



School-based Mental Health Interventions Targeting Depression or Anxiety: A Meta-analysis of Rigorous Randomized Controlled Trials for School-aged Children and Adolescents

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Abstract

Past meta-analyses in mental health interventions failed to use stringent inclusion criteria and diverse moderators, therefore, there is a need to employ more rigorous methods to provide evidence-based and updated results on this topic. This study presents an updated meta-analysis of interventions targeting anxiety or depression using more stringent inclusion criteria (e.g., baseline equivalence, no significant differential attrition) and additional moderators (e.g., sample size and program duration) than previous reviews. This meta-analysis includes 29 studies of 32 programs and 22,420 students (52% female, 79% White). Among these studies, 22 include anxiety outcomes and 24 include depression outcomes. Overall, school-based mental health interventions in grades K-12 are effective at reducing depression and anxiety ($ES = 0.24$, $p = 0.002$). Moderator analysis shows that improved outcomes for studies with anxiety outcomes, cognitive behavioral therapy, interventions delivered by clinicians, and secondary school populations. Selection modeling reveals significant publication and outcome selection bias. This meta-analysis suggests school-based mental health programs should strive to adopt cognitive behavioral therapy and deliver through clinicians at the secondary school level where possible.

Keywords School-based mental health · Depression · Anxiety · Meta-analysis

Introduction

Given the escalating mental health crisis (Wong et al., 2021), there is a substantial need for effective ways to improve depression and anxiety among school-age children. There exists a prolific amount of school-based mental health interventions, yet the quality of such interventions varies greatly. Previous meta-analyses provided many insights on effective interventions; however, they failed to use stringent inclusion criteria. There is a need to review high-quality randomized controlled trials to generate new and evidence-based insights. This study aims to synthesize research on existing mental health interventions targeting depression and anxiety of school-aged children and adolescents to provide updated guidance on effective interventions.

Prevalence of Depression and Anxiety in School-aged Children and Adolescents

In recent years, depression and anxiety have increased rapidly among 6-17 years old American children (Centers for Disease Control and Prevention (2022)). Approximately 9.4% 3-17-year-old children were diagnosed with anxiety problems (Centers for Disease Control and Prevention (2022)) and 31.5% 13-18-year-old children have experienced depression (Feiss et al., 2019). These statistics are concerning not only because of what they tell, but also because of what they do not tell. In the mental health area, numbers often underestimate the actual prevalence of mental health problems due to diagnostic challenges (Mathews et al., 2011), stigmatization (Moses, 2010), and subsequent reluctance to seek help (Reavley et al., 2010). On top of that, there is a gap between those who are diagnosed and those who receive treatment: around half of diagnosed American adolescents receive mental health treatments in the form of medication or counseling (Zablotsky, 2020). More needs to be done to provide accessible mental health support for school-aged children

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and adolescents (i.e., aged 10–19; World Health Organization (2022)).

Apart from the increasing prevalence and inadequate treatment in depression and anxiety, the associated consequences highlight the need to intervene early and effectively. Past literature found that depression and anxiety among children are associated with poor academic outcomes (Owens et al., 2012), deteriorating physical health (Naicker et al., 2013), substance abuse or dependence (Conway et al., 2006), negative coping strategies (Cairns et al., 2014), self-injury (Giletta et al., 2012), and suicidal attempts (Nock et al., 2013). In addition, anxiety and depression among adolescents are likely to be recurrent (Gillham et al., 2006), chronic (Costello et al., 2003), and persistent through adulthood (Lee et al., 2018). Treating depression and anxiety effectively can create great social, educational, and economic benefits. A meta-analysis of randomized controlled trials can produce guidance for policymakers by providing insights into the effectiveness of all related interventions. This meta-analysis intends to provide evidence to help school districts understand what types of mental health interventions work in the school environment.

School-based Mental Health Interventions

The importance of addressing mental health in children and adolescents cannot be understated. The long-term adverse outcomes outlined above exist not only for those who meet diagnostic criteria, but also for those with subclinical levels of depression (Copeland et al., 2021). Schools provide an ideal setting within which to both implement preventative interventions as well as identify and serve those with or at-risk of depression or anxiety. School settings can provide access to all school-age children, while overcoming barriers such as location, time, and stigma (Stephan et al., 2007). Compared to primary-care settings, school-based mental health programs can reach larger populations, provide more convenient access, and enhance social relationships between classmates and teachers (van Loon et al., 2020). An additional advantage of school-based interventions is that they can serve to identify students at high risk for depression and anxiety and provide them with clinical support. This is especially important because one major reason for untreated depression is the failure to identify or diagnose depressive symptoms (Hirschfeld et al., 1997). This challenge can be mitigated by school-based mental health programs. With these advantages, school-based mental health interventions are increasingly gaining popularity (Werner-Seidler et al., 2017).

Past Meta-analyses

Past meta-analyses have conflicting views on the effectiveness of school-based interventions targeting depression

and anxiety. One review identified 118 randomized controlled trials with 45,924 participants and found that these interventions had a small effect on depression and anxiety (Werner-Seidler et al., 2021). Similarly, another recent review analyzed 18 included studies and found that school-based programs had a small positive effect on self-reported anxiety symptoms (Hugh-Jones et al., 2021). These conclusions were challenged by another meta-analysis, where authors identified 137 studies with 56,620 participants and found little evidence that school-based interventions which focused solely on the prevention of depression or anxiety are effective (Caldwell et al., 2019). These three meta-analyses focused on children within the age group of 4–19 years old. When meta-analysts narrowed their focus to adolescents (11–18 years old) in the USA, they found significant effects of school-based programs on both depression and anxiety, but not on stress reduction (Feiss et al., 2019). One possible reason behind these conflicting conclusions is the distribution of age groups; perhaps school-based interventions are generally more effective for adolescents compared to younger children. Another possible source of conflict may be the subjective inclusion criteria created by researchers, which can bias the results (Cheung and Slavin, 2013). When applying more stringent inclusion criteria, the magnitude and statistical significance of effect sizes tends to diminish (Neitzel et al., 2022). The association between inclusion criteria and outcomes was demonstrated in another school-based meta-analysis, where the authors found that removing low-quality studies led to changes in average effect sizes (Tejada-Gallardo et al., 2020).

Outcome domain

Depression is a clinical symptom that involves persistent sadness and loss of interest in previously enjoyable activities (National Institute of Mental Health, 2018). Anxiety disorder refers to persistent anxiety that interferes with daily life (National Institute of Mental Health, 2022). In past meta-analyses, there are conflicting views on the effectiveness of depression- or anxiety-focused school-based interventions, ranging from no evidence of effectiveness in either depression or anxiety (Caldwell et al., 2019), to effectiveness dependent on program features (Feiss et al., 2019), to a small positive average effect size in both outcome domains (Werner-Seidler et al., 2021), to sustainable positive effect sizes even after 12 months (Hugh-Jones et al., 2021).

Program type

The universal approach delivers the treatment to the whole population (e.g., class, school, cohort) regardless of their

conditions while the targeted approach delivers the treatment to a selective group of students who show elevated symptoms of depression or anxiety. In targeted interventions, students were first screened using self-reported surveys to detect at-risk students. Universal programs are preventive in nature while targeted programs are curative. Each approach has its advantages and disadvantages. Targeted interventions may be difficult to apply at a large scale due to the tremendous amount of screening efforts required (Merry et al., 2004). Moreover, compared to the universal approach, the targeted approach involves taking students from classes, which may cause unintended effects of labeling and stigmatizing students (Huggins et al., 2008). Past research has shown that students selected for targeted mental health treatments feel embarrassed and may have negative attitudes towards receiving medication (Biddle et al., 2006). Universal programs avoid potential dangers of social stigmatization and can reach more children, but they may be more costly due to the larger group of participating populations (Ahlen et al., 2012). Furthermore, targeted programs were more effective compared to universal programs (Werner-Seidler et al., 2021). Since both approaches have pros and cons, investigating the effectiveness of one compared to another can generate useful scientific and implementation implications.

