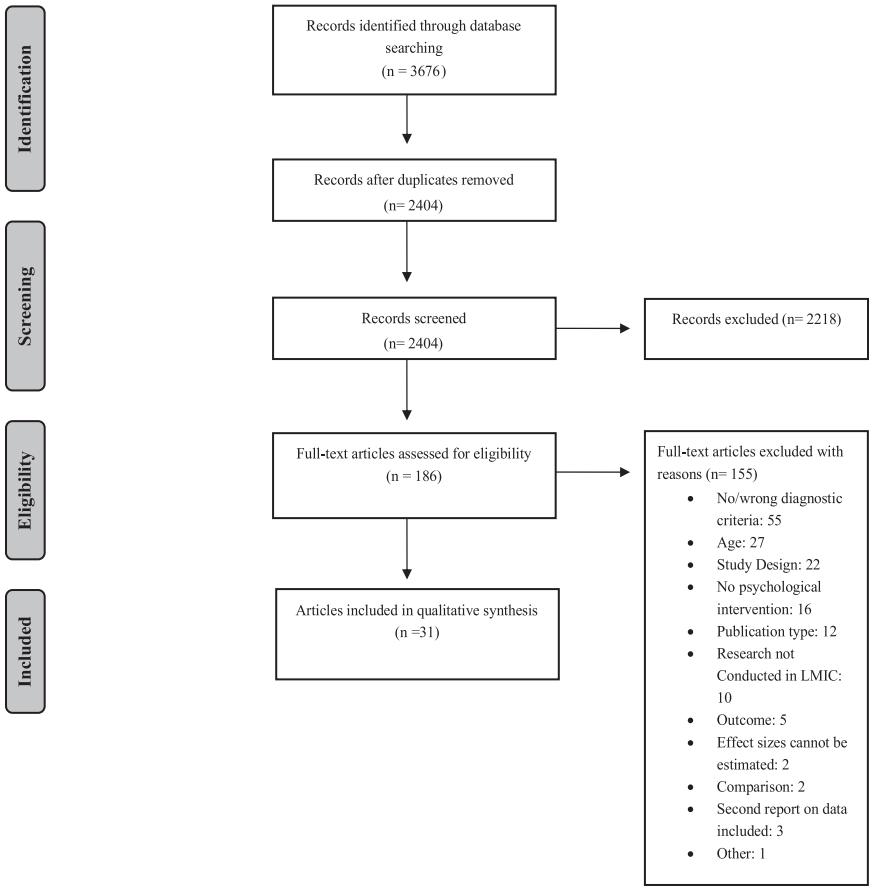

Figure 1 PRISMA flowchart for the inclusion of studies

outcomes, and 11 included PTSD outcomes. Three studies used multiple outcomes for depression and two studies used multiple measures for anxiety. In one study, both self-report and interview measures were used to assess PTSD. Self-report measures (including ones collected by assessors) were prioritized over interview measures. Only three studies utilized classification systems such as the International Classification of Diseases (ICD) or the Diagnostic and Statistical Manual of Mental Disorders (DSM) to establish their diagnoses. The remaining studies employed cut-off scores to evaluate the severity of symptoms. In studies which used both guardian and child reports, only child reported outcomes were included. Among the studies included in this meta-analysis, some utilized instruments that had already been validated in the language or culture of the study sample, while others utilized measures validated in high-income settings only. Follow-up assessments between 3 and 6 months were included in the analyses since there were only two studies included follow-ups over 6 months. Three multi-arm trials were included. Seventeen studies included psychological interventions containing CBT elements (e.g., desensitization, relaxation, cognitive restructuring, etc.), and others used alternative techniques (e.g., psychodynamic oriented techniques, self-help, and holistic stress management). In 13 studies, waitlist control groups were used as comparisons, in 12 studies the comparison was care as usual or no-contact control, and the remaining studies used other control groups (e.g., low intensity methods such as mentorship, or distributing printed manuals, or active controls such as CBT or supportive counseling). The number of sessions provided ranged from 1 to 20. Seven studies included individual interventions, two combined group interventions with individual sessions, one intervention was digital, and the remaining studies examined group interventions. Additionally, in 11 of the included studies, specialists delivered the interventions, whereas, in 16 of them the intervention was delivered by nonspecialists. Four studies did not report the facilitator qualifications, or it was not applicable.

