Society of Medical Education & Research

2025, Volume 5, Page No: 208-224
ISSN: 3108-4818

International Journal of Social and Psychological Aspects of Healthcare

A Systematic Review and Meta-Analysis of the Long-Term Effectiveness of Interventions Targeting Mental Health Literacy and Reducing Stigma of Mental Illness in Children and Adolescents

Tereza Novakova[1]*, Petr Svoboda[1]

[1]Department of Psychology, Faculty of Social Studies, Masaryk University, Brno, Czech Republic.

***E-mail** ✉ tereza.novakova@outlook.com

Abstract

The goal of this research is to conduct a comprehensive systematic review and meta-analysis examining the sustained impacts of programs designed to enhance mental health literacy and/or decrease stigmatizing views among children and adolescents. Publications in English or German from January 1997 to May 2020 were searched across five databases, resulting in an initial identification of 4,375 unique articles. Following the application of exclusion standards, 25 studies were selected for inclusion, with 13 suitable for meta-analytic synthesis. The mean follow-up duration across studies was approximately 5 months. Sustained positive effects over the long term were observed for mental health literacy, d = 0.48, 95 percent CI = (0.34, 0.62), stigmatizing attitudes, d = 0.30, 95 percent CI = (0.24, 0.36), and social distance, d = 0.16, 95 percent CI = (0.03, 0.29). Interventions incorporating both educational and contact elements yielded poorer outcomes for mental health literacy, though this was not the case for stigmatizing attitudes or social distance. Programs aimed at children and adolescents typically feature short follow-up intervals averaging 5 months. These initiatives demonstrate enduring gains in mental health literacy, yet they achieve more limited success in reducing stigma toward mental illness or decreasing social distance.

Keywords: Adolescents, Long-term effectiveness, Mental health literacy, Stigma, Social distance, Intervention

Introduction

The majority of mental health conditions onset in childhood or adolescence. It is estimated that 75 percent of mental disorders begin prior to age 25, and half before age 14 [1]. In addition to the suffering and functional limitations caused by these disorders, they exert adverse influences on educational performance, interpersonal connections, and employment stability, generating lasting societal and economic burdens into adulthood. Such detrimental impacts extend beyond the active phase of the disorder and can shape an individual's future mental health course [2, 3].

On a global scale, a substantial gap persists between the demand for mental health care and its availability and uptake across all age groups, hindered by various barriers such as resource constraints or insufficient knowledge about mental health [4]. This article emphasizes two critical elements believed to help bridge this gap: mental health literacy (MHL) and stigma.

The concept of MHL was initially introduced by Jorm *et al*. [5] as "knowledge and beliefs about mental disorders which aid their recognition, management or prevention." It has been recognized as a key determinant of help-seeking through professional mental health services [6]. In particular, Tully *et al*. [7] propose that low MHL among parents and surrounding adults may play a major role in the underuse of treatment services, especially for youth. Nevertheless, MHL represents a resource that can be developed at both individual and community levels in young populations. From a public health standpoint,

Access this article online https://smerpub.com/

Received: 07 May 2025; **Accepted:** 03 September 2025

How to cite this article: Novakova T, Svoboda P. A Systematic Review and Meta-Analysis of the Long-Term Effectiveness of Interventions Targeting Mental Health Literacy and Reducing Stigma of Mental Illness in Children and Adolescents. Int J Soc Psychol Asp Healthc. 2025;5:208-24. https://doi.org/10.51847/QSv95MjQE9

equipping children and adolescents with the ability to pursue assistance for psychological issues is essential for secondary and tertiary prevention of mental disorders (namely, treatment or ongoing management).

Stigma linked to mental illness similarly constitutes a major obstacle to help-seeking and has been characterized as "having worse consequences than the conditions themselves" [8]. This stems in part from prevalent biases and stereotypes (e.g., viewing individuals with mental illness as weak, dangerous, or incompetent), which foster discrimination at structural and personal levels—in settings like employment, healthcare, or daily interactions [9]. When confronted with these stereotypes, affected individuals may internalize stigma, resulting in diminished self-worth, reduced self-efficacy, adverse emotions, and behaviors that additionally impair life quality [10]. Consequently, self-stigma or anticipation of stigma may deter people from pursuing professional care, adversely affecting their subsequent mental well-being [11].