Program content

Cognitive behavioral therapy (CBT) is a traditional type of program targeting depression and anxiety (Feiss et al., 2019). In clinical settings, CBT treatment usually involves changing thinking and behavioral patterns, helping individuals to understand the problem, and developing a treatment strategy together with the psychologist (American Psychological Association, 2017). In K-12 school settings, CBT techniques and components can be adjusted and applied to the behavioral social-emotional needs of students even without clinical diagnosis (Joyce-Beaulieu & Sulkowski, 2019). Through CBT interventions, students gain skills to understand and cope with their own feelings, such as using relaxation techniques and interacting with peers more effectively (Joyce-Beaulieu and Sulkowski, 2019). School-based interventions with CBT components are found effective to reduce depressive symptoms (Rooney et al., 2013) and anxiety (Lewis et al., 2013), and to improve coping strategies (Collins et al., 2014). Apart from CBT, evidence suggests promising effects of other innovative program features, such as physical education (Olive et al., 2019), student-family-school triads (Singh et al., 2019), and Hatha yoga sessions (Quach et al., 2016). One past meta-analysis suggested that there are no significant differences between CBT programs and other approaches in treating either depression or anxiety (Werner-Seidler et al., 2021).

Yet, another meta-analysis reported weak evidence of CBT's effectiveness in reducing anxiety in both elementary and secondary school populations (Caldwell et al., 2019). Comparing traditional program types to other new program types can help us understand components that make interventions effective.

Delivery personnel

To meet the rapidly growing demand for school-based mental health services, the teacher's role shifts from being a supportive figure to being a service provider (Park et al., 2020). The appeal of hiring teachers to deliver interventions is increasing, yet there is lack of research that compares teacher-delivered interventions to clinician-delivered interventions. In school-based mental health interventions, interventions are normally delivered by either trained teachers or certified clinicians. Although trained psychologists or clinicians have more professional and practical knowledge than teachers, hiring specialists is more expensive compared to training schoolteachers through a short workshop. Moreover, students spend most of their time during schools with teachers and have developed rapport and trust with each other. In contrast to teachers, clinicians are less familiar with students' backgrounds and personalities. Very few meta-analyses were able to include the provider as a moderator in their meta-regression because very few interventions were delivered by teachers. Findings on providers are mixed, ranging from no significant moderation effect on delivery personnel (Ahlen et al., 2015), to external providers being more effective than school staff (Werner-Seidler et al., 2021), to teachers being more effective (Neil and Christensen, 2009), and to teachers being more effective under some treatment conditions (Franklin et al., 2017). This article contributes to the literature by comparing teacher-delivered interventions to clinician-delivered interventions.

Program duration

Past research has established that interventions delivered within a short span of time tend to produce much larger effect sizes than long-duration interventions (Cheung & Slavin, 2013). Factors contributing to this effect include novelty factors, a more experimentally-stable environment, and the feasibility of conditions only sustainable for short-duration interventions (Cheung & Slavin, 2013). Those findings suggest using 12 weeks as a benchmark to separate short-duration and long-duration studies.

Sample size

Study sample size has also been found to strongly impact effect sizes, with small sample sizes tending to inflate effect

sizes (Slavin & Smith, 2009). One reason behind this observation is the “superrealization” effect (Cronbach et al., 1980), which means that the high implementation fidelity maintained within a small sample can hardly be scaled to a larger sample. Another reason may be that small-scale studies are more likely to use researcher-developed measures compared to standardized tests (de Boer et al., 2014). Lastly, publication bias may have contributed to this phenomenon since small-scale studies have limited statistical power, which often requires higher effect sizes than large-scale studies to reach statistical significance. To the best of the authors’ knowledge, no prior meta-analysis has included sample size as a moderator.

Student age

As summarized in the previous section (i.e., past meta-analyses), results of the meta-analysis may be different across age groups. For example, one investigation of academic achievement found that students in the elementary grades gain much more academic progress than secondary school students in one academic year (Bloom et al., 2008). A separate meta-analysis of academic interventions found the same disparity between age groups, but the significance of these results disappeared when they restricted inclusion criteria to only randomized and quasi-experimental designs, which further demonstrated the importance of applying rigorous inclusion criteria (Cheung & Slavin, 2013).

Current Study

Past meta-analyses in mental health interventions failed to use stringent inclusion criteria and diverse moderators; therefore, there is a need to employ more rigorous methods to provide evidence-based and updated results on this topic. In order to identify characteristics of effective depression or anxiety interventions and provide evidence-based suggestions for current and future practices, this meta-analysis systematically reviews school-based mental health programs that serve K-12¹ students. The article aims to answer two research questions: What are the overall impacts of school-based randomized-controlled-trial programs on depression and/or anxiety reduction? (*Research question 1*). This study hypothesizes that school-based randomized-

controlled-trial programs can effectively reduce depression and anxiety in school-age children, as has been demonstrated in prior reviews (Feiss et al., 2019; Hugh-Jones et al., 2021; Werner-Seidler et al., 2021). (*Hypothesis 1*). To what extent do intervention outcomes differ according to methodological criteria, such as sample size and program duration; and intervention criteria, such as program type (targeted vs. universal); program delivery personnel (trained teachers vs. certified clinicians); program content (cognitive behavior therapy vs. others); and student age? (*Research question 2*). This study hypothesizes that the identified factors significantly moderate the impact of the programs. (*Hypothesis 2*).

Methods

Literature Search

To ensure a thorough literature search, the first author conducted database search, handsearching, and backward citation chasing. Using the list of keywords (Table 1), the first author searched for relevant articles in the Education Resources Information Center, PsychINFO, and Google Scholar. After the database search, the first author also conducted complementary handsearching in a set of reputable field-specific journals (listed in Table 2). The first author used *Paperfetcher*, a browser-based tool, to conduct both handsearching and backward citation chasing (Pallath & Zhang, 2022). All literature search was completed in June 2021. There are three steps in the screening: first, the first author used ASReview’s machine learning algorithms to rank all retrieved articles by their relevance and exported the most relevant 2308 studies (van de Schoot et al., 2021). This decision was made by the first author by manually browsing through the titles of the most relevant studies and making a cut-off point when studies become obviously irrelevant. To be cautious, the first author also sampled 10% of the 5864 studies excluded through ASReview’s machine learning ranking to confirm that they would be excluded. Then, these 2308 studies were imported into Covidence (Covidence systematic review software, 2013) for double-blinded screening. The authors chose Covidence here because it enables full-text review and the authors’ affiliated institutions provide free software licenses for this tool (Zhang & Neitzel, 2021). The first and second authors manually screened the title and abstract through a single-reviewer decision-making. Then the first and second authors manually screened full-text through a double-blinded decision-making. The proportionate agreement in this full-text screening stage is 0.85. The third author was invited for a group discussion to resolve all conflicts and 100% agreement was reached eventually.

¹ In the US educational system, K-12 refers to formal education covering elementary and secondary school grades through kindergarten to 12th grades (Department of Homeland Security, 2022). American children generally start formal education at age five or six. However, educational systems in other countries may be different from the US. For example, kindergarten is not included in elementary school grades in some countries. Thus, this study examines the effects of interventions for children and adolescents in kindergarten, elementary school, middle school, and high school.

