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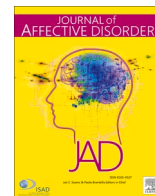
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## Review Article

# The effectiveness of targeted preventive interventions for depression symptoms in children and adolescents: Systematic review and meta-analyses

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## ABSTRACT

**Background:** Targeted interventions are needed to prevent depression in at-risk children and adolescents. Children and adolescents are commonly at risk of depression due to subsyndromal depressive symptoms or problems in their social environment.

**Methods:** This review was conducted according to the Cochrane guidelines (2023) and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. A literature search was done in December 2023 using three electronic databases and a manual search. The methodological quality of all eligible studies was assessed using the Cochrane Collaboration's tool for assessing the risk of bias.

**Results:** This review includes 77 intervention studies of which 13 are follow-ups. Of the 64 identified main studies ( $n = 11,808$ ), 19 were selective interventions targeting the problems in a social environment. Of the participants 63.6 % were girls and the mean age ranged between 9 and 17. Most of the studies were conducted in a Western school setting using psychological interventions, with the majority being CBT (cognitive behavioral therapy) based programs. Targeted interventions reduced the symptoms of depression statistically significantly at post-intervention (SMD 0.27, 95 % confidence interval 0.16–0.37) and 6-month follow-up (SMD 0.32, 0.18–0.45) compared to any comparator. Intervention effects were not statistically significant at the 12-month follow-up. **Conclusion:** Indicated and selective interventions targeted to children and adolescents at risk of depression due to their social environment have a small effect on depressive symptoms. Interventions should be delivered by mental health experts.

## 1. Introduction

Depression is a common and debilitating condition that often emerges early in life. In 2019 globally an estimated 279.6 million (3.4 %) people lived with depression (Dattani et al., 2021). Approximately 50 % of mental disorders emerge before the age of 14 and 75 % before the age of 24 (Kessler et al., 2005). The peak age at onset is 19.5 years

(Solmi et al., 2022). Depression is one of the leading causes of disability (GBD, 2022) and it causes major costs to society (König et al., 2019). To reduce the burden of depression, effective preventive interventions are needed. Preventive interventions should be delivered before the onset of the disorder, targeting preventive actions for children and adolescents (Papachristou et al., 2013).

According to an umbrella review, depression has multiple risk factors

**Abbreviations:** AST, Adolescent skill training; BDI, Beck's depression inventory; CBT, Cognitive behavioral therapy; CDI, Children depression inventory; CES-D, Center for epidemiological study depression scale; CESD-DC, The Center for Epidemiological Studies. Depression Scale for Children; HADS, Hospital anxiety and depression scale; IPT, Interpersonal psychotherapy; K-SADS, Kiddie Schedule for Affective Disorders and Schizophrenia; MFQ, Mood and feelings questionnaire; NT, No treatment; N/A, Not applicable; RADS-II, Reynolds Adolescent Depression Scale; RCADS, The Revised Children's Anxiety and Depression Scale; RCT, randomized controlled trial; SMD, Standardized mean difference; SMFQ, Short Mood and Feeling Questionnaire; TAU, treatment as usual.

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including biological, social, and psychological factors (Köhler et al., 2018). Especially among children and adolescents, many of the risk factors of depression are related to the social environment of children and adolescents. According to the systematic review by Basu and Banerjee (2020), the social environment of children and adolescents consists of the people around them at home, in daycare, at school, and in their leisure time. Reviews suggest that social environment problems, such as bullying (McKay et al., 2021) and parenting practices (Yap et al., 2014), can contribute to an increased risk of depression in later life. Loneliness (Kehusmaa et al., 2022), socioeconomic status of the family (Kessler and Bromet, 2013), and life circumstances such as parental mental disorders (Leverson, 2003) and family bereavement (Stikkelbroek et al., 2016) also increase the risk of depression in later life. It is therefore justified to target preventive interventions to address the social environmental factors of children and adolescents which we can have an impact on.

Preventive interventions are delivered by a universal, selective, or indicated approach. Universal interventions are intended for the entire population (Corrieri et al., 2014; O’Connell et al., 2009). Another, very common model in public health, is categorizing interventions into primary, secondary, and tertiary prevention (O’Connell et al., 2009). Universal, selective and indicated approaches are based on the costs and benefits of delivering the intervention to the targeted population. Selective interventions are targeted at those with increased risk factors of depression (selective approach) or for those with subsyndromal depressive symptoms (indicated approach). Selective interventions can be targeted at individuals at risk of depression due to environmental factors, for example, bullying (Midgett et al., 2021) or parental mental disorder (Beardslee et al., 2003, 2012).

Indicated interventions are targeted at individuals with subsyndromal depressive symptoms but not high enough to meet the diagnostic criteria of a depressive disorder. According to Wener-Seidler et al. (2021) systematic review targeted (selective or indicated) programs may be more effective compared to universal programs. Although, selective and indicated prevention strategies often require more intensive interventions, which may result in higher costs for participants. However, this is justified by their elevated risk levels and the potentially greater benefits they can gain from participation. (O’Connell et al., 2009) Effective selective and indicated interventions for individuals often include psychological interventions (see, e.g. Cuijpers et al., 2008; Merry et al., 2021). Most preventive intervention programs are conducted in school environments and schools are suitable for preventive interventions (Werner-Seidler et al., 2017, Wener-Seidler et al., 2021). Also, online interventions are becoming more popular (Karyotaki et al., 2018). More information is needed on which interventions are effective in promoting the mental health of children and adolescents.

Evidence-based interventions should always have a theoretical framework they base their effects on (French et al., 2012). In preventive research the most used are cognitive and interpersonal interventions (Hetrick et al., 2016). Cognitive-behavioral therapy aimed at young people aims to help them learn mental health skills (Oud et al., 2019) and the focus of interpersonal programs is on communication and social skills (Jones et al., 2021). There are evidence-based psychoeducational interventions that are shown to be effective (see e.g. Beardslee et al., 2003, 2012). However, there is a lack of evidence to support any one type of intervention to be effective in preventing depression in universal or targeted (selected or indicated approaches) interventions (Caldwell et al., 2019).

Intervention programs targeting high-risk individuals are reported to be more effective than universal ones in several intervention studies (Stice et al., 2009). Indicated interventions are widely studied (Ssegona et al., 2019) and the RCTs are well represented in reviews. However, there are a lack of reviews focusing on different areas of selective approaches. In the current study, we found one review focusing on intervention trials aimed at preventing depression by improving young people’s social relationships (Filia et al., 2021), while the review did not

provide quantitative data on the effectiveness. That is why we narrowed selective interventions to the ones that aimed to prevent risks of depression in children and adolescents due to the social and environmental risk factors.

Our study aimed to assess the effectiveness of interventions in preventing depressive symptoms in children and adolescents. We included indicated interventions based on depressive symptoms and selective interventions, targeted at children and adolescents at risk of depression due to the challenges in their social environment.

## 2. Methods

The systematic review was conducted according to the Higgins et al. (2024) and reported by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Page et al., 2021).

### 2.1. Data sources and search strategy

We conducted a systematic literature search without a time restriction using three databases, including Scopus, PubMed, and APA PsycArticles to identify English-written publications concerning preventive interventions targeted at children and adolescents at risk of depression due to subsyndromal depressive symptoms or problems in their social environment. Searches were conducted with the predefined search strategy described in Supplementary Table 1. We also carried out a manual search from all the references from previous reviews in the field and extracted relevant articles from the citations of the included manuscripts (Higgins et al., 2022).