Risk of bias assessment

Among the RCTs examining individual interventions, one study was identified as 'high risk', whereas the overall risk for six studies imposed 'some concerns', and the rest were rated as 'low risk'. The study rated as high risk failed to provide a clear description of the analysis carried out, dropout rates, and the potential deviations these issues might create. Other studies posed some concerns, mainly failing to

Table 1 Characteristics of the included studies

First author, Year	*N* (% female)	Age mean	Outcomes (measures)	Intervention	Comparison group	Number of sessions	Format	Country
Amin, 2020	76 (59)	14,85	Anxiety (LSAS-CA)	Guided Self Help	TAU	8	Individual	Pakistan
Are, 2021	40 (75)	15,27	Depression (BDI)	Teacher Delivered CBT	WL-Control	5	Group	Nigeria
Barron, 2016	154 (60)	13,51	Depression (DSRS), PTSD (CRIES-13)	Teaching Recovery Technique	WL-Control	5	Group	Palestine
Bella-Awusah, 2016	40 (70)	15,6	Depression (BDI, SMFQ)	School Based CBT	WL-Control	5	Group	Nigeria
Bolton, 2007	314 (57)	15,0	Depression (locally created instrument)	IPT	Creative Play, Control	16	Group	Uganda
Dorsey, 2020	640 (50)	10,6	PTSD (Child PTSD Symptom Scale)	TF-CBT	Usual Care	12 group +3–4 individual	Individual + group	Kenya & Tanzania
Egenti, 2019	155 (43)	14,35	Anxiety (SMGAD-C, LSAS-CA, SAS-A)	Music Therapy with CBT (MTCBT)	WL-Control	12	Group	Nigeria
El-Khani, 2021	119 (85,7)	Range: 9 to 12	Depression (DSRS), Anxiety (SCARED), PTSD (CRIES-13)	Teaching Recovery Skills with Parenting Skills (TRT + P)	TRT, WL-Control	5 children +5 parent sessions	Group	Lebanon
Getanda, 2020	54 (59)	Range: 14 to 17	Depression (DSRS), PTSD (CRIES-13), Anxiety (RCMAS)	Writing for Recovery (WfR)	WL-Control	3	Individual	Kenya
Gordon, 2008	82 (76)	16,3	PTSD (HTQ)	Mind Body Skills Group	WL-Control	12	Group	Kosovo
Jacob, 2016	30 (100)	13,9	Depression (BDI-II, AADS, KADS-11)	Bibliotherapy	Control	8	Group	Philippines
Jibunoh, 2021	40 (70)	14,55	Depression (SMFQ), Anxiety (SCAS)	Group-based Psychoeducation	WL-Control	3	Group	Nigeria
Jordans, 2010	325 (49)	12,7	Depression (DSRS), Anxiety (SCARED-5), PTSD (CPSS)	School Based Intervention	WL-Control	15	Group	Nepal
Michelson, 2020	251 (30)	15,61	Anxiety (PSS)	Problem Solving Intervention	Control (distribution of printed PS Booklets)	4 to 5 sessions	Individual	India
Murray, 2015	257 (50)	13,7	PTSD (PTSD-RI)	TF-CBT	TAU	NR	Individual	Zambia
Obiweluozo, 2021	178 (52)	9,44	Anxiety (SMGAD-C, LSAS-CA)	Cognitive Behavioral Play Therapy (CBPT)	No-contact control	12	Individual	Nigeria
Omkarappa, 2022	211 (39)	14,68	Depression (CES-D), Anxiety (SCAS)	Psychosocial Intervention for Internalizing Behaviors	WL-Control	8	Group	India
Osborn, 2021	413 (65)	15,5	Depression (PHQ-8), Anxiety (GAD-7)	Shamiri Intervention	Study Skills Control	4	Group	Kenya
Osborn, 2020	51 (61)	15,8	Depression (PHQ-8), Anxiety (GAD-7)	Shamiri Intervention	Study Skills Control	4	Group	Kenya
Ramdhonee-Dowlot, 2021	100 (76)	11,75	Anxiety (RCADS)	Super Skills for Life (SSL)	WL-Control	8	Group	Mauritius
Rentala, 2019	60 (100)	17,13	Depression (DASS-d), Anxiety (DASS-a)	Holistic Stress Management	Control	8	Group	India
Rentala, 2019	230 (100)	17,8	Depression (DASS-d), Anxiety (DASS-a)	Holistic Stress Management	Control	8	Group	India
Rossouw, 2020	63 (87)	15,35	Depression (BDI), PTSD (CPSS-SR, CPSS-I)	Prolonged Exposure (PE)	Supportive Counseling	7 to 14	Individual	South Africa

(continues)

Table 1 (continued)