As described, the likelihood of seeking help upon noticing mental illness symptoms is thought to be closely tied to societal views of mental illness, encompassing stigmatizing perspectives. Therefore, stigma is a common focus in research on mental disorders [12]. Although numerous programs exist to support mental health in children and adolescents, O'Reilly *et al*. [13] have highlighted the inadequate evidence supporting them and raised concerns about their enduring effectiveness. Furthermore, while anti-stigma interventions have undergone more frequent reviews [14–16], information on MHL remains scarcer. Moreover, to our knowledge, prior reviews of MHL-enhancing programs for children and adolescents have not addressed long-term efficacy. Notable works in this area, varying in focus and breadth, include those by Wei *et al*. [17] (evaluating overall program efficacy), Seekadet *et al*. [18] (examining efficacy by program type), and Patafio *et al*. [19] (surveying available programs). Certain drawbacks in the Wei *et al*. [17] and Patafio *et al*. [19] reviews involved incorporating studies without control groups, suggesting less robust designs and potentially biased findings. By comparison, the current review restricts inclusion to controlled studies and concentrates on sustained program effects.

Aim

This work seeks to deliver a systematic review and meta-analysis of programs intended to boost MHL in youth and/or diminish stigma associated with mental illness within this population. MHL and stigma are treated as distinct, though potentially interconnected, program outcomes, recognizing that MHL, in its present conceptualization, is multifaceted and might encompass stigma alongside other components. Nonetheless, separating MHL and stigma as outcomes helps prevent the confusion and variability that occur when diverse measured elements are grouped under the broad term "MHL" [20].

Furthermore, to address the existing shortfall in understanding the enduring impacts of such programs [14, 15], emphasis is placed on studies that include three assessment points to track outcomes over time.

Research question: Are programs in mental health directed at children and adolescents successful in 1) lowering stigma toward mental illness and/or 2) enhancing MHL over the long term?

Materials and Methods

Search methodology

To identify evaluated programs targeting stigma related to mental health and/or mental health literacy (MHL) in children and adolescents, searches were performed in the following databases for publications in English or German from 1997—the year the concept of "mental health literacy" was coined by Jorm *et al*. [5]: PubMed, PsycINFO, PSYNDEX, ERIC, and Web of Science Core Collection. Direct searches were conducted in PubMed and Web of Science, whereas PsycINFO, PSYNDEX, and ERIC were accessed through the EBSCOhost platform. The search process occurred in two stages: the first covered articles published from 1997 to May 2018 and was carried out by two researchers; the second, added later due to delays in publication, extended the coverage from May 2018 to May 2020 to ensure up-to-date findings. Identical search terms were applied across both stages.

The search strategy was refined iteratively within the research team, with input sought from librarians and external specialists. The query was tailored to the specifics of each database.

In addition, a hand-search was undertaken by reaching out to experts and relevant organizations and by reviewing the reference lists of prominent articles identified in the database searches.

Inclusion and exclusion criteria

Studies qualified for inclusion if they:

- involved children and adolescents, using 18 years (the typical age of legal consent) as a general guideline while allowing inclusion of studies with a small number of participants slightly above this age,
- incorporated three assessment time points: baseline (pre-intervention), immediate post-intervention, and a later follow-up,
- implemented an active intervention program,
- featured a control condition or compared the intervention to treatment as usual,
- measured mental health-related stigma and/or MHL via direct self-reports from the young participants, rather than proxy reports from caregivers or teachers.

Studies were excluded if they:

- provided no details on participants' age or educational affiliation, making it impossible to determine minor status,
- assessed MHL and/or stigma indirectly through proxies such as parents or teachers instead of the youth themselves,
- presented no outcome data (e.g., protocols or abstracts of ongoing trials).

Selection process

Records retrieved from the databases, including titles, abstracts, and keywords, were imported into reference management software.

Duplicates were first removed automatically by the software and then confirmed manually by two researchers across both search phases. Next, to calibrate screening, the same two researchers jointly reviewed 200 abstracts, achieving an initial agreement rate of 86.5%; after resolving differences through discussion, full consensus was reached in a subsequent joint review.