### 2.2. Eligibility criteria

We conducted a systematic literature search using eligibility criteria based on the PICOS framework. The eligibility criteria are presented in Table 1. We included papers if they were peer-reviewed original publications based on individual-level data and provided sufficient results of the study. We included trials regardless of the setting within which the intervention took place.

We excluded trials if they included children and adolescents who met the diagnostic criteria for depressive disorders, or if they were designed to be treatment trials, targeted at any other risk factors than those relating to the social environment of children and adolescents, or targeted to prevent depressive relapse, or any other depressive disorder other than a major depression or dysthymia, or if they used universal interventions or included participants who were recruited primarily concerning other psychological issues or physical illnesses where depression was a potential comorbid issue and was therefore measured

**Table 1**  
Eligibility criteria (PICO) for systematic search of the literature.

Eligibility criteria	
Population	Children and adolescents with a mean age ranging between 7-and 17 years with increased risk of depression due to elevated depressive symptoms or challenges in a social environment. The social environment includes all the social relationships that a child or an adolescent has (parents, peers, friends, family, teacher, etc.). Parental psychiatric disorders are included.
Intervention	Interventions targeted at children and/or adolescents at risk of developing a depressive disorder, i.e., selective interventions targeted to risk factors relating to social environment. Indicated interventions targeted to participants with depressive symptoms are not high enough to meet the criteria for a clinical diagnosis of depressive disorder.
Comparator	Active controls (i.e., other preventive intervention designed to control) or passive controls (e.g., waitlist or treatment as usual or no treatment)
Outcome	Depressive symptoms
Study design	Randomized controlled trial (RCT)

as a secondary outcome measure.

### 2.3. Study selection

To identify eligible studies, two independent investigators (JL and AW) screened the titles and abstracts of all the publications using [Covidence systematic review software \(2021\)](#). Next, potential publications were reviewed in full text by two independent investigators (JL/HR and AW). Any disagreements were resolved by discussion or if necessary, together with other co-authors (JM and HR).

### 2.4. Data extraction and quality assessment

We extracted data from each eligible trial identifying sample sizes, participant details, intervention components, outcome details, and study designs (see Supplementary Table 2). The methodological quality of all eligible trials was assessed using the Cochrane Collaboration's tool for assessing the risk of bias (RoB-2) ([Higgins et al., 2022](#)) by two reviewers (JL/HR and AW). First, both reviewers assessed the same 10 trials to harmonize the assessment. The rest of the trials were assessed by one of the two authors. JL double-checked the quality assessments made by AW and disagreements were resolved by discussion and if necessary, together with the co-authors (JM and HR). The assessment included 'bias arising from the randomization process', 'bias due to deviations from intended interventions', 'bias due to missing outcome data', 'bias in measurement of the outcome', and 'bias in selection of the reported results'. The risk of bias was scored as 'low risk', 'some concerns', or 'high risk' according to the RoB-2 guidance ([Higgins et al., 2022](#)). Studies were not excluded based on their methodological quality.

### 2.5. Data analysis

We conducted a random-effect meta-analysis to assess the pooled effectiveness of interventions in preventing depression in children and adolescents at three-time points: postintervention, 6-month follow-up, and 12-month follow-up. We pooled the means and standard deviations using the standardized mean difference (SMD) using Cohen's *d*. SMD effect sizes of 0.2, 0.5, and 0.8 are considered a "small", "medium" and "large" effect ([Chen et al., 2010](#)). We present the pooled effectiveness of the interventions with 95 % confidence intervals and forest plots.

We used  $I^2$  to measure heterogeneity across the eligible studies. A large number of  $I^2$  statistics provide evidence of heterogeneity, with 50 %–90 % representing substantial heterogeneity and 75 % to 100 %: considerable heterogeneity. Whereas 0 % to 40 % heterogeneity might not be important ([Deeks et al., 2023](#)). We conducted a subgroup analysis to investigate whether the setting, description, broader category of the intervention, intervention deliverers, income status of the country, assessment points, depression measurement tool, or type of control group modified the pooled effect size. As we anticipated considerable heterogeneity in the included study results, we performed meta-regression analyses with *t*-statistics to investigate the factors associated with variations in intervention effects. Factors included the setting (school, online or other), description (indicated or selective), theoretical framework of the intervention (Cognitive behavioral therapy, CBT or Interpersonal psychotherapy, IPT based or other), intervention deliverers (mental-health experts, non-mental health experts or others), depression measurement tool (the Children's Depression Inventory CDI, Center for Epidemiological Studies-Depression CES-D or other scales), income status of the country that the study was conducted in (high or low/middle), assessment points (post-intervention, 6-months or 12-months follow-up), and type of control group (treatment as usual, active/attention control, no treatment, waitlist or unclear). All the factors were categorized if there were less than three studies consisting of the results and the categorization was reasonable. These factors were included to meta-regression one by one to check if these factors affect the variation in the SMD, and these factors were also available from the

original studies.

All analyses were performed using STATA software version 16 ([StataCorp., 2019](#)) and  $p < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Search findings

The main search found 11,805 publications and 7611 titles and abstracts were screened, after the duplicates were removed. In total, 4196 titles and abstracts were reviewed. A total of 247 articles were assessed for full-text eligibility. In the full-text phase 170 studies were excluded (see [Fig. 1](#)). The main reasons for exclusion were that interventions were universal or were primarily not targeted at depression prevention. The final number of included studies came to 77, of which 13 were follow-ups. 57 interventions (some studies included two or more interventions in their RCT) were included in the meta-analysis and evaluated the intervention effectiveness.

### 3.2. Population

The sample size of the interventions ranged from 20 ([Karami et al., 2012](#)) to 1258 (Kindt 2014). The population of this systematic review consists of a total of 11,808 participants and 63.6 % of the participants were girls. The mean age ranged between 9.38 ([Vliek et al. 2019](#)) and 16.63 ([Ip et al., 2016](#)).

### 3.3. Study design

All included studies were randomized controlled trials (RCTs). The studies were mainly, single-randomized ( $n = 46$ ), and 20 studies used cluster randomization.

### 3.4. Study setting

The studies were predominantly conducted in the USA or Canada ( $n = 30$ ). The next largest number of studies were conducted in Europe ( $n = 11$ ), Asia ( $n = 10$ ) and Africa ( $n = 6$ ). The rest of the studies were conducted in Australia and Oceania ( $n = 5$ ) and South America ( $n = 1$ ). Most of the studies were conducted in high-income countries ( $n = 50$ ). Fourteen studies were conducted in two low-income countries.

Interventions were delivered mainly in school settings ( $n = 41$ ). There were eight online interventions and others were delivered by health maintenance organizations ( $n = 2$ ), in clinical environments ( $n = 4$ ), community settings ( $n = 2$ ), residential care institutions ( $n = 2$ ), homeless shelters ( $n = 1$ ), drop-in centers ( $n = 2$ ) and at home ( $n = 2$ ). Two of the included trials had several settings for the interventions.