Table 1 Search Keywords

Treatment variables	“education*” OR “education program” OR “health education” OR “health literacy” OR “education intervention” OR “school-based” OR “K-12”
Outcome variables	“psychological well-being” OR “mental health” OR “anxiety” OR “mental illness” OR “emotional” OR “mental disease” OR “depression” OR “depressive symptoms” OR “internalizing problems” OR “clinical symptoms”
Method variables	“randomized controlled trials” OR “RCT” OR “random assignment”

Table 2 Journals Used for Handsearching

Journal Name	ISSN
Review of Educational Research	1935–1046
Journal of Research on Educational Effectiveness	1934–5739
AERA Open	2332–8584
School Mental Health: A Multidisciplinary Research And Practice Journal	1866–2633
Professional School Counseling Journal	2156–759x
Journal of Counseling and Development	1556–6676
School Psychology	2578–4226
Journal of School Psychology	0022–4405
School Psychology International	1461–7374
School Psychology Review	2372–966x
Psychology in the Schools	1520–6807
American Psychologists	1935–990x
Research on Child and Adolescent Psychopathology	2730–7174
Clinician’s Research Digest®: Child and Adolescent Populations	2169–7094

Eligibility Criteria

This article used the following inclusion criteria for full-text review to ensure consistency and high standards in study quality:

- (1) Randomized controlled trials (RCT) must have at least 30 students per experimental condition to reduce bias in small studies (Cheung & Slavin, 2016) and at least 2 teachers/schools per condition to eliminate confound due to sample size (What Works Clearinghouse, 2020a). For example, one study was excluded because it used a one school vs. one school design (Harnett & Dadds, 2004). Another study was excluded because it had 22 and 24 students in control and treatment conditions respectively (Burckhardt et al., 2016).
- (2) Program duration from program start to posttest must be at least four weeks to remove particularly short interventions. A study was excluded because it was a one-week intervention (Link et al., 2020).
- (3) Studies must have taken place in the following countries: USA, Canada, Europe (European Union + U.K. + Switzerland + Norway), Israel, Australia, and New Zealand. This geographical restriction intends to narrow down the scope of review to countries that share similar economic and political situations. A study was excluded because it took place in South Africa (Fernald et al., 2008).
- (4) Studies must use randomization to focus on studies of the highest level of internal validity. The level of random assignment may be schools, classes, or students. For example, a study was excluded because it allocated students to treatment and control based on number of students and gender composition (Kowalenko et al., 2005).
- (5) Differences between conditions at baseline on depression/anxiety measure must be less than 0.25 standard deviations (*SDs*) to reduce bias from unreliable statistical analyses (Rubin, 2001). For example, a study was excluded because its depression measurements at baseline were inequivalent (Ardic & Erdogan, 2017).
- (6) Differential attrition between treatment and control groups must be less than 15% to reduce bias (What Works Clearinghouse, 2020a).
- (7) A control group must be present.
- (8) Intervention or instruction should be delivered by non-researchers. Treatments had to be delivered by ordinary teachers, not by researchers, because effect sizes are inflated when researchers deliver the treatment (Scamacca et al., 2007). For example, a study was excluded because the intervention was delivered by lead author and master’s students in clinical psychology (García-Escalera et al., 2020). Similarly, a study was excluded because the intervention was delivered by lead author and a research assistant (Burckhardt et al., 2016).
- (9) Outcomes of interest measurements must include quantitative measures of either depression/depressive symptoms/depression literacy or anxiety/anxious symptoms. For example, a study was excluded because outcomes did not measure depression or anxiety (Daunic et al., 2012).
- (10) Text must be available in English.
- (11) Articles must be published on or after January 1st, 2000. This means that this study reviewed experimental studies in the last two decades for the most updated evidence.
- (12) Children participating in the programs must come from K-12 school grades. This means that this study includes

studies that focus on students studying in kindergarten, elementary, secondary (including middle and high schools). For example, a study was excluded because the intervention focused on college students (Xiong et al., 2022).

Analytical Plan

This study conducted the meta-analysis in R (R Core Team, 2021) using the *metafor* package (Viechtbauer, 2010). The three authors performed double coding in Google spreadsheet and held discussion to eventually reach 100% interjudge reliability in codification. This study used weighted mean effect sizes and meta-analytic tests such as Q statistics. Weights were then assigned to each study based on inverse variance (Lipsey & Wilson, 2001) and adjusted weights (Hedges, 2007). A random-effects model was used in meta-regression since there was no single true effect size but a range of effect sizes that may have depended on other factors (Borenstein et al., 2010). For cluster randomization, this study added adjustments for clustering adapted from What Works Clearinghouse (2020b). This study analyzed six pairs of moderators (more details in the next section) and examined differential effects by including interaction terms. All moderators and covariates were grand mean centered to facilitate interpretation of the intercept. All reported mean effect sizes come from this meta-regression model, which adjusts for potential moderators and covariates. To assess publication bias, this study adopted selection modeling instead of other traditional techniques (e.g., funnel plot, Egger's regression, fail-safe N) because of the limitations² in these traditional techniques. Selection modeling involves a model of the selection process that uses a weight function to estimate the probability of selection in random-effect meta-analysis (Hedges, 1992). Selection modeling is the most recommended method to investigate meta-analyses' publication bias (Terrin et al., 2005). This study used *weightr* package (Coburn & Vevea, 2019) to apply the weight-function model (Veeva & Woods, 2005). To conduct risk of bias analysis, the authors decided to use JBI Checklist for Randomized Controlled Trials (Joanna Briggs Institute, 2017) because it provides a clear guideline for systematic review and meta-analysis on randomized controlled trials, which fits well with this meta-analysis.

² The evaluation of funnel plots is subjected to meta-analysts' interpretations, which are often misled by the plot shapes (Terrin et al., 2005). In addition, visual assessment of funnel plots or Egger's regression only presents part of the publication bias related to small-study bias. The fail-safe N technique is also largely abandoned in the field due to its arbitrary choice of zero, ignorance of heterogeneity in primary studies (Iyengar & Greenhouse, 1988), and other major flaws (Becker, 2005).

Following the open science movement, the complete dataset and code are publicly available at <https://github.com/qiyangzh/School-based-Mental-Health-Interventions-Targeting-Depression-or-Anxiety-A-Meta-analysis>.

Moderators

This study added moderators to explain the difference in impacts based on outcome domains, methodological criteria, intervention criteria, program delivery personnel, program content, and student age.

Outcome domain: depression vs. anxiety

Outcome domain was coded as depression if the outcome used a depression scale, such as Children's Depression Inventory and Beck Depression Inventory II. It was coded as anxiety if the outcome included used an anxiety scale, such as Spence Children's Anxiety Scale and Multi-dimensional Anxiety Scale for Children.

Program type: universal vs. targeted

Programs were coded as either universal or targeted. Universal means the program was delivered to entire classes, schools, or cohorts, regardless of risk level. Targeted means the program was delivered to specific groups of students showing elevated levels of depression or anxiety.

Program content: cognitive behavioral therapy vs. others

Programs were coded as either cognitive behavioral therapy or others. CBT programs have design features that involve CBT techniques and components. Non-CBT programs refer to a wide range of other designs, including mental health education, yoga, physical education, mindfulness, coping skills.

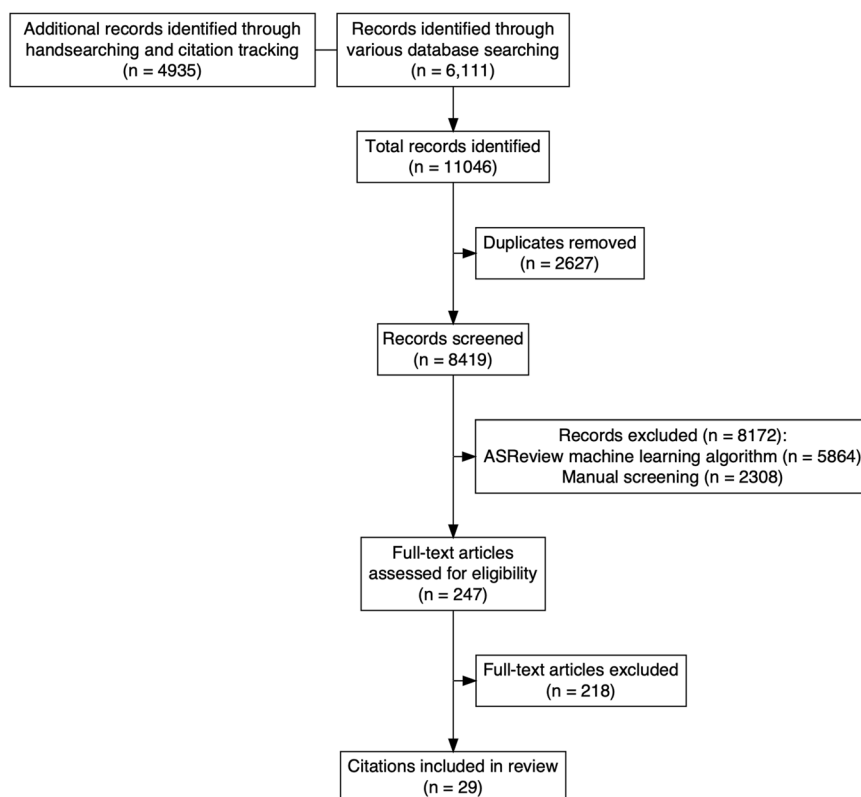
Delivery personnel: teachers vs. clinicians