Title and abstract screening was then performed independently: in the first phase by both researchers (with one handling PsycINFO and Web of Science, and the other covering PubMed, ERIC, and PSYNDEX), and in the second phase by a single researcher across all databases.

Full texts of potentially eligible studies were retrieved via the university library system; when unavailable, corresponding authors were contacted. Full-text evaluation was conducted jointly by the two researchers in the first phase and by one researcher in the second phase. Any doubts about eligibility were addressed through discussion until agreement was reached on inclusion or exclusion. Data from the final set of included studies were then systematically extracted into custom tables detailing sample characteristics and intervention features.

Quality assessment

The methodological quality of included studies was independently evaluated by two authors using the 14-item Checklist for quality assessment of controlled intervention studies provided by the National Heart, Lung, and Blood Institute [21]. Ratings for each item were compared, and disagreements were settled through discussion. Overall quality scores were calculated based on the checklist criteria, with a point allocated for each affirmative response.

The item on participant blinding was excluded from the total score, as blinding is typically impractical in educational interventions. Additionally, an extra criterion—provision of training for intervention facilitators—was considered for fidelity but also omitted from scoring. For item 13 (prespecification of outcomes or subgroups), scoring was nuanced: full preregistration earned 1 point, while merely stating outcome changes as aims earned 0.5 points. Final scores ranged from 0 (indicating very high risk of bias) to 13 (indicating low risk of bias).

Data analysis

Weighted averages were calculated for the duration of follow-up periods and for participants' mean ages. In cases where follow-up duration was given as a range, the midpoint of that range was used. Although odds ratios were initially planned for binary outcomes, this was feasible for only two studies. Studies that provided means and standard deviations for the primary outcomes were identified and incorporated into a meta-analysis employing a random-effects model. The meta-analysis was performed by one author using STATA version 16 [22]. Given the diversity of assessment instruments, outcomes were consolidated into three broad domains [1]: mental health literacy (MHL), stigmatizing attitudes, and social distance. Heterogeneity was quantified using Higgins's I^2 statistic, which reflects "the proportion of variation between the sample estimates that is due to heterogeneity rather than to sampling error" [23]. An I^2 value of 50% or higher was interpreted as indicating substantial heterogeneity [23].

These domains were derived inductively, taking into account both the theoretical conceptualization and the operationalization of the instruments employed. When studies did not explicitly label the construct assessed, categorization was based on a close examination of the measures:

- MHL: items focused on knowledge,
- stigmatizing attitudes: items capturing attitudes (e.g., endorsement of stereotypes about mental illness),
- social distance: items assessing willingness to engage in interactions with individuals experiencing mental illness across different situations.

Finer distinctions within MHL (e.g., distinguishing general mental health literacy from disorder-specific knowledge, such as depression literacy) or within stigma (e.g., isolating self-stigma) were explored but ultimately not pursued due to insufficient numbers of studies in each subcategory.

In addition, linear meta-regression was conducted to examine whether the timing of post-intervention or follow-up assessments influenced effect sizes. Potential moderating effects of intervention format (purely educational versus educational combined with contact components) and study design (randomized controlled trials versus non-randomized designs) were also evaluated.

Results and Discussion

The database searches yielded 6,345 records, with 1,975 identified as duplicates. Hand-searching added a further 5 articles. The detailed flow of the screening and selection procedure is depicted in **Figure 1**. Ultimately, 25 studies met criteria for inclusion in the review. Of these, ten focused exclusively on stigma outcomes, three targeted MHL alone, and twelve evaluated both constructs.