First author, Year	N (% female)	Age mean	Outcomes (measures)	Intervention	Comparison group	Number of sessions	Format	Country
Salama, 2022	30 (37)	11,47	Anxiety (STAI-C)	Neurofeedback Training	CBT	Neurofeedback: 20, CBT: 8 to 12	Individual	Egypt
Simms, 2022	842 (55)	14,81	Depression (PHQ-9)	Zvandiri Program + Friendship Bench (Zvandiri + PST)	Zvandiri	6 (plus optional 6)	Individual + group	Zimbabwe
Srivastava, 2020	21 (24)	16,05	Depression (BDI-II, CDRS, CGI-S)	Smartteen (Computer Assisted CBT Intervention)	TAU	12	Computer assisted	India
Thabet, 2005	111 (46)	12,34	Depression (CDI), PTSD (CPTSD-RI)	Crisis Intervention	Teacher Education, Control	7	Group	Gaza Strip
Tol, 2008	403 (49)	10,2	Depression (DSRS), Anxiety (SCARED-5), PTSD (CPSS)	School-Based Intervention	WL-Control	15	Group	Indonesia
Tol, 2012	399 (39)	11,03	Depression (DSRS), Anxiety (SCARED-5), PTSD (CPSS)	School-Based Intervention	WL-Control	15	Group	Sri Lanka
Tol, 2014	329 (48)	12,29	Depression (DSRS), Anxiety (SCARED-5), PTSD (CPSS)	School-Based Intervention	WL-Control	15	Group	Burundi
Zafar, 2015	100 (50)	15,14	Depression (DASS-d), Anxiety (DASS-a)	Didactic Therapy	Control	6	Group	Pakistan

provide enough information on the randomization process, analysis plan, and the selection of the reported results. Among the seven cRCTs, four of them were rated as 'high risk', two of them were found to pose 'low risk', whereas one of them created 'some concerns'. The main reason for the high risk of bias came from the failure to blind assessors to the study conditions as the assessors were also delivering the interventions. The other reasons for the high risk of bias were problems with the randomization process and the timing of randomizing participants to the clusters. One study posed some concerns regarding the exclusion of two participants from the analysis following loss to follow-up for the outcome measures. Graphical representations of risk of bias assessments for individual trials can be found in Figure S1, and cRCTs in Figure S2.

Effects of psychological interventions on depression, anxiety, and PTSD

The analysis yielded a moderate effect of psychological interventions on depression compared to the control conditions ($g = 0.53$; 95% CI: 0.06–0.99; NNT = 6.09) with very high heterogeneity ($I^2 = 93$; 95% CI: 91–95) and a broad PI (PI = −1.8 to 2.86). After excluding three identified outliers, this effect was decreased (g = 0.39, 95% CI: 0.21–0.58; NNT = 8.05), and heterogeneity was also reduced ($I^2 = 75$; 95% CI: 62–83), while PI remained broad (PI = −0.33 to 1.12).

The effects of psychological interventions on anxiety outcomes showed a large effect compared to the comparison conditions ($g = 0.88$; 95% CI: −0.03 to 1.79; NNT = 3.32) with very high heterogeneity ($I^2 = 98$; 95% CI: 97–98). The combined effect was not significant ($p = .06$), and the PI was broad (PI = −3.14 to 4.9). With sensitivity analysis for outliers, seven studies were identified. After removing the identified outliers, the effect was moderate ($g = 0.49$; 95% CI: 0.14–0.84; NNT = 6.62) with high heterogeneity ($I^2 = 90$; 95% CI: 85–93) and a broad PI (PI = −0.75 to 1.73).

Psychological interventions for children and adolescents indicated a moderate effect on PTSD symptoms ($g = 0.54$; 95% CI: 0.19–0.9; NNT = 5.86) with high heterogeneity ($I^2 = 89$; 95% CI: 83–93) and a broad PI (PI = −0.64 to 1.72). After removing two outliers, the effect size remained moderate ($g = 0.52$; 95% CI: 0.24–0.8; NNT = 6.17), heterogeneity remained high ($I^2 = 81$; 95% CI: 66–89), and the PI remained broad (PI = −0.29 to 1.33).