### 3.5. Intervention

Forty-one of the interventions were indicated, while 19 were selective. Four trials used both indicated and selective approaches. Inclusion criteria for selective interventions included: parental depression ( $n = 4$ ), being a child of a Mexican immigrant woman ( $n = 1$ ), parental divorce ( $n = 2$ ), bully victimization, bully perpetration, and or loneliness ( $n = 1$ ), being an adolescent from low-income areas ( $n = 1$ ), being an African American adolescent/child living in low-income neighborhoods ( $n = 1$ ), being in residential care ( $n = 3$ ), parental bereavement ( $n = 3$ ), experiencing physical violence from peers ( $n = 1$ ), being a child experiencing problems in social interactions ( $n = 1$ ) and being a child in a support program for orphans and other vulnerable children ( $n = 1$ ). The rest of the interventions were targeted at the population with elevated depressive symptoms ( $n = 45$ ).

#### 3.5.1. Theoretical framework of the interventions

Most of the interventions were psychological, with the majority

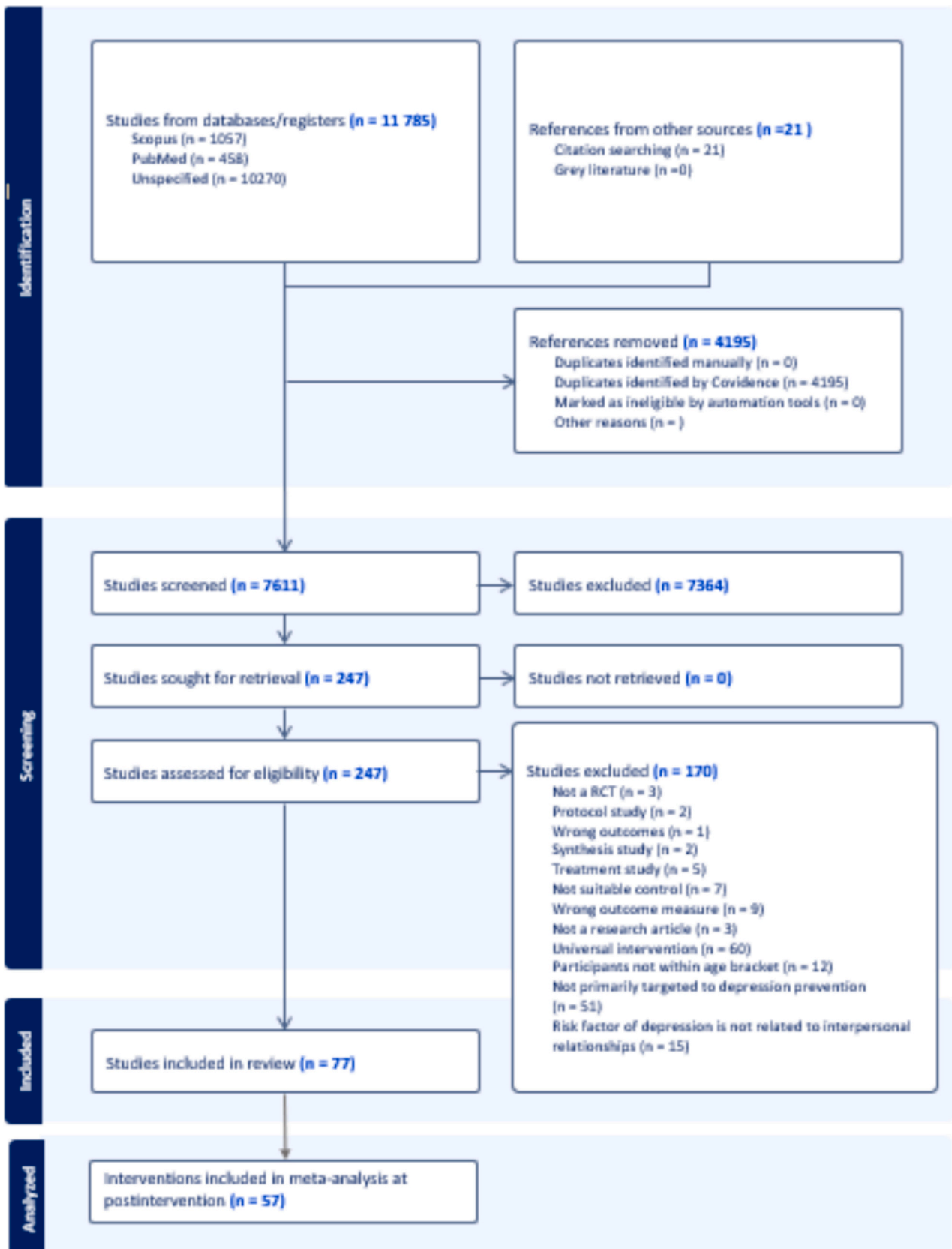


Fig. 1. Flowchart of the study selection.

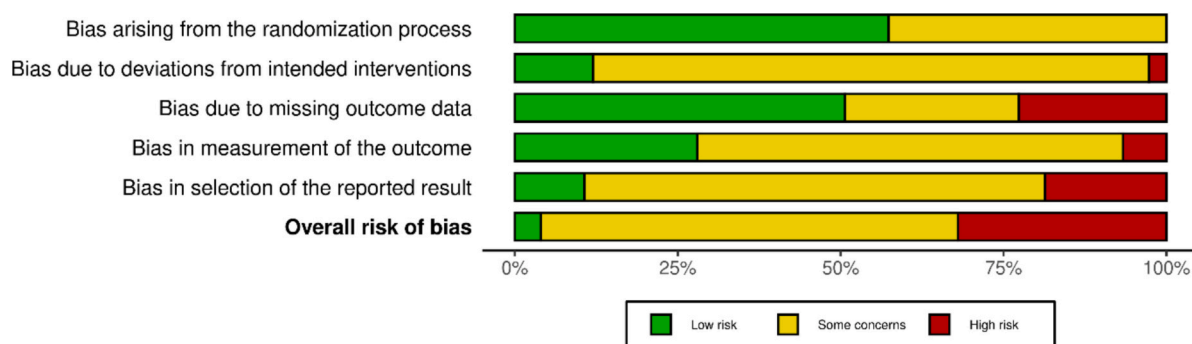


Fig. 2. The summary plots of the risk of bias assessment.

being CBT-based programs ( $n = 43$ ). IPT was used in four interventions, and six interventions combined CBT and IPT. CBT was also combined with a psychoeducational program in one intervention. Psychoeducation was used in five interventions. The rest of the interventions used positive psychology ( $n = 1$ ), ACT (acceptance and commitment therapy) ( $n = 1$ ), SCT (social cognitive theory) ( $n = 1$ ), stress diathesis model of depression ( $n = 1$ ), writing therapy ( $n = 1$ ), and a mentorship program ( $n = 1$ ) as a theoretical framework in their interventions.

### 3.5.2. Control groups

The majority of the studies had TAU (treatment as usual) ( $n = 22$ ) as a control group. Active and attention control was used in several studies ( $n = 15$ ). Twelve of the studies used ‘no treatment’ and 12 were ‘waitlist control’ groups. With Karami et al. (2012), King et al. (2018), Lei et al. (2021), and Moeini et al. (2019) it was unclear what the control group was like.

### 3.5.3. Intervention sessions, doses, and deliverers

Intervention sessions ranged from five to 21, and some did not include specific sessions, such as Rohde et al.’s (2014) bibliotherapy. The total number of session hours for the interventions ranged from 1.5 to 63 h, an average being ~13 h.