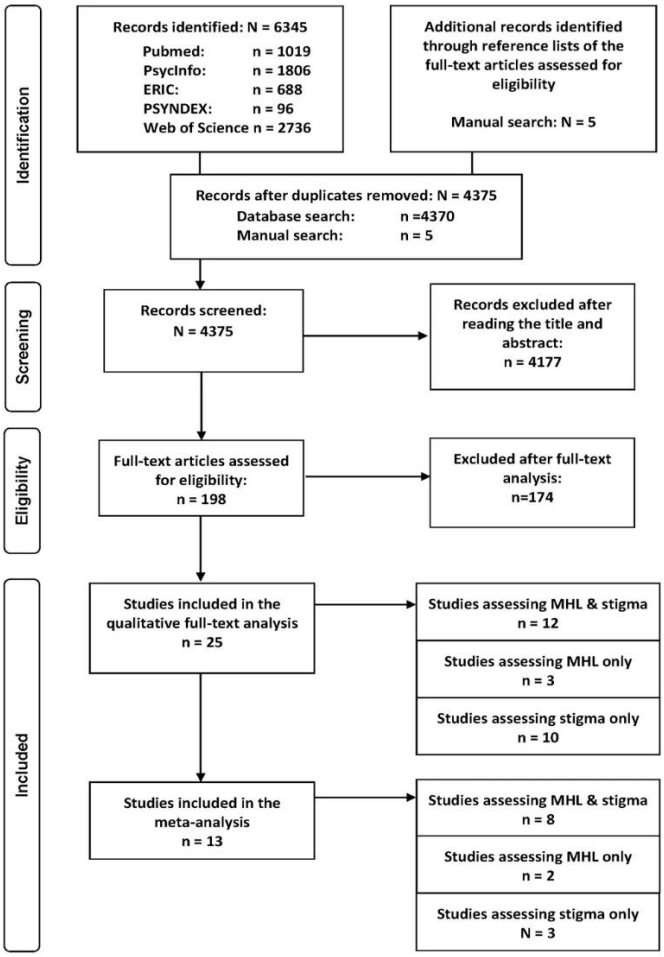

Figure 1. PRISMA diagram outlining the selection process for articles in this systematic review on the sustained impact of programs aimed at enhancing mental health knowledge and decreasing negative attitudes toward

psychological disorders among youth, covering publications from January 1997 through May 2020. This work was part of the IMPRES initiative (Improving Mental Health Literacy to Reduce Stigma), conducted in Bielefeld, Germany, from March 2018 to February 2021.

An initial search up to May 2018 identified 17 relevant articles, while an updated search from May 2018 to May 2020 added 8 more. Based on the predefined criteria for inclusion and exclusion, every selected article included at least three assessment points overall. This requirement of multiple assessments was strictly met for the groups receiving the programs, though four articles deviated slightly for the comparison groups (specifically, studies numbered 1, 5, and 11 lacked a delayed assessment, and study 6 skipped the immediate post-evaluation in favor of proceeding directly to the delayed one). These were retained to preserve a broader set of evidence. The typical delay to the final assessment was approximately 5 months following program completion. In cases where articles featured multiple assessments beyond the immediate post-program point, analyses focused on the initial and final delayed evaluations.

Overview of key features in selected articles

An overview of essential features across the selected articles is provided in **Table 1**, with detailed accounts of individual articles available in **Table 2**.

Table 1. Overview of characteristics in studies evaluating sustained impacts on mental health literacy and/or stigma related to mental disorders among children and adolescents: search period January 1997 to May 2020. Project: Improving Mental Health Literacy to Reduce Stigma (IMPRES), Bielefeld, Germany, March 2018 – February 2021.

Characteristic	All included studies (n = 25)	Studies suitable for meta-analysis (n = 13)
Sample size	n = 18,157	n = 6,528
Study design	52% randomized controlled trials (randomization at school, class, or individual level)	38.5% randomized controlled trials (randomization at school, class, or individual level)
Follow-up duration (weeks)	Weighted mean = 23.14 Range = 4.3–103.2	Weighted mean = 23.73 Range = 6–103.2
Participants' age (years)	Weighted mean = 14.55 Range = 9–21	Weighted mean = 14.50 Range = 9–18
Continent	• Europe: 9 • Australia: 7 • North America: 6 • Asia: 3	• North America: 4 • Australia: 7 • Europe: 2 • Asia: 2
Setting	76% school-based; remainder in community settings, school/sports clubs, or clinical samples	69.23% school-based; remainder in community settings, school/sports clubs, or clinical samples
Intervention type	• Education only: 11 • Education + contact: 10 (in-person: 8; in-person + video: 1; video only: 1) • Direct comparison of education vs. education + contact: 1 • Indirect via parent training: 1 • Contact only (video): 1 • Unknown: 1	• Education only: 8 • Education + contact: 3 (in-person: 2; in-person + video: 1) • Indirect via parent training: 1 • Unknown: 1
Main topic of intervention	• General mental health: 17 • Specific disorder: 7 (depression: 4; schizophrenia: 3) • Unknown: 1	• General mental health: 9 • Specific disorder: 3 (depression: 3) • Unknown: 1
Total intervention duration	Range: <1–18 hours • ≤1 hour: 5 • >1–5 hours: 8 • >5–9 hours: 3 • >9 hours: 6	Range: <1–18 hours • ≤1 hour: 1 • >1–5 hours: 5 • >5–9 hours: 0 • >9 hours: 4