The effect of psychological interventions for all outcomes was moderate to large ($g = 0.77$; 95% CI: 0.28–1.26; NNT = 3.88) with again high heterogeneity ($I^2 = 94$; 95% CI: 95–97). The PI was repeatedly broad (PI = −2.07 to 3.62). When outliers were removed, the effect was moderate ($g = 0.52$; 95% CI: 0.34–0.7; NNT = 6.18) and heterogeneity high ($I^2 = 81$; 95% CI: 76–86). The PI was broad

Table 2 Effects of psychological interventions on depression, anxiety, and PTSD

Outcomes	*k*	*g*	CI	*p*	I^2	CI	PI	NNT
Depression								
All comparisons (effect sizes combined)	26	0.62	0.22–1.02	.22–1.02	92.06	89.8–93.82	−1.54 to 2.78	5.02
All studies (effect sizes combined)	26	0.53	0.06–0.99	.029	93.05	90.95–94.66	−1.8 to 2.86	6.09
Three-level model (CHE)	26	0.57	0.05–1.08	.032	97.90		−1.88 to 3.01	5.60
One effect size per study (lowest)	23	0.52	−0.01–1.05	.054	93.62	91.61–93.15	−1.99 to 3.04	6.13
One effect size per study (highest)	23	0.60	0.07–1.13	.028	93.49	91.61–95.06	−1.9 to 3.1	5.20
Outliers removed	23	0.39	0.21–0.58	<.001	74.63	61.91–83.11	−0.33 to 1.12	8.50
Influence analysis	24	0.46	0.25–0.68	<.001	79.44	70.06–85.88	−0.46 to 1.38	7.10
Only RoB >3	15	0.84	0.2–1.48	.014	92.70	89.58–94.89	−1.62 to 3.31	3.50
Anxiety								
All comparisons (effect sizes combined)	23	1.51	0.44–2.59	.008	98.45	98.15–98.7	−3.7 to 6.73	1.85
All studies (effect sizes combined)	19	0.88	−0.03–1.79	.056	97.77	97.23–98.21	−3.14 to 4.9	3.32
Three-level model (CHE)	23	1.07	0–2.14	.049	99.30		−3.54 to 5.68	2.65
One effect size per study (lowest)	18	0.86	−0.09–1.82	.072	97.59	96.97–98.09	−3.24 to 4.97	3.40
One effect size per study (highest)	18	1.19	0.03–2.35	.045	98.27	97.87–98.59	−3.82 to 6.2	2.36
Outliers removed	14	0.49	0.14–0.84	.010	90.13	85.21–93.41	−0.75 to 1.73	6.62
Influence analysis	18	0.60	−0.13–1.34	.103	96.72	95.78–97.46	−2.55 to 3.75	5.20
Only RoB >3	13	1.34	0.16–2.52	.029	97.62	96.87–98.18	−0.53 to 5.67	2.66
PTSD								
All comparisons (effect sizes combined)	12	0.54	0.19–0.9	.007	89.3	83.23–93.17		5.86
All studies (effect sizes combined)	12	0.54	0.19–0.9	.007	89.3	83.23–93.17		5.86
Three-level model (CHE)	12	0.58	0.22–0.95	.005	93.40	—		5.42
One effect size per study (lowest)	11	0.58	0.18–0.97	.008	90.18	84.46–93.17	−0.68 to 1.83	5.48
One effect size per study (highest)	11	0.59	0.22–.097	.005	89.89	83.94–93.64	−0.59 to 1.78	5.27
Outliers removed	10	0.52	0.24–0.8	.002	81.20	66.48–89.46	−0.29 to 1.33	6.17
Influence analysis	12	0.54	0.19–0.9	.007	89.29	83.23–93.17	−0.64 to 1.72	5.86
Only RoB >3	4	0.68	0.04–1.33	.044	90	77.31–95.59	−1.22 to 2.59	4.47
Three outcomes combined								
All comparisons (effect sizes combined)	66	0.92	0.51–1.34	<.001	96.60	96.12–97.02	−2.39 to 4.24	3.15
All studies (effect sizes combined)	34	0.77	0.28–1.26	.003	94.04	95.2–96.74	−2.07 to 3.62	3.88
Three-level model (CHE)	66	0.90	0.32–1.47	.003	99		−2.31 to 4.1	3.26
One effect size per study (lowest)	31	0.67	0.12–1.23	.018	96.35	95.55–97	−2.38 to 3.73	4.55
One effect size per study (highest)	31	1.14	0.5–1.77	<.001	96.44	95.67–97.07	−2.35 to 4.63	2.49
Outliers removed	26	0.52	0.34–0.7	<.001	80.72	75.52–86.47	−0.26 to 1.3	6.18
Influence Analysis	32	0.49	0.18–0.8	.003	92.27	90.13–93.95	−1.18 to 2.16	6.62
Only RoB >3	21	1.12	0.42–1.82	.003	95.56	95.64–97.29	−2.12 to 4.36	2.53

(PI = −0.26 to 1.3) (for overview of all results see Table 2). See Figures S3–S5 for the forest plots of depression, anxiety, and PTSD outcomes, respectively.