Delivery personnel was coded as either teachers or clinicians. Among non-teacher delivered programs, one intervention was delivered through a self-directed online program; others were delivered by personnel with psychological backgrounds, such as psychologists, mental health workers, clinicians, social workers, and counselors. In the following analysis, this study treats all non-teacher delivery personnel as clinicians.

Program duration: short duration (<12 weeks) vs. long duration (≥12 weeks)

This article codes interventions shorter than 12 weeks as short duration and interventions equal to or longer than

Fig. 1 PRISMA Diagram



12 weeks as long durations to compare the effect sizes of the two types.

Sample size: small sample (<250) vs. large sample (≥250)

Sample size was either small or large. When the total participating student sample is smaller than 250, the program was coded as having a small sample size. When the sample is equal or larger than 250, the program was coded as having a large sample size.

Student age: grade level comparison between elementary and secondary schools

Student age was coded as 1 for kindergarten and elementary schools, 2 for middle schools, and 3 for high schools. In analysis, 2 and 3 are combined to refer to secondary school students.

Results

Descriptive Results

This study retrieved both published studies and unpublished studies to minimize publication bias in this review. Figure 1 presents the PRISMA screening process in Covidence.

Among the 218 excluded studies in the full-text review stage, the top five reasons for exclusion are inadequate outcome measures ($n = 52$), irrelevant ($n = 46$), wrong design ($n = 33$), meta-analysis/review ($n = 23$) and outside the geographical scope ($n = 17$). After applying the inclusion criteria, this review found a total of 29 qualified studies evaluating 32 programs³ (Fig. 1, Table 3). In total, these programs have 22,420 K-12 students ($n = 12,174$ in treatment group, and $n = 10,246$ in control group). Among these students, 52% are female and 79% are White. Table 4 presents the descriptive statistics of the 29 included studies. Among the included studies, most were conducted in Australia and USA (13 and nine respectively, Table 4). For grade levels, 17 programs (53.1%) focused on the elementary school population and 15 (46.9%) focused on the secondary school population. Overall, 22 programs (68.8%) employed Cluster Randomized Controlled Trials (CRCT) and the other 10 programs (31.2%) used RCT design. In terms of intervention design, 22 programs (68.8%) examined interventions with CBT components and 10 programs (31.2%) reported interventions with non-CBT strategies. In terms of duration, 10 programs (31.2%) evaluated interventions that last at least 12 weeks (i.e., long duration), while 22 programs (68.8%) reported interventions that last

³ If one study contains two interventions or two program types (i.e., universal vs. targeted population), it is treated as two programs.

less than 12 weeks (i.e., short duration). Sample sizes of included programs vary greatly, ranging from 68 students (Chaplin et al., 2006) to 5,634 students (Sawyer et al., 2010). In total, 17 programs (53.1%) have small sample sizes (less than 250) and 15 (46.9%) have large sample sizes. The majority (78.1%) of the interventions were universal, and seven programs (21.9%) are targeted. This demonstrates universal programs' increasing popularity. This study analyzed 79 effect sizes related to depression or anxiety. Among these outcomes, 40 effect sizes (50.6%) were related to anxiety, and 39 effect sizes (49.4%) were related to depression. In addition, 40 (50.6%) studies evaluated teacher-delivered interventions and 39 (49.4%) studies investigated non-teacher-delivered interventions.

Meta-analysis Results

As shown in Table 5, the overall mean effect size for these 32 programs is 0.24 ($p = 0.002$) while holding all moderators fixed at their mean. The 95% predictive interval ranges from -0.91 to 1.39 .

Outcome domain: depression vs. anxiety

Overall, outcomes using anxiety-related measurements have a significant weighted mean effect size ($ES = 0.44$, $p = 0.001$, Table 6). But no significant mean effect size was found in outcomes measuring depression ($ES = 0.04$, $p = 0.723$). The difference between anxiety outcomes and depression outcomes was 0.4 SDs on average ($p = 0.025$).

Program type: universal vs. targeted

Intervention type was not a significant moderator of effect sizes. The mean effect size for interventions focused on targeted populations was 0.42 ($p = 0.021$), while the mean effect size for interventions focused on universal populations was 0.18 ($p = 0.028$).

Intervention design: cognitive behavioral therapy vs. others

Intervention design was a significant moderator of impact. On average, CBT programs have significantly higher effect sizes than those without CBT components ($p = 0.016$). CBT programs have a mean effect size of 0.33 ($p = 0.002$), while programs without CBT elements have a non-significant mean effect size of -0.15 ($p = 0.260$).

Intervention delivery: teachers vs. clinicians

Intervention delivery personnel were a significant moderator of impact. On average, the effect size of teacher-delivered programs is 0.39 SDs lower than programs

delivered by non-teacher personnel ($p = 0.013$). Programs delivered by non-teacher personnel have, on average, a significant mean effect size of 0.44 ($p = 0.007$) while programs delivered by teachers have an average non-significant mean effect size of 0.05 ($p = 0.371$).

Intervention duration: short duration (<12 weeks) vs. long duration (≥ 12 weeks)

No significant difference was found between the mean effect size of long-duration and short-duration programs. On average, short duration programs had a statistically significant mean effect size ($ES = 0.28$, $p = 0.003$), compared to long duration programs with a non-significant mean effect size of 0.14 ($p = 0.222$).

Sample size: small sample (<250) vs. large sample (≥ 250)

The weighted mean effect size of interventions with small sample sizes ($n < 250$) is 0.35 ($p = 0.019$), while the mean effect size of large-sample interventions ($n \geq 250$) is 0.13 ($p = 0.221$). The difference between the mean effect sizes of small-sample and large-sample interventions is not significant ($p = 0.271$).

Grade level: elementary vs. secondary schools

On average, there was no significant effect found in the interventions implemented in elementary schools ($ES = 0.06$, $p = 0.547$). Interventions implemented in secondary schools had a significant average effect size of 0.42 ($p = 0.006$). The difference in the effect sizes between secondary school population and elementary school population is 0.36 SDs , which is marginally statistically significant ($p = 0.076$).

Interactions

The interaction analysis identified a marginally significant differential effect for personnel by presence of CBT ($\beta = -0.75$, $p = 0.059$). On average, clinicians have higher effect sizes with CBT ($ES = 0.59$, $p = 0.007$) than they do without CBT ($ES = -0.27$, $p = 0.325$). Teachers have smaller average effect sizes, with average effect sizes for CBT of 0.07 ($p = 0.295$) and for without CBT of -0.04 ($p = 0.732$).