	• Unknown: 3	• Unknown: 3
Intervention timespan	Range: 1 day to 2.5 months • 1 day: 10 • >1 day to <1 week: 6 • >1 week to <1 month: 2 • ≥1 month: 4 • Unknown: 3	Range: 1 day to 2.5 months • 1 day: 3 • >1 day to <1 week: 5 • >1 week to <1 month: 0 • ≥1 month: 3 • Unknown: 2
Intervention deliverer	• Mental health professional/teacher/researcher/unknown + person with lived experience: 8 • Teacher (with researcher in 1): 5 • Mental health professional: 4 • Trained facilitator: 3 • Person with lived experience only: 2 • Unknown: 4 (note: total n=26; one study compared two delivery modes)	• Mental health professional/teacher + person with lived experience: 2 • Teacher (with researcher in 1): 4 • Mental health professional: 3 • Trained facilitator: 1 • Person with lived experience only: 1 • Unknown: 3 (note: total n=14; one study compared two delivery modes)
Teaching methods	Multimodal approach: 21; predominantly single method: 2; unknown: 2 • Educational lectures/presentations: 21 • Interactive activities (games, role-plays, exercises): 15 • Facilitated discussions: 12 • Q&A with person sharing lived experience: 9 • Educational videos: 8	Multimodal approach: 10; predominantly single method: 1; unknown: 2 • Educational lectures/presentations: 11 • Interactive activities (games, role-plays, exercises): 8 • Facilitated discussions: 5 • Q&A with person sharing lived experience: 4 • Educational videos: 4

Q&A = question and answer.

Table 2. Studies evaluating the sustained impacts on mental health literacy and/or stigma toward mental disorders in children and adolescents: detailed overview of each individual study, search period January 1997 to May 2020. Project: Improving Mental Health Literacy to Reduce Stigma (IMPRES), Bielefeld, Germany, March 2018 – February 2021.

No.	Authors (Year) [Ref]	Country	Setting	Participant age (mean)	Participant age (SD)	Participant age range/grade	Sample size (baseline)	Follow-up duration (weeks)	Risk of bias score (0–13; higher = lower risk)	Randomization	Assessed outcomes	Outcome categories	Intervention type	Intervention topic
1	Ahmad *et al.* (2019) [20]	United States	School clubs	Not reported	Not reported	Not reported	545	15.05	3.5	Yes (school level)	MHL, S	MHL, stigmatizing attitudes, social distance	Unknown	Unknown

9	8	7	6	5	4	3	2
Perry *et al.* (2014) [28]	Morgan *et al.* (2019) [27]	Lai *et al.* (2016) [26]	Ibrahim *et al.* (2020) [25]	Fraser *et al.* (2008) [24]	Esters *et al.* (1998) [23]	Campos *et al.* (2018) [22]	Andrés-Rodríguez *et al.* (2017) [21]
Australia	Australia	China	Malaysia	Australia	United States	Portugal	Spain
School	Community	School	Clinical population (with	Clinical population	School	School	School
14.8	13.3	15.1	14.61	13.34	14.7	13.04	14.24
0.73	1.54	1	1.39	1.58	Not reported	0.79	0.47
13–16	12–15	14–16	13–17	12–17	13–17	12–14	14–18
380	301	3391	101	44	40	543	393
25.8	103.2	19.35	12.9	19	12	25.8	38.7
7	10	4.5	4.5	0.5	2	2.5	4.5
Yes (class level)	Yes (individual level)	No	No	No	No	Yes (class level)	No
MHL, S	S	MHL, S	MHL, S	MHL	S	MHL	S
MHL, stigmatizing attitudes	Stigmatizing attitudes, social distance	MHL, stigmatizing attitudes	MHL, stigmatizing attitudes	MHL	Stigmatizing attitudes	MHL	Stigmatizing attitudes, social distance
Education	Indirect: education for	Education	Education	Education	Education	Education	Education + contact
General mental health	General mental health	Specific: depression	Specific: depression	General mental health	General mental health	General mental health	General mental health