For anxiety outcomes, the Egger test of the intercept suggested significant funnel plot asymmetry (p = .03), thus indicating potential publication bias. After adjustment with the Duvall and Tweedie trim and fill procedure, the effect size dropped to (g = 0; 95% CI: −1.08 to 1.07) with high heterogeneity (I^2 = 99; 95% CI: 98–99). Additionally, limit meta-analysis method (g = −0.35; % CI: −1.76 to 1.06) and the selection model (g = −0.14; % CI: −2.15 to 1.87) highly decreased the effect size for the anxiety outcome; with high heterogeneity levels (I^2 = 100; 95% CI: NR and I^2 = 99; 95% CI: 99–100, respectively).

Similarly, Egger's test suggested significant funnel plot asymmetry (p = .01) for the combined anxiety, depression, and PTSD outcomes. The Duvall and Tweedie trim and fill procedure adjusted the overall effect size to g = 0.23, resulting in low effect size with high heterogeneity (I^2 = 98, CI = NR). Additionally, limit meta-analysis method (g = 0.05; % CI: −0.68 to 0.77) and the selection model (g = −2.34; % CI: −5.37 to 0.69) highly decreased the effect size for the anxiety outcome; with high heterogeneity levels (I^2 = 98; 95% CI: NR and I^2 = 100; 95% CI: 99–100 respectively).

Ten studies reported results for follow-up measurements between 3 and 6 months. The combined effect size of psychological interventions in the follow-up assessments was high (g = 0.91; 95% CI: 0.15–1.68; NNT = 3.19) with high heterogeneity (I^2 = 95; 95% CI: 93–97) and a broad prediction interval (PI = −1.57 to 3.39). After removing two outliers, the effect size decreased but remained high (g = 0.76; 95% CI: 0.26–1.25; NNT = 3.97), heterogeneity remained high (I^2 = 93; 95% CI: 89–96), and the PI remained broad (PI = −0.71 to 2.22).

Subgroup analysis

Subgroup analysis showed no significant differences in the effect sizes between CBT-based interventions and other interventions for depression (p = .9),

anxiety (p = .8), or PTSD (p = .6). When comparing non-professional interventions and specialist-delivered interventions, there is a difference in their effect sizes for anxiety symptoms (p = .005), and no statistically significant difference for depression outcomes (p = .3) or PTSD outcomes (p = .7). The format of the psychological interventions created significant effect size differences only for the PTSD outcomes (p = .02), showing higher effect sizes for individual interventions than the group interventions. In terms of the PTSD outcomes, significant differences in effect sizes were found comparing interventions delivered to children younger than 13 and adolescents up to 18 years (p < .001), with the interventions for the adolescents showing larger effect sizes. Additionally, individual RCTs had significant larger effect sizes compared to the cluster RCTs for PTSD outcomes (p < .001) as well as for the combined outcome (p = .03). No other significant subgroup differences were observed (see Table 3).

Discussion

The aim of this meta-analysis was to examine the effectiveness of psychological interventions for children and adolescents with symptoms of depression, anxiety, and PTSD in low- and middle-income countries. The search resulted in 31 trials with 6,123 participants across 20 countries, which is much higher number than previous meta-analyses among children in LMICs that included between 11 and 21 studies (Morina et al., 2017; Purgato, Gross, et al., 2018; Uppendahl et al., 2020; van Ginneken et al., 2021). The results showed a moderate effect of psychological and psychosocial interventions for children and adolescents on depression symptoms, a moderate to high effect on anxiety symptoms and a moderate effect on PTSD symptoms.

Regarding the beneficial effect on depression outcomes, our results are in line with the previous meta-analysis of Uppendahl et al. (2020). However, earlier meta-analyses in trauma- and violence-exposed children in LMICs found no significant effects of interventions for depression outcomes (Purgato, Gross, et al., 2018) or small effects (Morina et al., 2017; van Ginneken et al., 2021). In terms of reducing anxiety, we found moderate to high effects, which was more positive than findings of previous research that failed to find a significant effect of focused psychosocial support interventions in reducing anxiety symptoms for children in low-resource settings (Purgato, Gross, et al., 2018) or only found small effects (Uppendahl et al., 2020). Finally, similar to previous research (Morina et al., 2017; Purgato, Gastaldon, et al., 2018; Purgato, Gross, et al., 2018; Uppendahl et al., 2020) we also found beneficial effects in reducing PTSD symptoms. This finding contrasts with interventions administered by nonspecialists, as earlier studies have indicated little or no effects on PTSD scores postintervention (van Ginneken et al., 2021). It should be noted though that, for the anxiety outcomes, we found indications of publication bias. After adjusting for publication bias, the effect size of the interventions on anxiety outcomes decreased, which suggests that future studies need to be conducted to arrive at more definitive conclusions.