In addition, a significant differential effect for personnel also was identified by intervention type ($\beta = 0.83$, $p = 0.024$). On average, interventions delivered by clinicians for targeted populations have a larger effect size ($ES = 0.92$, $p = 0.023$) compared to interventions for the universal population ($ES = 0.26$, $p = 0.044$). On the contrary, although no significant effect sizes were found by teacher-delivered interventions for both universal

Table 3 Included 29 Studies' Characteristics

Study	Program name	Age	Country	Type	N (T, C)	Duration	Design	Control	Program content	Targeted outcomes	Program delivery
Barnes et al. (2012)	The William LifeSkills	14–17	USA	U	159 (86,73)	Twelve weekly sessions, 3 months	CRCT	Health education	Workshop trains in anger and stress coping skills	Anger and stress management (anxiety and blood pressure)	Teachers at school
Barrett & Turner (2001)	Friends for Children	10–12	Australia	U	325 (188, 137) 400 (263, 137)	75-min per session, 10 sessions	CRCT	Usual care	CBT	Depression and anxiety	Psychologists and Teachers
Britton et al. (2014)	Mindfulness meditation	11–12	USA	U	100 (52, 48)	Daily meditation for 6 weeks	CRCT	Experiential activity	Based on integrative contemplative pedagogy	Student acceptability, engagement, clinical symptoms	Two history teachers who completed mindfulness training
Chaplin et al. (2006)	Penn Resiliency Program	11–14	USA	U	103 (65, 38)	90 min/week for 12 weeks	RCT	Co-ed	CBT and social problem-solving intervention	Depression	Teachers, guidance counselors with a week-long training
Collins et al. (2014)	Lessons for living: Think well, Do well	9–10	UK	U	238 (103, 135) 214 (79, 135)	Ten-lesson program	CRCT	Regular personal and social education	The intervention was theoretically grounded in CBT for the development of coping skills.	Anxiety, coping	Psychologists and Teachers
DeRosier (2004)	S.S.GRIN (Social Skills Group Intervention)	8–11	USA	T	381 (187, 194)	8 weeks, 50 to 60 mins, weekly	RCT	No-treatment control group	Social responsibility training, S.S.GRIN combines social learning and cognitive-behavioral techniques	Social anxiety and depression	School's counselor and a trained undergraduate intern
Haugland et al. (2020)	Cool Kids Program	12–16	Norway	T	201 (106, 95)	10 weeks: total 15 h plus two 90-minute parents-only sessions	RCT	Waitlist	CBT	Anxiety	School personnel or mental health workers
	Vaag				177 (82, 95)	5 sessions: with weekly sessions of 45 to 90 min (total 5.5 hours) over the first 4 weeks, followed by a final session 5 weeks later					

Table 3 (continued)

Study	Program name	Age	Country	Type	N (T, C)	Duration	Design	Control	Program content	Targeted outcomes	Program delivery
Kraag et al. (2009)	Learn Young, Learn Fair	10	Netherlands	U	1384 (652, 732)	8 weekly one-hour lessons, 5 weekly one-hour booster sessions	CRCT	Waitlist	Addressed stress, stress awareness, coping skills and possible barriers and was developed using the Intervention Mapping protocol	Anxiety, depression, stress symptoms, coping, stress awareness	Teachers
Lewis et al. (2013)	Positive Action	12–13	USA	U	1170 (585, 585)	6 years	CRCT	Business as usual	Based on self-esteem enhancement theory	Positive affect, life satisfaction, depression, anxiety	Teacher, counselor, and family training
Lowry-Webster et al. (2001)	FRIENDS	10–13	Australia	U	531 (392, 139)	10 sessions	CRCT	Waitlist	CBT	Depression and anxiety	Teachers
Merry et al. (2004)	RAP-Kiwi	13–15	New Zealand	U	332 (178, 154)	11 sessions for 11 weeks or 6 weeks	RCT	Placebo	CBT and interpersonal therapy	Depression	Teachers with 2.5-days of training
Mifsud & Rapee (2005)	Cool Kids Rapee Program	9–10	Australia	T	91 (51, 40)	1-hour sessions, 8 sessions, one per week	CRCT	Waitlist	Education about anxiety	Anxiety, internalizing problems	School counselors and social workers
Miller et al. (2011)	FRIENDS	10.1	Canada	T	180 (61, 119)	9 weeks	CRCT	Attention-control	CBT	-	Implemented by the trained school person (i.e., teacher) paired with a trained school counselor (or trained psychology graduate student)
O'Kearney et al. (2009)	MoodGYM	15–16	Australia	U	157 (67, 90)	6 weeks	RCT	Usual health education	Coping skills to tackle depression	Depression and anxiety	Online intervention
Olive et al. (2019)	LOOK	8	Australia	U	642 (335, 307)	Two 50-minute sessions/week over four years	CRCT	Similar to intervention but moderated	Specialist-taught physical education: emphasize enjoyment of movement, de-emphasize individual competition, reflective discussion, engaging every child	Depression, body image, and stress	University trained and qualified PE teachers
Quach et al. (2016)	Mindfulness Meditation Hatha yoga	12–17	USA	U	107 (54, 53) 118 (65, 53)	45 min/session, 2 sessions/week for 4 weeks	RCT	Waitlist	Based on the mindfulness-based stress reduction (MBSR) program developed by Jon	Working memory, capacity, stress, anxiety	Two instructors with 5–10 years of experience in meditation

Table 3 (continued)

Study	Program name	Age	Country	Type	N (T, C)	Duration	Design	Control	Program content	Targeted outcomes	Program delivery
Roberts et al. (2003)	Penn Prevention Program	11–13	Australia	T	189 (90, 99)	12 sessions	CRCT	Usual health education classes	Kabat-Zinn, breathing techniques, formal meditation, discussion CBT	Depressive symptoms, anxiety	School psychologists and nurses
Roberts et al. (2010)	Aussie Optimism	11–13	Australia	U	428 (237, 191)	60-minute session, 20 weeks	CRCT	Usual health lessons	CBT intervention strategies	Depression and anxiety	Teachers
Rooney et al. (2006)	The Positive Thinking Program	8–9	Australia	U	120 (72, 48)	Eight 60-min weekly sessions	CRCT	Regular health education curriculum	CBT	Depression and anxiety	Psychologists
Rooney et al. (2013)	The Aussie Optimism: Positive Thinking Skills Program	9–10	Australia	U	910 (467, 443)	Ten weekly 60-min sessions	CRCT	Health education	CBT intervention strategies	Internalizing problems and protective factors	Classroom teachers
Sawyer et al. (2010)	Beyondblue	13	Australia	U	5634 (3037, 2597)	3 years, 40–45 min	CRCT	Business as usual	Curriculum, building supportive environment, building pathways for care and education	Depression	Teachers
Sheffield et al. (2006)	Cognitive-Behavioral Approaches	13–15	Australia	U	1248 (634, 614)	One 45 min session per week for 8 weeks	CRCT	No intervention	Integrate two major CBT components: cognitive restructuring and problem-solving skills training	Depression, anxiety, and externalizing problems	Teachers
Shochet et al. (2001)	Resourceful Adolescent Program (RAP)	12–15	Australia	U	172 (65, 107)	40–50-min sessions, 11 sessions for 11 weeks	RCT	Observation, previous cohort, simply complete the measures	CBT	Depression	Psychologists
Sinclair (2016)	Think, Be, Do	14–21	USA	U	115 (74, 41)	10 sessions over five weeks	CRCT	Business as usual	Based on CBT and ecological theory	Knowledge, mental health, academic competency, internalizing and externalizing symptoms	Teacher trained for 2 hours
Skryabina et al. (2016)	FRIENDS	9–10	UK	U	844 (457, 387)	12 months	CRCT	Usual personal, social, health and education	CBT	Anxiety	Health care staff

Table 3 (continued)