The interventions were mainly delivered by mental health experts ( $n = 42$ ), non-mental health experts ( $n = 10$ ), and others, such as students, school personnel, or mentors ( $n = 5$ ). Some of the interventions used self-monitoring ( $n = 4$ ), so there were no intervention deliverers. The intervention delivery was unclear in three studies (McCarty et al., 2013, Karami et al., 2012, Unterhitzberger and Rosner, 2014).

## 3.6. Outcomes

### 3.6.1. Depression self-report measurements

Depressive symptoms were measured using several different versions of self-report measurement tools including CDI ( $n = 24$ ), CES-D ( $n = 16$ ), BDI ( $n = 3$ ), SMFQ ( $n = 5$ ), MFQ ( $n = 4$ ), RADS ( $n = 5$ ), RCADS ( $n = 3$ ), HADS ( $n = 1$ ), K-SADS ( $n = 1$ ). Some used both CDI and RADS (Jaycox et al., 1994) or BDI-II, AADS, and KADS-11 (Jacob and Guzman, 2016), CES-D and CDI (Dobson et al., 2010) but in this case we included the values from CDI in the meta-analysis.

### 3.6.2. Assessment points

The intervention effects were assessed by post-intervention measurement only ( $n = 13$ ), at post-intervention and 1–3 months follow-up ( $n = 5$ ), at 4–12-months follow-up ( $n = 28$ ) and over 12-months follow-up ( $n = 9$ ). Four of the trials did not have a postintervention measurement but used follow-ups only for outcome measurement. They used 1–3 month ( $n = 2$ ), over 12-month ( $n = 1$ ) and 12-month ( $n = 1$ ) follow-ups.

## 3.7. Quality assessment

The quality of the trials was assessed using the Cochrane Collaboration’s tool for assessing the risk of bias (RoB-2) (Higgins et al., 2022) in five different areas. Over half of the trials had low risk concerning the randomization process while the rest of the studies had some concerns. When assessing bias due to deviations from the intended intervention, most of the RCTs had some concerns. The main reason was that a large proportion of the trials did not report whether the participants were blinded or not. Considering the nature of the interventions, the participants and intervention deliverers were probably not blinded. Missing data and how it was handled, varied across trials. Half of the trials reported a low rate of missing data and/or the results were analyzed using appropriate analysis methods. 25 % of the RCT’s risk of bias resulted in ‘high risk’ in this section. Most of the trials had deficiencies in reporting the results or no protocol study/study plan available to confirm no deviations that affected the outcome. The summary plot of the risk of bias assessment is shown in Fig. 2 and Fig. 3 shows the risk of bias assessment by studies. The quality and judgment comments of the studies are described in the supplementary Table 3.

## 3.8. Intervention effectiveness

A total of 57 interventions evaluated the effectiveness of the targeted depression prevention program post-intervention and had outcome data suitable for meta-analyses (See Table 2, the intervention effects at post intervention measurement). According to our results, 30 % of the targeted interventions ( $n = 17$ ) reduced the symptoms of depression postintervention, and two interventions favored control. The difference between intervention and control conditions was statistically significant (SMD 0.27, 95 % CI 0.16–0.37,  $I^2 = 82.7$  %). At the 6-month follow-up, 29.7 % of the interventions ( $n = 11$ ) had a statistically significant effect in preventing depressive symptoms. At the 6-month follow-up, the interventions had a small effect (SMD 0.31, 95 % CI 0.18–0.44,  $I^2 = 83.9$  %) on depressive symptoms compared to any comparator. The intervention effects were not statistically significant at the 12-month follow-up (SMD 0.10, 95 % CI -0.02–0.22,  $I^2 = 68.6$  %). At the 12-month follow-up 3 of 20 (15 %) interventions had statistically significant effects on preventing depressive symptoms. All these three interventions were indicated and CBT-based. All of them had TAU as a control condition, but the depressive symptoms had been assessed by different measurement tools in all three intervention studies. The results of the meta-analysis at post-intervention, 6-month follow-up, and 12-month follow-up are presented in Figs. 4, 5 and 6.

## 3.9. Subgroup analyses and meta-regression results

According to our meta-regression analyses, if the intervention delivered involved mental-health experts (38 interventions) the intervention effects were greater ( $d = 0.40$ , 95 % CI 0.24–0.55) and the

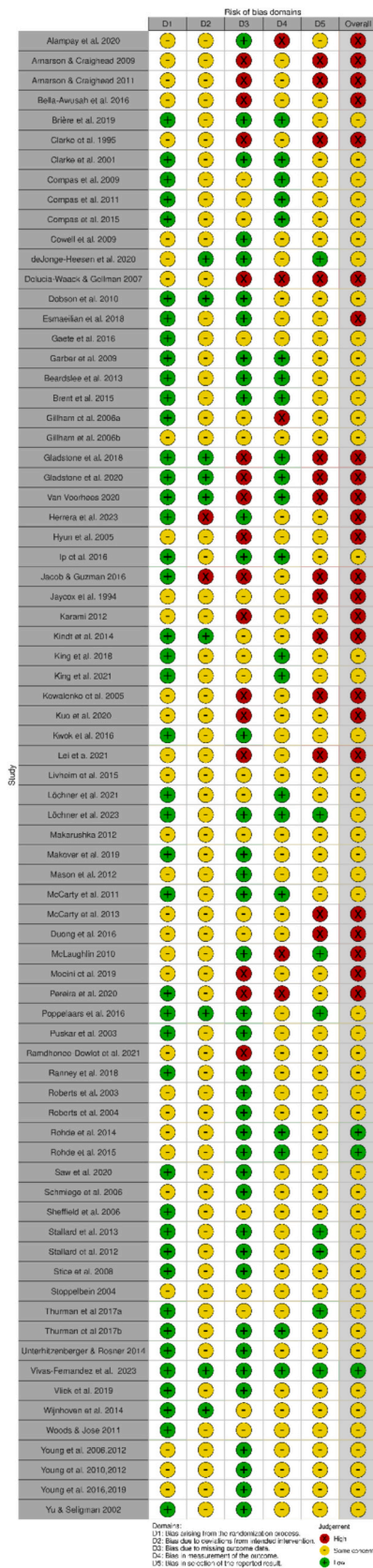


Fig. 3. The Risk of Bias assessment of included studies.

difference was significant ( $t = -2.07, p = 0.043$ ). The income status of the country that the study was conducted in was associated with the effects of the intervention ( $t = 2.11, p = 0.04$ ) at the post-intervention measurement (45 studies). The interventions that were conducted in low- or middle-income countries had significantly greater intervention effects (12 studies). Other factors were not associated with the effects. In the subgroup analyses, there was some variation in the results. In those interventions using a waitlist control condition there was an increase in the intervention effects ( $d = 0.81, 95\% \text{ CI } 0.23\text{--}1.39$ ) compared to other conditions, but the difference was not statistically significant ( $t = 1.30, p = 0.21$ ). In other intervention settings, the intervention effects were greater than school or online settings ( $d = 0.32, 95\% \text{ CI } 0.01\text{--}0.62$ ), but the difference was not statistically significant ( $t = -0.19, p = 0.854$ ). As a theoretical framework for intervention, IPT seemed to have a greater impact on depression prevention compared to other frameworks ( $d = 0.57, 95\% \text{ CI } 0.02\text{--}1.13$ ), but the difference was not statistically significant ( $t = (0.23), p = 0.829$ ). Those interventions using CDI or CES-D had a smaller impact compared to the other measurement tools used ( $d = 0.39, 95\% \text{ CI } 0.14\text{--}0.63$ ). Although, the difference was not statistically significant ( $t = 1.07, p = 0.29$ ).