Another important point to consider were the high levels of heterogeneity observed between the studies. This finding replicates the findings of studies in low-resource settings that high heterogeneity exists between in studies conducted in these settings (Purgato, Gastaldon, et al., 2018; Purgato, Gross, et al., 2018; Uppendahl et al., 2020; Yatham et al., 2018). There are several reasons why I^2 levels can be inflated, such as the differences in treatments, population, designs, data analysis methods, or the number of studies included in the meta-analysis (Migliavaca et al., 2022; von Hippel, 2015). For this reason, using PIs, rather than relying only on I^2 statistics, is considered to be more meaningful for assessing heterogeneity (Migliavaca et al., 2022). Because both the I^2 statistics and PIs showed high levels of heterogeneity, the findings of this meta-analysis should be interpreted cautiously.

To identify sources of heterogeneity between the studies, and to understand which subgroups of children benefit most from the psychological and psychosocial interventions, we ran several subgroup analyses. When all outcomes were combined, only the design of the study (RCT or cRCT) created a difference in the outcomes, with individually randomized studies showing stronger effects. This is in line with a similar subgroup finding in the previous meta-analysis of Uppendahl et al. (2020). cRCTs are commonly used in public health and mental health research, especially in studies employing recruitment form community centers or schools, rather than recruitment by referral. This difference in recruitment strategy may explain the smaller effects found in cRCTs. Further, studies in which specialists (e.g., psychologists or psychiatrists) delivered the interventions had larger effect sizes in reducing anxiety symptoms than studies where the interventions were delivered by nonspecialists. This corresponds with previous research suggesting that although task-shifting interventions show positive effects in improving mental health outcomes among adults, interventions targeting children and adolescents may have little to no effect on PTSD and depressive symptoms (van Ginneken et al., 2021). In general, effects of nonspecialist-delivered interventions have been found to be smaller than the effects of specialist-delivered interventions (Karyotaki et al., 2022). Interventions developed for task-shifting (e.g., delivery by paraprofessionals or non-specialist) or are usually lighter, less intensive, and shorter versions of specialized interventions, which may impact their effectiveness. Yet, being more