17	16	15	14	13	12	11	10
Economou *et al*. (2011) [36]	Conrad *et al*. (2009) [35]	Chisholm *et al*. (2016) [34]	Campbell *et al*. (2010) [33]	Wahl *et al*. (2011) [32]	Ventieri *et al*. (2011) [31]	Robinson *et al*. (2010) [30]	Pinto-Foltz *et al*. (2011) [29]
Greece	Germany	United Kingdom	United Kingdom	United States	Australia	Australia	United States
School	School	School	School	School	School	School	School
13.84	Not reported	12.21	14.64	12.5	10.67	15.2	15
0.82	Not reported	0.58	0.48	0.6	0.89	0.5	0.67
13–15	13–18	12–13	14–15	7th–8th grade	9–12	14–16	13–17
616	210	769	92	193	195	246	156
51.6	12.9	25.8	10	6	17.2	10.6	8
5.5	1.5	9	6.5	1.5	1.5	1.5	6.5
Yes (class level)	No	Yes (class level)	Yes (class level)	No	No	No	Yes (class level)
S	S	MHL, S	S	MHL, S	MHL, S	MHL, S	MHL, S
Stigmatizing attitudes	Social distance	MHL, social distance	Stigmatizing attitudes	MHL, stigmatizing attitudes, social	MHL, stigmatizing attitudes, social	MHL, stigmatizing attitudes, social	MHL, social distance
Education	Education + contact	Education vs. education + contact	Education + contact	Education	Education	Education + contact (in-	Education + contact
Specific: schizophrenia	General mental health	General mental health	Specific: psychosis (categorized as schizophrenia)	General mental health	General mental health	Specific: depression	General mental health

25	24	23	22	21	20	19	18
Wahl *et al.* (2018) [44]	Swartz *et al.* (2017) [43]	Schulze *et al.* (2003) [42]	Ng *et al.* (2002) [41]	Mulfinger *et al.* (2018) [40]	Liddle *et al.* (2021) [39]	Hart *et al.* (2019) [38]	Goncalves *et al.* (2015) [37]
United States	United States	Germany	China	Germany	Australia	Australia	Portugal
School	School	School	School	Clinical population	Football club	School	School
14.7	Not reported	15.1	15	15.75	14.3	15.87	Not reported
Not reported	Not reported	Not reported	Not reported	1.63	1.75	0.52	Not reported
13–18	14–15	14–18	13–21	Not reported	12–18	15–17	7th–9th grade
932	6679	150	169	98	102	1605	207
5	17.2	4.3	30.1	6	4.3	51.6	4.3
1.5	3	1.5	3.5	9	9	7	3.5
No	Yes (school level)	No	No	Yes (individual within clusters)	Yes (team/age-group level)	Yes (school level)	Yes (class level)
MHL, S	MHL, S	S	S	S	MHL, S	MHL	S
MHL	MHL, social distance	Stigmatizing attitudes, social distance	Stigmatizing attitudes	Self-stigma	MHL, stigmatizing attitudes	MHL	Stigmatizing attitudes, self-stigma
Education + contact (video)	Education	Education + contact	Education + contact	Education + contact	Education + contact	Education	Contact (video)
General mental health	Specific: depression	Specific: schizophrenia	General mental health	General mental health	General mental health	General mental health	General mental health

Studies numbered 1 to 13 were eligible for inclusion in the meta-analysis. Where age range was unavailable, school grade information is provided instead. Sample sizes reflect baseline data collection. Follow-up weeks were calculated by multiplying reported months by 4.3; when only a range

was given, the midpoint was used; for multiple follow-ups, the longest was recorded. MHL = mental health literacy; S = stigma; stigmatizing attitudes = measures of negative attitudes; social distance = desire for distance from people with mental illness; self-stigma = internalized stigma. Intervention types: E = education only; C = contact (in-person or video-based). MH = mental health.