According to the meta-regression results, the income status of the country seemed to affect the results ( $t = 2.87, p = 0.007$ ) at the 6-month follow-up (32 studies). There was a significant increase in the intervention effects in those studies conducted in low- or middle-income countries (6 studies). There were some variations in the result of other factors, but there were no statistically significant differences between them. These results are shown in Table 3. At the 12-month follow-up (20 studies) there were no mentionable variations in the results nor statistically significant differences in the results (see Table 4 for more specific results). The assessment points had no statistically significant associations with the intervention effects at any of the assessment points. Several primary studies conducted subgroup analyses, including comparisons between boys and girls, to explore potential differences in outcomes. (e.g. Schmiege et al., 2006; Compas et al., 2015).

#### 4. Discussion

##### 4.1. Main results

The aim of this study was to assess the effectiveness of targeted interventions designed to prevent depression in children and adolescents. The results showed that compared to any control condition, there was a small effect due to prevention programs on the symptoms of depression. The effect was maintained in the 6-month follow-up, but not anymore at the 12-month follow-up. At the post-intervention measurement, if the intervention was delivered by a mental health expert it positively affected the intervention effectiveness. At post-intervention and the 6-month follow-up the income status of the country in which the study was conducted affected the results.

Two intervention studies differ visually from the other interventions at the post-intervention (Ramdhoney-Dowlot et al., 2021) and 6-month (Ramdhoney-Dowlot et al., 2021, Saw et al., 2020) assessment points. According to the authors of the study by Saw et al. (2020), a test of normality was conducted, but the number of participants with severe clinical depression was high. It remains unclear if the comparison of the means was suitable for the data. In the case of Ramdhoney-Dowlot et al. (2021), the intervention effect results had comparatively small standard deviations. It remains unclear whether a test of normality was conducted and if the comparison of the means was a suitable analysis for the data.

Our results of the overall effectiveness of the interventions are consistent with the previous literature. According to previous reviews, there might be a small effect favoring preventive programs, but positive results are not necessarily maintained in the long term (Ssegonja et al., 2019; Hetrick et al., 2016).

**Table 2**  
Intervention effects at post-intervention measurement.

	Number of interventions		SMD		Heterogeneity, I <sup>2</sup>	Statistical test
	N		d	95 % CI	%	t, (p-value)
All interventions						
Post-intervention	57		0.27	0.16–0.37	82.7	
Control condition						1.30, (0.201)
Treatment as usual	18		0.26	0.09–0.43	74.3	
Active/attention control	16		0.08	–0.03–0.19	46.9	
No treatment	12		0.19	–0.03–0.40	76.3	
Waitlist	10		0.81	0.23–1.39	94.8	
Setting						–0.19, (0.854)
School	36		0.30	0.18–0.42	73.4	
Online	8		0.08	–0.09–0.25	50.4	
Other	13		0.32	0.01–0.62	92.9	
Intervention description						–0.49, (0.629)
Indicated	38		0.29	0.18–0.39	68.4	
Selective	19		0.21	–0.01–0.43	90.3	
Theoretical framework						0.23, (0.820)
CBT	40		0.29	0.16–0.42	83.7	
IPT	4		0.57	0.02–1.13	89.3	
CBT + IPT	3		0.03	–0.49–0.54	80.8	
Other	10		0.15	–0.13–0.42	73.8	
Intervention deliverers						–2.07, (0.043)
Mental health experts	38		0.40	0.24–0.55	84.2	
Non-mental health experts	10		0.07	–0.08–0.21	61.7	
Other	6		0.16	–0.13–0.48	84.5	
Depressive symptoms measurement tool						1.07, (0.29)
CDI	20		0.14	0.02–0.26	60.1	
CES-D	13		0.27	0.90–0.45	75.8	
Other	23		0.39	0.14–0.63	89.7	
Income status of the country						2.11, (0.040)
High	45		0.17	0.09–0.25	61.9	
Low	12		0.71	0.20–1.19	94.5	
Assessment points						
6-month follow-up conducted	36		0.33	0.20–0.47	84.9	1.00, (0.323)
12-month follow-up conducted	18		0.12	0.01–0.23	61.3	–0.80, (0.426)

d = Cohen’s d, SMD=Standardized mean difference, CI=Confidence interval, CBT = Cognitive behavioral therapy, IPT = Interpersonal psychotherapy, CDI = The Children’s Depression Inventory, CES-D=Center for Epidemiological Studies-Depression.

#### 4.2. Study setting

Most studies had been conducted in high-income and Western countries, but it was pleasing to be able to also include several trials undertaken in low- to middle-income countries. It is possible that the socioeconomic status of children and adolescents increases the risk of depressive symptoms (Peeverill et al., 2021, Gilman et al., 2002). Living environments in low- to middle-income countries can consist of chronic poverty, poor nutrition and sanitation, violence, and inadequate learning opportunities (Black et al., 2017). Preventive interventions are needed in these circumstances, but the results of the high-income country interventions are not necessarily implementable in low- or middle-income countries. This review manages to shed light on that gap in the knowledge.

According to our results, the income status of the country was associated with greater effectiveness of the preventive intervention. The population of these studies consisted of children and adolescents who may have multiple challenges in their living environment. It could be that for children who live for example in a shelter or orphanage, any kind of intervention, which provides positive attention to them, can have positive effects on their future mental health. In high-income countries children and adolescents usually have more support from the environment they live in. Intervention effects can also be greater, if the depression symptoms are greater at baseline. However, at baseline, none of the participants had depression diagnoses. We included interventions in this review that were targeted at children or adolescents who were at risk of depression due to the social environment or had some symptoms of depression.

Most of the interventions in our data were implemented in a school setting. The school setting is widely studied as a natural environment

which is able to reach children and adolescents. However, the school environment was not significantly associated with the effectiveness of the intervention in our data. Previous literature has produced mixed results concerning this. The results of a recent meta-analysis (Caldwell et al., 2019) also suggest that there is no significant association with school-based preventive interventions and a reduction in depression of children and adolescents. This is contrary to a more recent review (Filia et al., 2021) in which the results suggest that school-based programs could be effective in preventing depression of young people. Another recent review (Werner-Seidler et al., 2021) assessed school-based programs only and found a small effect favoring the intervention condition. It might be that school is a good environment to implement preventive interventions, but it does not provide a superior environment compared to other environments. However, in schools, children and adolescents are easy to reach and the implementation is cost-effective (Lee et al., 2017).

According to our meta-analyses, other settings increased the effectiveness of the preventive interventions compared to school or online settings, although the difference was not statistically significant. The heterogeneity of results in this group was rather high, which can affect the interpretation of the results. This result is inconsistent with previous reviews (Filia et al., 2021, Li et al., 2021), which recommend that online interventions could be the most effective ones preventing depression in young people. It should be noted that Filia et al. (2021) did not provide quantitative data of the effectiveness and Li et al. (2021) also included a universal prevention program in their study, unlike our review. According to our analyses the setting of the intervention did not modify the overall results.