Study	Program name	Age	Country	Type	N (T, C)	Duration	Design	Control	Program content	Targeted outcomes	Program delivery
Spence et al. (2005)	The problem solving for life	12–14	Australia	U	1500 (751, 749)	45–50 min weekly, 8 sessions	CRCT	(PSHE) lessons Monitoring control condition	CBT	Depression	Teachers
Stein et al. (2003)	Cognitive-Behavioral Intervention for Trauma in Schools (CBITS)	9–10	USA	T	117 (54, 63)	10 sessions	RCT	Delayed intervention	CBT	PTSD, depression, psychosocial dysfunction, classroom problems	Trained school mental health clinicians with 2-day training and weekly group supervision
Tak et al. (2016)	Op Volle Kracht (OVK, based on Penn Resilience Program)	14	Netherlands	U	1341 (634, 707)	16 50-min lessons, a 2 h booster session delivered at 12 months follow up	CRCT	School as usual	Based on several psychological theories and principles, namely CBT, the ABC model (Ellis, 1991), and the hopelessness theory of depression	Depression	Psychologists with varying degrees of experience in CBT and teaching
Volanen et al. (2020)	Mindfulness-Based interventions	12–15	Finland	U	2258 (1157, 1101)	Nine weekly 45-min sessions	CRCT	Both	Mindfulness: attending, observing, and accepting	Resilience, socio-emotional functioning, and depressive symptoms	Trained, certified teachers, or experienced leaders of well-being groups

Note. RCT refers to randomized controlled trial, CRCT refers to cluster randomized controlled trial, N is the total number of participants at the post test, T, C means number of treatment participants and number of control participants respectively, U means universal and T means targeted, CBT Cognitive Behavior Therapy, PTSD Posttraumatic stress disorder

Table 4 Descriptive Statistics of Included Studies

Category	Level	Overall
Study Level		
Total Studies		32
Country		
	Australia	13 (40.6)
	Canada	2 (6.2)
	Finland	1 (3.1)
	Netherlands	2 (6.2)
	New Zealand	1 (3.1)
	Norway	2 (6.2)
	UK	2 (6.2)
	USA	9 (28.1)
Universal		
	No	7 (21.9)
	Yes	25 (78.1)
Elementary		
	No	17 (53.1)
	Yes	15 (46.9)
Long Duration		
	No	22 (68.8)
	Yes	10 (31.2)
Design		
	CRCT	22 (68.8)
	RCT	10 (31.2)
CBT		
	No	10 (31.2)
	Yes	22 (68.8)
Small Sample		
	No	15 (46.9)
	Yes	17 (53.1)
Outcome Level		
Total Effect Sizes		79
Teacher		
	No	39 (49.4)
	Yes	40 (50.6)
Construct		
	Anxiety	40 (50.6)
	Depression	39 (49.4)

Note. Long duration refers to interventions lasting at least 12 weeks

Design: *RCT* refers to randomized controlled trial, *CRCT* refers to cluster randomized controlled trial. Small sample refers to sample sizes less than 250. *CBT* Cognitive Behavior Therapy

population and targeted population, the magnitude of the effect sizes showed that teacher-delivered intervention for universal population had higher effect sizes ($ES = 0.09$, $p = 0.297$) compared to the effect sizes of targeted population ($ES = -0.08$, $p = 0.499$).

The effect sizes for different grade levels also varied significantly by delivery personnel ($\beta = 0.78$, $p = 0.049$). At secondary school level, the effects of interventions delivered by clinicians have a larger mean effect size of 0.81 ($p = 0.012$) compared to interventions delivered by teachers with a mean effect size of 0.03 ($p = 0.711$). At elementary school level, no difference in effect size was identified by delivery personnel. Effect sizes for teacher-delivered interventions were similar across grade levels, with an average effect size of 0.06 ($p = 0.316$) at the elementary school level and an average effect size of 0.03 ($p = 0.711$) at the secondary school levels.

Table 5 Overall Results for Meta-regression

Coefficient	beta	SE	t	df	P value
Null Model					
Intercept	0.28	0.13	2.20	29.41	0.036
Meta-Regression					
Intercept	0.24	0.06	3.95	11.87	0.002
Long duration	-0.14	0.13	-1.06	10.90	0.310
Small sample	0.21	0.18	1.16	11.22	0.271
Universal	-0.24	0.18	-1.32	10.57	0.215
Depression	-0.40	0.16	-2.50	14.71	0.025
Teacher	-0.39	0.13	-3.00	10.32	0.013
CBT	0.48	0.16	2.91	9.54	0.016
Elementary	-0.36	0.19	-1.89	16.75	0.076
Teacher × CBT	-0.75	0.34	-2.20	7.89	0.059
Universal × Teacher	0.83	0.32	2.60	11.30	0.024
Teacher × Elementary	0.78	0.37	2.13	15.88	0.049
Depression × Teacher	0.89	0.33	2.69	14.44	0.017
Depression × CBT	-0.39	0.28	-1.36	6.53	0.219

Note. *SE* standard error, *df* degrees of freedom, *CBT* Cognitive Behavior Therapy

Moreover, significant differential effects were identified for outcome types by delivery personnel ($\beta = 0.89$, $p = 0.017$). Interventions with outcomes on anxiety delivered by clinicians have a significantly larger effect size ($ES = 0.86$, $p = 0.004$) compared to those delivered by teachers ($ES = 0.03$, $p = 0.657$). Those with outcomes on depression have a different trend. Teacher-delivered interventions on depression have a somewhat higher effect size ($ES = 0.07$, $p = 0.368$) than those of clinician-delivered interventions on depression ($ES = 0.01$, $p = 0.980$).

No significant differential effects were found for intervention outcomes (depression vs. anxiety) by intervention design ($\beta = -0.39$, $p = 0.219$).

Exploratory and Sensitivity Analyses

In exploratory analysis, an additional moderator called waitlist is included in the meta-regression model. The waitlist moderator is coded as 1 when the control group adopts business as usual or waitlist, which are considered as inactive group. It is coded as 0 when the control group has an active intervention serving as a placebo as compared to the real treatment. After adding this moderator, estimates and significance values were broadly similar to the original results.

Two types of sensitivity analyses were performed on the two moderators with arbitrary cut-off points: program duration and sample size. In the first round of sensitivity analysis, duration and sample sizes were coded as continuous variables. In the second round, they were coded as categorical variables with three levels using 33% and 66% percentile values as

Table 6 Marginal Means

Moderator	Group	k	n	ES	SE	t	df	p
Program Duration	Short Duration	22	55	0.28	0.08	3.64	12.90	0.003
	Long Duration	10	24	0.14	0.10	1.35	6.66	0.222
Sample Size	Large Sample	15	39	0.13	0.10	1.29	12.70	0.221
	Small Sample	17	40	0.35	0.12	2.95	7.95	0.019
Delivery Personnel	Not Teacher	15	39	0.44	0.12	3.77	6.90	0.007
	Teacher	20	40	0.05	0.05	0.94	9.09	0.371
Program Content	CBT	22	65	0.33	0.08	4.24	9.91	0.002
	Not CBT	10	14	-0.15	0.13	-1.22	7.14	0.260
Program Type	Targeted	7	21	0.42	0.16	2.63	12.46	0.021
	Universal	25	58	0.18	0.07	2.54	10.61	0.028
Grade Level	Elementary	15	39	0.06	0.09	0.62	10.24	0.547
	Secondary	17	40	0.42	0.13	3.25	12.88	0.006
Outcome Type	Anxiety	22	40	0.44	0.10	4.26	11.69	0.001
	Depression	24	39	0.04	0.10	0.36	16.16	0.723
Teacher × CBT	Not Teacher CBT	11	32	0.59	0.15	4.04	5.98	0.007
	Not Teacher Not CBT	4	7	-0.27	0.24	-1.14	3.52	0.325
	Teacher CBT	14	33	0.07	0.06	1.13	7.29	0.295
	Teacher Not CBT	6	7	-0.04	0.11	-0.36	5.50	0.732
Universal × Teacher	Targeted Not Teacher	6	20	0.92	0.30	3.13	5.52	0.023
	Targeted Teacher	1	1	-0.08	0.11	-0.70	12.11	0.499
	Universal Not Teacher	9	19	0.26	0.10	2.57	5.78	0.044
	Universal Teacher	19	39	0.09	0.08	1.10	9.74	0.297
Teacher × Elementary	Not Teacher Elementary	7	18	0.06	0.17	0.33	6.03	0.750
	Not Teacher Secondary	8	21	0.81	0.25	3.24	7.87	0.012
	Teacher Elementary	11	21	0.06	0.06	1.06	10.00	0.316
Depression × Teacher	Teacher Secondary	9	19	0.03	0.09	0.38	8.15	0.711
	Anxiety Not Teacher	11	22	0.86	0.20	4.29	7.06	0.004
	Anxiety Teacher	14	18	0.03	0.06	0.46	9.76	0.657
	Depression Not Teacher	11	17	0.01	0.19	0.03	8.71	0.980
Depression × CBT	Depression Teacher	15	22	0.07	0.07	0.94	11.34	0.368
	Anxiety CBT	16	32	0.56	0.13	4.38	9.94	0.001
	Anxiety Not CBT	6	8	-0.11	0.19	-0.60	5.82	0.571
	Depression CBT	19	33	0.09	0.11	0.79	13.12	0.443
	Depression Not CBT	5	6	-0.20	0.17	-1.18	3.59	0.310