Table 3 Subgroup analyses

Variable	Levels	n_{comp}	g	CI	I^2	CI	NNT	p
Depression								
Type of intervention	CBT-based	14	0.56	[−0.3; 1.43]	95.5	[93.9; 96.8]	5.66	.858
	Other	12	0.48	[0.08; 0.89]	83.8	[73.1; 90.2]	6.77	
Type of control	Wait-list	12	0.84	[0.06; 1.62]	93.5	[90.4; 95.6]	3.51	.407
	CAU	10	0.19	[−0.72; 1.1]	95	[92.6; 96.7]	19.09	
	Other	4	0.40	[0.14; 0.66]	0	[0; 84.7]	8.35	
Facilitator	Nonspecialists	17	0.20	[−0.24; 0.65]	90.7	[86.7; 93.5]	18.06	.354
	Specialists	7	1.14	[−0.37; 2.65]	96.4	[94.4; 97.7]	2.48	
Age group	Children (<13)	9	0.23	[−0.33; 1.84]	94.3	[91.2; 96.3]	3.95	.504
	Adolescents (>13)	17	0.76	[−0.12; 0.93]	92.6	[89.6; 94.7]	8.35	
Study design	Individual RCT	19	0.64	[−0.01; 1.29]	94.8	[93.1; 96.1]	4.84	.198
	Cluster RCT	7	0.23	[0.02; 0.43]	56	[0; 81.1]	15.51	
Format	Individual	3	0.92	[0.12; 1.72]	15	[0; 91.2]	3.16	.158
	Group	23	0.48	[−0.05; 1]	93.7	[91.7; 95.2]	6.77	
Anxiety								
Type of intervention	CBT-based	10	0.93	[−0.86; 2.72]	98.7	[98.3; 99]	3.12	.909
	Other	9	0.83	[0.1; 1.56]	91.9	[86.8; 95]	3.56	
Type of control	Wait-list	9	1.33	[−0.45; 3.12]	98.5	[98.1; 98.9]	2.10	.389
	CAU	7	0.58	[−0.96; 2.12]	97.3	[96; 98.2]	5.43	
	Other	3	0.24	[−0.86; 1.35]	44.8	[0; 83.6]	14.80	
Facilitator	Nonspecialists	11	−0.06	[−0.71; 0.58]	94.2	[91.4; 96.1]	64.03	**.019**
	Specialists	6	2.51	[0.19; 4.89]	98.3	[97.5; 98.8]	1.30	
	N/A	2	1.19	[−16.8; 19.19]	97.1	[92.5; 98.9]	2.36	
Age group	Children (<13)	8	0.63	[−0.8; 2.07]	97.2	[95.9; 98.1]	4.93	.621
	Adolescents (>13)	11	1.06	[−0.32; 2.45]	97.9	[97.3; 98.4]	2.69	
Study design	Individual RCT	15	1.12	[−0.01; 2.25]	97.7	[97; 98.2]	2.53	.086
	Cluster RCT	4	0.01	[−1.17; 1.19]	96.7	[94.1; 98.2]	393.30	
Format	Individual	5	0.96	[−0.38; 2.31]	93.9	[88.6; 96.7]	3.01	.884
	Group	14	0.85	[−0.38; 2.09]	98.2	[97.7; 98.6]	3.47	
PTSD								
Type of intervention	CBT-based	8	0.46	[0.12; 0.81]	90.1	[82.8; 94.3]	7.11	.561
	Other	4	0.73	[−0.67; 2.14]	89.8	[76.6; 95.5]	4.14	
Type of control	Wait-list	7	0.58	[−0.03; 1.19]	90.7	[83.5; 94.8]	5.43	.802
	CAU	4	0.43	[−0.4; 1.25]	89.9	[77.1; 95.6]	7.69	
	Other	1	0.83	[−0.39; 2.05]	—	—	3.56	
Facilitator	Nonspecialists	8	0.50	[−0.04; 1.04]	89.6	[81.9; 94]	6.46	.652
	Specialists	4	0.64	[−0.02; 1.3]	88	[71.6; 94.9]	4.84	
Age group	Children (<13)	7	0.21	[−0.04; 0.45]	80.6	[60.6; 90.4]	17.13	**<.001**
	Adolescents (>13)	5	1.05	[0.54; 1.57]	67.7	[16.5; 87.5]	2.72	
Study design	Individual RCT	6	0.92	[0.42; 1.42]	87.1	[74.3; 93.6]	3.16	**<.001**
	Cluster RCT	6	0.16	[−0.13; 0.45]	81.2	[59.7; 91.2]	22.96	
Format	Individual	3	1.22	[−0.01; 2.45]	67.8	[0; 90.7]	2.30	**.005**
	Group	9	0.33	[0.04; 0.62]	83.2	[69.5; 90.7]	10.39	
Combined								
Type of intervention	CBT-based	18	0.63	[0; 1.79]	97.5	[96.9; 98]	3.24	.570
	Other	16	0.83	[0.2; 1.06]	89.9	[85.3; 93.1]	4.93	
Type of control	Wait-list	14	1.21	[0.18; 2.23]	97.4	[96.6; 98]	2.32	.201
	CAU	15	0.52	[−0.14; 1.17]	95.7	[94.1; 96.8]	6.17	
	Other	5	0.32	[−0.12; 0.77]	36.7	[0; 76.4]	10.75	
Facilitator	Nonspecialists	19	0.22	[−0.17; 0.62]	91.3	[87.8; 93.7]	16.28	.089
	Specialists	11	1.58	[0.31; 2.84]	97.8	[97; 98.3]	1.77	
	N/A	3	1.17	[−2.37; 4.71]	94.3	[86.6; 97.5]	2.41	
	Not reported	1	1.29	[−1.3; 3.88]	—	—	2.17	
Age group	Children (<13)	12	0.59	[−0.23; 1.42]	94.7	[92.4; 96.3]	5.32	.571
	Adolescents (>13)	22	0.87	[0.21; 1.53]	96.6	[95.7; 97.3]	3.37	
Study design	Individual RCT	26	0.94	[0.31; 1.58]	96.7	[96.9; 97.3]	3.08	**.030**
	Cluster RCT	8	0.23	[−0.06; 0.51]	81.8	[65.3; 90.5]	15.51	
Format	Individual	8	0.98	[0.28; 1.67]	90.6	[83.8; 94.5]	2.94	.526
	Group	26	0.71	[0.08; 1.34]	96.5	[95.6; 97.1]	4.28	

Note: Significant subgroup differences were bolded.

accessible and scalable, their public health benefit may still be substantial for having the potential to reach larger number of children.