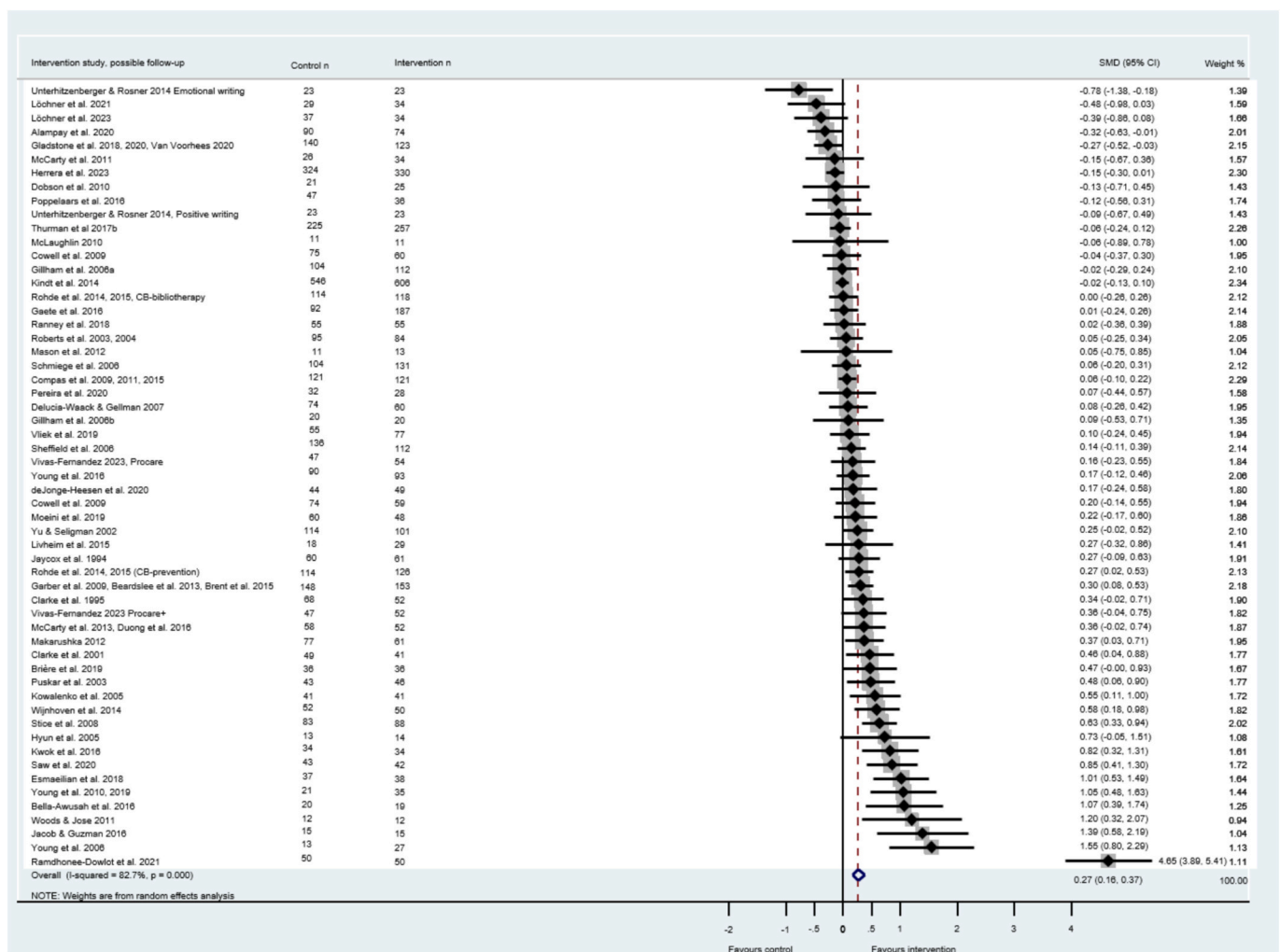


Fig. 4. The effectiveness of interventions (n = 57) at post measurements on children and adolescents' depressive symptoms.

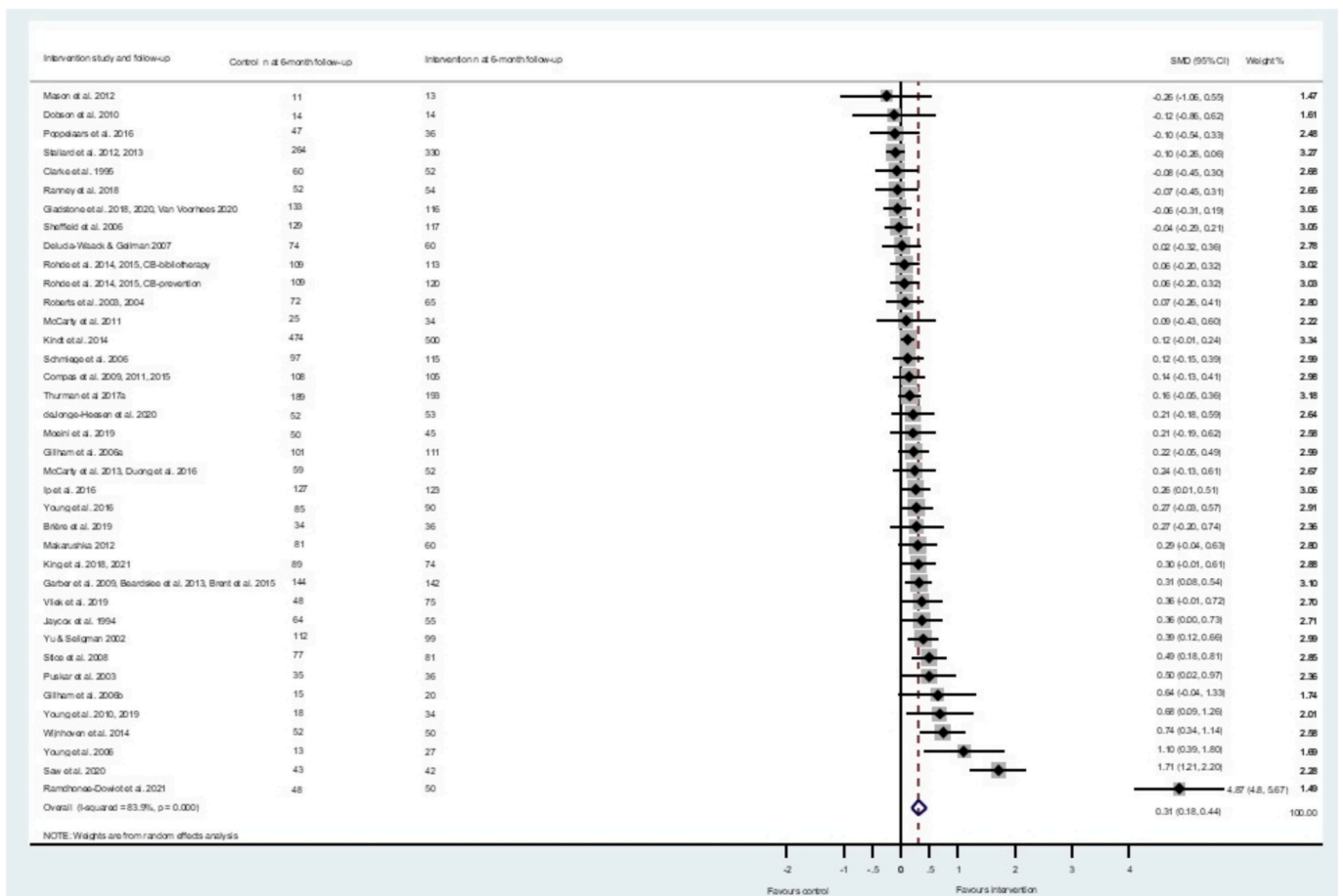


Fig. 5. The effectiveness of interventions (n = 38) at 6-month follow-up on children and adolescents' depressive symptoms.