Note. *k* number of studies, *n* number of outcomes, *ES* effect size, *SE* standard error, *df* degrees of freedom, *CBT* Cognitive Behavior Therapy

cut-off points. In both sensitivity analyses, estimates and significance values were broadly similar to the original results. Results of the exploratory and sensitivity analyses are available from the authors upon request.

Publication Bias

Applying the weight-function model, this study found significant publication bias. In the adjusted model, the test for heterogeneity is significant ($Q [df = 92] = 1485, p < 0.001$). Likelihood ratio test for the model result is significant (x squared = 81.88, $p < 0.001$). This means that the estimated

pooled effect of school-based programs is upwardly adjusted, suggesting that statistically significant positive effects were 38.90 times more likely to be reported than non-significant results. Readers should exercise caution when interpreting the results since there is a good chance that the overall effect is overestimated.

Risk of Bias Analysis

Since this meta-analysis applied stringent inclusion criteria, all the studies fulfill the JBI Checklist's criteria except the sixth criteria, therefore only sixth criteria were coded: Were

outcomes assessors blind to treatment assignment? The risk implied in the sixth criteria is that when assessors of the targeted outcomes are aware of participants' allocation to the treatment or control, there may exist measurement errors. Among the 29 included studies, seven are blinded, 16 are not blinded, and six are unclear. Table 7 presents the risk of bias analysis. Overall, there is a low risk of bias among the included studies.

Discussion

There is an urgent need for schools to provide more mental health services and support; however, existing meta-analyses are insufficient in providing evidence-based insights on high-quality interventions. School-based mental health interventions are promising tools to protect school-aged children, so there is a pressing need to identify and disseminate evidence-based models to address the increasing number of children with depression and anxiety in schools. This meta-analysis aims to identify elements of effective school-based mental health interventions targeting depression and anxiety for K-12 students. This meta-analysis only included RCTs and used more stringent inclusion criteria (e.g., baseline equivalence, no significant differential attrition) and additional moderators (e.g., sample size and program duration) than previous reviews. The results indicate that, overall, compared to control groups, there was a significant positive mean effect of school-based interventions on symptoms of depression and anxiety. However, this result may be somewhat inflated due to publication bias, which was found to be likely in this study.

The overall findings disagree with a previous systematic review and meta-analysis that found a lack of evidence of the effectiveness of school-based interventions focusing on depression or anxiety (Caldwell et al., 2019). One reason to explain this disparity may lie in the method: the present study used a random-effects model looking across studies whereas the previous study used a network meta-analysis approach that is better suited to comparing the relative effectiveness of different interventions. In addition, the difference in inclusion criteria result in very different samples of studies analyzed in each study.

Apart from main findings, the moderator analyses help us gain a better understanding of the characteristics of effective depression- or anxiety-focused interventions. One interesting finding is that interventions focused on anxiety are more effective than those on depression for the K-12 population. Furthermore, the results find that CBT programs were more common and had significantly higher effect sizes than programs of other types. This supports the existing wide-usage of CBT programs (Werner-Seidler et al., 2017) and confirms previous research establishing CBT as an essential

component in depression and anxiety reduction for school-aged children (Rooney et al., 2013). For intervention delivery, this study find that teacher-delivered programs had a lower mean effect than clinician-delivered programs, such that while clinician-delivered programs had significant, positive impacts, teacher-delivered programs had null effects. This finding is consistent with one previous meta-analysis on this topic, which found that programs delivered by non-school personnel are more effective (Werner-Seidler et al., 2021). Grade level was a marginally significant moderator, with interventions being more effective on the secondary-school population compared to the elementary-school population. No significant impacts were found in other moderators: program type (universal vs. targeted), program duration, and sample size. The result on program type disagrees with a previous meta-analysis that suggests targeted programs being more effective compared to universal programs (Werner-Seidler et al., 2021). The null finding from program type may be a result of offsetting effects between targeted programs' pros and cons. Targeted programs' screening and selection process may embarrass students, which further exacerbates their depression and anxiety. The positive effects brought by targeted programs may be nullified by the negative consequences of labeling and stigmatizing students (Huggins et al., 2008). This supports the notion that both targeted and universal program types are useful, and more benefits can be reaped if suitable programs are matched with suitable delivery personnel and treatment populations.

Moreover, the moderator analyses indicate that study-related factors are not significant moderators of impacts. While short-duration interventions had a significantly positive mean effect while long-duration interventions had no significant effect, this difference was not significant. Similarly, small sample sizes were associated with significantly positive effect sizes, while large sample sizes had no significant effects, yet the difference between these was not significant. While intervention duration and sample size may not be significant moderators, another possible explanation is that intervention duration and sample size do not have an impact on the intervention results when using the arbitrary cutoff in the analyses (intervention duration: 12 weeks; sample size: 250).

Interesting findings come from interaction analyses related to delivery personnel, an additional moderator many previous meta-analyses failed to include. The results demonstrated differential effects for delivery personnel by four pairs of interacting moderators. First, the effect sizes vary for personnel by intervention design. Clinicians had higher effect sizes with CBT programs than with non-CBT programs. This suggests that CBT programs have better effects when they are delivered by personnel with psychological backgrounds and professional training, while

Table 7 Risk of Bias Analysis

Study	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8	Criteria 9	Criteria 10	Criteria 11	Criteria 12	Criteria 13
Barnes et al. (2012)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Barrett and Turner (2001)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Britton et al. (2014)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Chaplin et al. (2006)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Collins et al. (2014)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
DeRosier (2004)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Haugland et al. (2020)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Kraag et al. (2009)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Lewis et al. (2013)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
Lowry-Webster et al. (2001)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
Merry et al. (2004)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Mifsud and Rapee (2005)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Miller et al. (2011)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
O’Keamey et al. (2009)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Olive et al. (2019)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Quach et al. (2016)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
Roberts et al. (2003)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Roberts et al. (2010)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Rooney et al. (2006)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Rooney et al. (2013)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Sawyer et al. (2010)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Sheffield et al. (2006)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Shochet et al. (2001)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
Sinclair (2016)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Skryabina et al. (2016)	Y	N	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Spence et al. (2005)	Y	N	Y	U	N	U	Y	Y	Y	Y	Y	Y	Y
Stein et al. (2003)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Tak et al. (2016)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y
Volanen et al. (2020)	Y	N	Y	U	N	N	Y	Y	Y	Y	Y	Y	Y

Note. Criteria 1. Was true randomization used for assignment of participants to treatment groups? Criteria 2. Was allocation to treatment groups concealed? Criteria 3. Were treatment groups similar at the baseline? Criteria 4. Were participants blind to treatment assignment? Criteria 5. Were those delivering treatment blind to treatment assignment? Criteria 6. Were outcomes assessors blind to treatment assignment? Criteria 7. Were treatment groups treated identically other than the intervention of interest? Criteria 8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed? Criteria 9. Were participants analyzed in the groups to which they were randomized? Criteria 10. Were outcomes measured in the same way for treatment groups? Criteria 11. Were outcomes measured in a reliable way? Criteria 12. Was appropriate statistical analysis used? Criteria 13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?
 Y Yes, N No, U Unclear

non-CBT programs have null effects no matter who they are delivered by. This makes sense because delivering CBT programs needs rigorous training and experience working in mental health fields.