Subgroup analysis suggested stronger effects in improving PTSD symptoms among adolescent (13–18 years) than among child (younger than 13 years) samples. This outcome is in line with previous meta-analyses on the effects of psychological treatments for PTSD symptoms among children and adolescents (Gutermann et al., 2016) and trauma-exposed

children and adolescents in LMICs (Purgato, Gross, et al., 2018). Retrieving traumatic memories through exposure is widely recognized as a crucial component of effective trauma therapies (ISTSS, 2018). However, it is noteworthy that some of the studies included in this meta-analysis, specifically those focusing on younger children, did not uniformly incorporate modules involving exposure to traumatic memories (e.g., Tol et al., 2008) which might have led to this result. Interestingly as well was the finding that individual interventions were more effective in reducing PTSD symptoms than group interventions. The group interventions included in our analysis incorporated trauma focused techniques, but mostly without strong elements of exposure such as imagery exposure. Instead, these group interventions employed creative expressive techniques such as drawings, drama, and dance as alternative means of facilitating exposure to past traumatic events (e.g., Jordans et al., 2010; Thabet, Vostanis, & Karim, 2005; Tol et al., 2012). It is worth noting that participation in these creative expressive activities were mostly voluntary for the children involved (e.g., Jordans et al., 2010; Tol et al., 2008). Moreover, in LMICs, where there may be high levels of self-stigma surrounding mental health issues, individuals might be hesitant to openly share their symptoms in a group setting which could further impact outcome. However, it is important to underline that subgroup analyses are not causal evidence (Oxman & Guyatt, 1992), and such findings can easily be chance findings or are caused by other, third non-measured factors.

Fortunately, the evidence base for child and adolescent psychological interventions in LMIC settings is growing. Risk of bias assessments of the included studies showed that more recent studies tended to have lower risk of bias. The main reason for an included study being considered to have high risk of bias in the current review was the inability to blind the assessors to the study conditions during the trial, by having the same research staff delivering the intervention and doing the assessments. Even in studies that used self-report measures, these instruments were administered in interview format by assessors who were not blinded to the study conditions, and this impacted the possibility of introducing bias to the study (e.g., Tol et al., 2008, 2014).

To the best of our knowledge, this meta-analysis provided the most comprehensive overview of psychological interventions for children and adolescents residing in LMICs and included at least 10 more studies than previous meta-analyses. Apart from the study's strengths, there are some limitations that should be addressed while interpreting the results. First, the high heterogeneity of the studies might question how much the findings can be generalized. Only a minority of studies assessed outcomes beyond posttreatment or 3 months follow-up. Additionally, results of the subgroup analyses should be interpreted with caution because of lack of statistical power, which is very common for power calculations for subgroup analyses (Cuijpers, Griffin, & Furukawa, 2021). Finally, most of the studies included in this meta-analysis measured outcomes through symptom severity measures, rather than diagnostic outcomes. Future RCTs may consider including remission of disorders as outcomes. Future research should also aim to address barriers such as language differences and stigmas to actively involve parents and caregivers in interventions for children and adolescents in LMICs.

Conclusions

There is strong evidence for the positive effects of psychological interventions for depression, anxiety, and PTSD in children and adolescent populations in LMICs. Promoting high-quality research focusing on different modes of interventions including follow-up assessments to better understand the long-term implications on mental health outcomes may contribute to the development of the countries' clinical practice and mental health policies.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix S1. Search strategy.
Figure S1. Risk of bias assessment for individual RCTs.
Figure S2. Risk of bias assessment for cluster trials.
Figure S3. Forest plot of trials for depression outcome.
Figure S4. Forest plot of trials for anxiety outcome.
Figure S5. Forest plot of trials for PTSD outcome.

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Correspondence

Cansu Alozkan Sever, Department of Clinical, Neuro- and Developmental Psychology, WHO Collaborating Center for Research and Dissemination of Psychological Interventions, Amsterdam Public Health Research Institute, Vrije Universiteit Amsterdam, Van der Boechorststraat 7, 1081 BT Amsterdam, The Netherlands; Email: c.alozkan@vu.nl

Key points

- The prevalence of mental health problems among children and adolescents in low- and middle-income countries (LMICs) is high, and it is crucial to develop effective psychological interventions.
- In this meta-analysis, we included 31 randomized controlled trials (RCTs) conducted in LMICs testing the effectiveness of psychological and psychosocial interventions compared to other comparison conditions on depression, anxiety, and post-traumatic stress-related symptoms in children and adolescents.
- Psychological and psychosocial interventions were effective in reducing symptoms for depression, anxiety, and PTSD in children and adolescent populations in LMIC settings.
- Future studies may explore psychological and psychosocial interventions that target these symptoms and include longer term (e.g., 12 months) follow-up assessments.

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