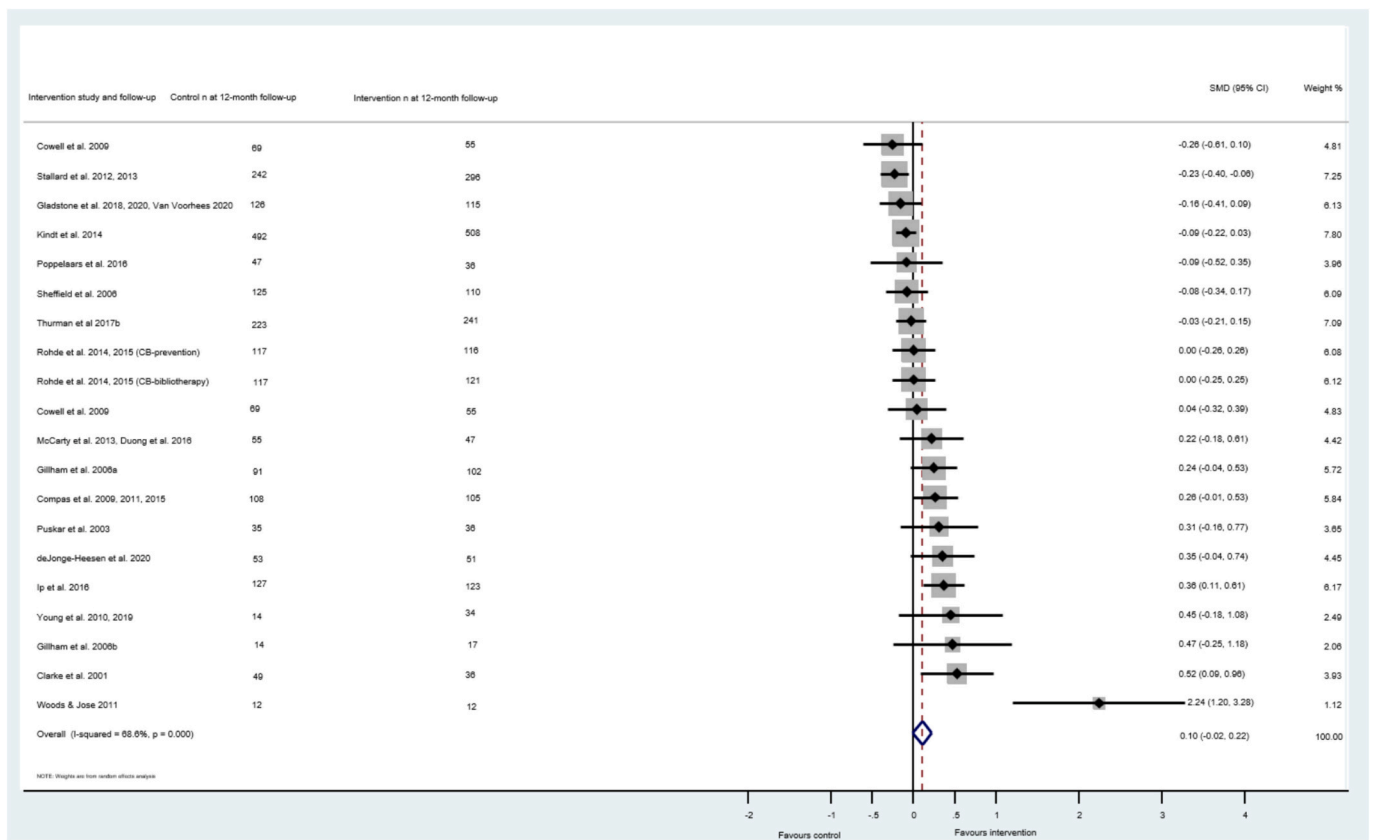


Fig. 6. The effectiveness of interventions (n = 20) at 12-month follow-up on children and adolescents' depressive symptoms.

**Table 3**  
Intervention effects at 6-month follow-up.

	Number of studies		SMD		Heterogeneity, I <sup>2</sup>	Statistical test
	n	d	95 % CI	%	t, (p-value)	
All interventions	38	0.31	0.18–0.44	84.4		
6-month follow-up						
Control condition					2.09, (0.044)	
Treatment as usual	11	0.25	0.12–0.39	42.6		
Active/attention control	11	0.11	0.01–0.20	0.0		
No treatment	4	0.29	0.03–0.54	66.1		
Waitlist	6	1.23	0.28–2.17	96.8		
Setting					0.97, (0.336)	
School	24	0.27	0.15–0.40	72.8		
Online	7	0.11	–0.02–0.23	5.7		
Other	7	0.77	0.17–1.37	95.4		
Description					0.96, (0.344)	
Indicated	30	0.26	0.15–0.37	68.7		
Selective	8	0.56	0.13–0.99	94.9		
Theoretical framework					–0.14, (0.888)	
CBT	28	0.36	0.20–0.52	86.5		
IPT	3	0.60	0.12–1.08	61.6		
CBT + IPT	3	–0.08	–0.21–0.10	0.0		
Other	4	0.16	–0.04–0.35	0.0		
Intervention deliverers					1.00, (0.537)	
Mental health experts	24	0.36	0.17–0.55	86.2		
Non-mental health experts	6	0.37	0.04–0.71	88.1		
Other	7	0.24	–0.11–0.58	82.7		
Depressive symptoms measurement tool					1.00, (0.324)	
CDI	13	0.21	0.10–0.32	38.7		
CES-D	12	0.21	0.10–0.33	36.3		
Other	9	0.80	0.13–1.47	95.1		
Income status of the country					2.87, (0.007)	
High	32	0.18	0.10–0.25	44.4		
Low	6	1.17	0.44–1.91	96.8		
Assessment points						
Post-intervention conducted	32	0.31	0.16–0.45	82.8	–0.09 (0.932)	
12-month follow-up conducted	15	0.11	0.02–0.20	35.3	–0.17, (0.251)	

d = Cohen’s d, SMD=Standardized mean difference, CI=Confidence interval, CBT = Cognitive behavioral therapy, IPT = Interpersonal psychotherapy, CDI = The Children’s Depression Inventory, CES-D=Center for Epidemiological Studies-Depression.

### 4.3. Control condition

According to our meta-analyses, in trials with a waitlist control condition, interventions were more effective than with other control conditions, although the difference was not statistically significant. The waitlist condition is often compared to the ‘no treatment’ condition, but there is a significant difference between them. Participants in the waitlist group know they are going to receive an intervention, and this might prevent natural recovery from happening. Previous literature also suggests that studies with waitlist control conditions may overestimate treatment effects (Cunningham et al., 2013). However, in our data the result was not statistically significant.