Second, the effects of interventions vary for personnel by intervention type. Clinician-delivered programs had higher effect sizes for the targeted population than for the universal population (though both were significant and beneficial); while teacher-delivered programs showed the opposite pattern, although both were non-significant. Clinicians tend to have better effects when delivering programs to the targeted population. In targeted approaches, children demonstrate symptoms of depression or anxiety. In such cases, clinicians have more expertise in treating these symptoms compared to classroom teachers, so clinicians are likely to use more professional strategies when delivering programs to the targeted population.

Third, the effect sizes of interventions also vary for personnel by grade level. Compared to teachers, clinicians had a noticeably larger mean effect size at the secondary school level. Teachers had similar (non-significant) effect sizes at the elementary school level and at the secondary school level. One explanation for this may be that because adolescents experience a more severe level of mental health impairment than children (Olfson et al., 2015), adolescents may be more receptive to CBT interventions delivered by clinicians. It may also be that older students are more able to engage with and understand the content of the intervention, due to their more mature cognitive processes (Stice et al., 2009). This also fits with recommendations to target these symptoms early (ages 11–15), before those behaviors and beliefs become ingrained (Gladstone et al., 2011).

Fourth, the effects of interventions vary for personnel by intervention outcomes. For clinicians, they had larger impacts on average on anxiety outcomes, with null effects on depression outcomes, while for teachers, they had null effects on both depression and anxiety outcomes.

Limitations and Strengths

Readers may want to take note of several limitations when interpreting the results. First, this study only focuses on depression and anxiety outcomes. In the process of coding, the authors found some other interesting outcomes worth investigating, such as internalizing problems, stress, externalizing problems (Fung et al., 2019), worry (Skryabina et al., 2016), depression literacy (O’Kearney et al., 2009), stigma, and help-seeking tendencies (Link et al., 2020). The limited number of studies investigating these outcomes restricts this study’s ability to perform meaningful meta-regression analysis. Future studies can focus on these commonly under-researched outcomes of interest. Second, the authors were not able to extract information on socio-economic status (SES) for

all studies, which could be a valuable moderator to the outcomes. SES may have impacts on the prevalence of mental health issues, access to treatment and support, the delivery personnel of mental health interventions. SES can be reflected in free and reduced lunch eligibility, household median income, single or double parenting etc. Future studies can examine the moderator effect of SES on depression and anxiety. Third, two of the twelve inclusion criteria used arbitrary cut-off points, which may have led to the exclusion of quality articles. However, during the screening process, only 10 studies were excluded because they have a sample size smaller than 60 and six studies were excluded because the program duration is less than five weeks. In total, this means that 7.33% of the studies were excluded in the full-text review stage due to these arbitrary cut-offs, so the results are likely not changed substantially by their exclusion. Fourth, publication bias was identified in the sample. That likely means there are many studies that have not been made public, and those studies likely have null effects. The average effect sizes reported here are likely larger than what would be seen if all studies were reported.

Despite these limitations, this study has a number of strengths and makes significant contributions to existing literature. Unlike previous meta-analyses on this topic, this article adds program duration, sample size, delivery personnel, and grade level as moderating factors. Understanding the effects of these additional moderators is important for making evidence-based decisions as well as designing future interventions. The findings related to the heterogeneity of delivery personnel and its interactions with other program features have implications for policymakers and practitioners.

Recommendations for Future Research

Future meta-analyses may benefit from doing further moderator and interaction analysis in this vein. Moreover, this study applied more stringent inclusion criteria to identify high-quality primary studies. The quality of systematic reviews depends on the quality of primary studies. Many previous meta-analyses acknowledge inconsistencies in primary studies’ quality as one limitation (e.g., Gerlinger et al., 2021). This study only included RCTs that meet certain standards, such as having equivalence in baseline conditions, low attrition rates, etc. However, the field would be stronger with more rigorous studies, that report more details about the population, such as SES data, as well as better descriptions of the counterfactual. Additionally, there is a dearth of effective programs at the elementary level as well as those delivered by teachers. Future work should explore if there are ways for teachers to deliver effective mental health programming or whether it can be implemented with younger students as a preventative approach.

Implications for Policy

This meta-analysis provides updated evidence and has practical implications for policymakers. While child and adolescent mental health has always been a concern, the need for services for school-age children is even greater, as mental health needs have increased as a result of the COVID-19 pandemic (Pfefferbaum, 2021). Given limited resources, investment in students' mental health and overall well-being often faces competition from investment in academic achievement given the intense pressure to enhance performance (Zhang & Storey, 2022). It is essential that any efforts to provide school-based mental health interventions using this limited funding prioritize evidence-based interventions.

The current study highlights that depression- and anxiety-focused school-based interventions are more effective when delivered by professionals, such as certified clinicians or psychologists, compared to classroom teachers or school-health staff. In reality, this need is unmet by many schools due to a severe shortage of clinicians countrywide, not to mention pediatric clinicians (Elias, 2021). Policymakers should consider implementing more creative incentives, such as reducing costs to obtain certifications or enabling smoother transitions from associate degrees to bachelor's degrees, to build a pipeline for school-based mental health clinicians (Kirchner & Cuneo, 2022).

Although this meta-analysis concludes that teacher interventions are not effective, some school districts may be unable to employ enough clinicians to provide mental health supports to their students. In those cases, where schools must rely on teachers to deliver interventions, based on data from other meta-analyses and applying a caution approach, we recommend focusing the available mental health professionals on the targeted populations at the secondary level while having teachers provide universal interventions at the elementary level. Another policy takeaway is that innovative programs are not necessarily better than traditional programs. There is a lack of conclusions on new interventions' (e.g., mindfulness, yoga, positive psychology) effectiveness, but ample evidence on CBT programs' efficacy.

Conclusion

Past meta-analyses provide many insights, yet they fail to use stringent criteria and diverse moderators. In light of the increasing incidence rates of depression and anxiety among children, there is an imperative to provide proven services to school-aged children. To synthesize rigorous past studies, this meta-analysis only included RCTs and used more stringent inclusion criteria (e.g., baseline equivalence, no

significant differential attrition) and additional moderators (e.g., sample size and program duration) than previous reviews. This meta-analysis found that, overall, school-based mental health interventions in school settings are effective at reducing depression and anxiety. However, these impacts may be somewhat inflated due to likely publication bias. Moderator analysis shows that anxiety-focused interventions are more effective than depression-focused programs, cognitive behavioral therapy is more effective than other types of programs, clinicians are more effective than teachers, and programs focusing on secondary school adolescents are more effective than those focusing on elementary school children. For practitioners, useful implications from this meta-analysis are that CBT is an effective program type and certified clinicians are more effective as compared to trained teachers in delivering mental health interventions, while efforts should focus on the secondary school level. More research is needed to explain the mechanisms behind effective elements in interventions and differences between children and adolescents. Although trained teachers are less costly and more widely available, this meta-analysis found that hiring professional psychologists or clinicians to deliver interventions produces more visible enhancements. At the same time, this field-specialization can also reduce teachers' burdens and help them focus on teaching. In the post-pandemic era, identifying evidence-based mental health interventions can help us better prevent the onset of depressive and anxiety symptoms from an early stage.

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Data Sharing and Declaration The datasets generated and/or analyzed during the current study are available in the github repository: <https://github.com/qiyangzh/School-based-Mental-Health-Interventions-Targeting-Depression-or-Anxiety-A-Meta-analysis>

Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

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