### 4.4. Intervention

The previous literature has produced mixed results concerning whether interventions should be delivered universally or targeted at high-risk groups. In our study the focus was solely on indicated and selective interventions. Universal interventions, while important, were not the primary focus in this context, as we wanted to explore the impact of more targeted approaches. However, we acknowledge the value of universal interventions and their potential benefits in a broader context, and further research could help compare the effectiveness of both types of interventions. There are several systematic reviews studying the effects of indicated interventions preventing depression (Ssegonja et al., 2019), but to our knowledge, this was the first review assessing the effectiveness of selective interventions targeted at children and adolescents who were at risk of depression due to social environmental factors. According to our analyses selective interventions were more effective than indicated ones, although no statistically significant differences

were found. Stockings et al. (2016) concluded that “universal, selective and indicated prevention interventions are efficacious in reducing internalizing disorders and symptoms in the short term.”

Our results suggest that preventive interventions should be delivered by mental health experts. It should be noted that the intervention effects were statistically significant even at the 12-month measurement point, but when compared to those who received the intervention delivered by other than mental health experts the difference was not significant. Ahlen et al., 2015 concluded that intervention deliverers were not significant moderators of intervention effects. However, they studied universal interventions, and it could be possible that it would be more important for high-risk participants to have a mental health expert to deliver the intervention, as concluded in the review by Stice et al. (2009).

As psychological interventions, CBT and IPT have the most rigorous evidence in treating depression with children and adolescents (Duffy et al., 2019; Oud et al., 2019). They are also the most studied psychological interventions in prevention research. In our data, IPT was more effective compared to CBT at all assessment points, but the theoretical framework did not produce statistically significant differences in the effectiveness of reducing depressive symptoms. The same result was found in a previous Cochrane review in this area (Hetrick et al., 2016). Psychoeducational interventions were not included in our study, but very few of those studies fulfilled the criteria for our systematic review. Psychoeducational interventions were included in the same category with the other psychological interventions.

### 4.5. Depression measurement tool

According to our results, the depression measurement tool did not

**Table 4**  
Intervention effects at 12-month follow-up.

	Number of studies		SMD		Heterogeneity, I <sup>2</sup>	Statistical test
	N	d	95 % CI	%	t, (p-value)	
All interventions						
12-month follow-up	20	0.130	−0.02–0.22	68.6		
Control condition						−1.12, (0.277)
Treatment as usual	9	0.21	−0.02–0.43	80.2		
Active/attention control	5	0.15	−0.08–0.38	64.6		
No treatment	2	−0.10	−0.28–0.08	0.0		
Waitlist	–	–	–	–		
Setting						0.75, (0.463)
School	13	0.07	−0.08–0.23	68.2		
Online	3	0.05	−0.32–0.42	77.6		
Other	4	0.20	−0.01–0.42	60.4		
Description						−1.03, (0.318)
Indicated	15	0.17	0.01–0.36	72.6		
Selective	4	−0.02	−0.15–0.12	41.8		
Both						
Theoretical framework						−1.75, (0.098)
CBT	13	0.16	0.02–0.30	67.7		
IPT	2	0.11	−0.31–0.53	51.4		
CBT + IPT	2	−0.21	−0.35–(−0.07)	0.0		
Other	–	–	–	–		
Intervention deliverers						−1.65, (0.116)
Mental health experts	13	0.23	0.06–0.39	59.3		
Non-mental health experts	4	−0.08	−0.17–0.02	0.0		
Other	3	−0.02	−0.37–0.34	87.0		
Depressive symptoms measurement tool						−0.58, (0.569)
CDI	8	0.15	−0.09–0.40	76.6		
CES-D	6	0.18	−0.03–0.40	69.3		
Other	6	−0.02	−0.18–0.14	41.2		
Income status of the country						0.27, (0.791)
High	18	0.09	−0.04–0.22	67.5		
Low	2	0.16	−0.22–0.54	83.9		
Assessment points						
Post-intervention conducted	17	0.11	−0.02–0.24	45.0		0.46, (0.651)
6-month follow-up conducted	15	0.07	−0.04–0.19	61.0		−0.39, (0.705)

d = Cohen’s d, SMD=Standardized mean difference, CI=Confidence interval, CBT = Cognitive behavioral therapy, IPT = Interpersonal psychotherapy, CDI = The Children’s Depression Inventory, CES-D=Center for Epidemiological Studies-Depression.

affect the overall results statistically significantly. However, ‘other’ category consisted of studies that used measurement tools that had greater intervention effects compared to others at the postintervention and 6-month follow-up. It should be noted that the other category included various measurement tools, and those may differ from each other in psychometric properties, thus the results are uncertain. We carried out an analysis separately with specific categories for the different versions of the measurement tools and there were two measurement tools (RCADS and HADS) that differed from the others significantly (results available from the authors), but these categories were too small to produce reliable results on their own. Measurement tools that were used in these studies are both DSM-IV-based and are shown to be reliable for measuring the depressive symptoms of at-risk adolescents (Chorpita et al., 2000; White et al., 1999).

#### 4.6. Strengths and limitations

The main strength of this study is its extensive data. Although the grey literature was not included to this review. In the review, we did not exclude studies based on language; however, all studies included in the review were in English. The publication bias may be present, but we believe that this very comprehensive review covers up to date and essential research of this topic.

This review sheds light on the effectiveness of both indicated and selective interventions preventing depression in children and adolescents. To our knowledge, this was the first review of selective interventions targeted at the social environment of children and adolescents. The distinction between selective and indicated interventions is not always clear, and it is true that risk factors and sub-

syndromal symptoms can overlap. This complexity is something that requires further consideration in future research to better understand the nuanced relationship between these factors and the effectiveness of targeted interventions. It also included several studies conducted in low-to middle-income countries, which are usually missing from reviews.

There are various limitations in the included studies. First, studies that did not clearly specify a primary outcome measure or conducted subgroup analyses without pre-specification may be at risk of multiple testing, which could lead to chance findings, particularly when considering three data points. Secondly, the overall quality of the trials was rather poor. Assessed using the Cochrane Collaboration’s tool for assessing the risk of bias (RoB-2) (Higgins et al., 2022), only one of the studies was able to achieve the ‘low risk of bias’ in the overall assessment (Vivas-Fernandez et al., 2023). Even though a quality assessment of the trials was made by two authors, each study was not assessed by both. This might reduce the reliability of the quality assessment results and that is why the quality of the trials was not used when assessing the effectiveness of the interventions. On the other hand, the quality assessment results of the trials in this area are in line with the assessment made in other reviews (see e.g. Hetrick et al., 2016). This review is not registered, nor has the protocol been published. However, we conducted and reported this review carefully and transparently. The results also should be interpreted with caution given evidence of heterogeneity. This also is a common problem in the field (see e.g. Conejo-Cerón et al., 2020, Rohde et al., 2017). This review may have missed literature that is not published in English or that exists in grey literature sources.

## 5. Conclusion

Indicated and selective interventions targeted at children and adolescents at risk of depression due to their social environment have a small effect on depressive symptoms. It seems that the most disadvantaged children and adolescents would benefit from the interventions the most. Interventions should be delivered by mental health experts. The intervention effects remain at six-month follow-up, but not anymore at 12-month follow-up.

## CRediT authorship contribution statement

**Johanna Luttinen:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anni Watroba:** Writing – review & editing, Investigation, Data curation. **Mika Niemelä:** Writing – review & editing, Supervision. **Jouko Miettinen:** Writing – review & editing, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Heidi Ruotsalainen:** Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## Registration and protocol

The review was not registered.

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### Appendix A. Supplementary data

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