Research was carried out across nine countries. The majority took place in educational settings, typically integrated into standard class time, with only six exceptions (three in clinical environments, two in sports or after-school clubs, and one in a community setting). Most investigations involved participants of both genders, though two focused exclusively on boys (studies 11 and 20), and one solely on girls (study 10). Participants had a mean age of 14.55 years, with ages spanning from 9 to 21 years.

The primary approaches to intervention were education-only programs (n = 11) and programs combining education with direct contact (n = 10). The other four adopted varied strategies: one directly contrasted education-only with education-plus-contact (study 15), one featured solely video-based contact with an individual who had lived experience of mental illness (study 18), one used an indirect approach targeting parents (study 8), and one lacked a clear description of its intervention format (study 1). The bulk of programs covered broad mental health themes (n = 17), whereas others concentrated on particular conditions, namely depression (n = 4) or schizophrenia (n = 3).

Programs varied considerably in structure and delivery. Length ranged from less than one hour to as long as 18 hours, with more than half (13 of 22) lasting no more than five hours; three failed to specify duration. In terms of overall timeframe, ten were delivered in a single day (short-term), eight extended up to one week (n = 6) or one month (n = 2) (mid-term), and four exceeded one month (long-term).

Delivery was commonly handled jointly by educators and mental health specialists. One investigation examined differences in outcomes when the same program was led by specialists versus teachers (study 7). Various formats were employed, often blending lectures or videos with interactive elements such as activities, games, role-playing, or facilitated discussions. Nine programs incorporated direct personal contact, allowing individuals with lived experience of mental illness to share their stories and answer questions.

Intervention Effects on Stigma Reduction and Mental Health Literacy (MHL) Enhancement

Where available, means and standard deviations were extracted from reports (n = 12); additional data were supplied by one author upon request (study 13), but could not be obtained for the rest. Study 15 provided complete means but lacked a no-intervention control, instead comparing two variants of the same program, and was therefore omitted from meta-analysis to avoid bias. Study 7, which tested two delivery modes (professional-led vs. teacher-led) against a shared control, was treated as two independent comparisons, adjusting participant counts accordingly (though the full control group appears in meta-analysis figures).

Ultimately, 13 independent comparisons entered the meta-analysis. Five derived from randomized controlled trials (studies 1, 3, 8, 9, 10), with the remainder using non-random allocation. The weighted mean follow-up duration was approximately 24 weeks (ranging from 6 weeks to 2 years). Regression modeling showed no meaningful influence of time on effect stability, suggesting that gains in knowledge and attitude improvements (including reduced social distance preferences) persisted across the observed period.

Meta-regression revealed no notable impact of intervention format (education-only, education-plus-contact, or unclear) on stigma-related attitudes or social distance at either immediate or follow-up assessment. However, MHL gains were significantly smaller for contact-only approaches versus education-only at both immediate [$\beta = -0.84$; 95% CI (-1.51, -0.16); SE = 0.35; $p < 0.05$] and later evaluation [$\beta = -0.46$; 95% CI (-0.87, -0.04); SE = 0.21; $p < 0.05$]. The unclear-format study also yielded markedly poorer MHL results immediately post-intervention [$\beta = -1.02$; 95% CI (-1.66, -0.38); SE = 0.33; $p < 0.01$].

Randomized designs produced significantly smaller effect sizes than non-randomized ones for stigmatizing attitudes [$\beta = -0.27$; 95% CI (-0.52, -0.02); SE = 0.13; $p < 0.05$], social distance [$\beta = -0.26$; 95% CI (-0.49, -0.04); SE = 0.11; $p < 0.05$], and MHL [$\beta = -0.67$; 95% CI (-1.08, -0.26); SE = 0.21; $p = 0.001$] immediately after intervention. At follow-up, this pattern held only for MHL [$\beta = -0.39$; 95% CI (-0.66, -0.13); SE = 0.13; $p < 0.01$], with no design-related differences for attitudes or social distance.

Mental health literacy outcomes

Data from eight studies (3,979 participants) informed immediate post-intervention MHL effects, while seven studies (3,522 participants) contributed to longer-term assessment **(Figure 2).** Programs produced a significant medium-sized improvement in MHL shortly after delivery (within 1–2 weeks) [d = 0.62, 95% CI (0.34, 0.91)]. This benefit moderated somewhat over an average of 23.62 weeks (range 6–25.8 weeks) but retained statistical significance and a medium effect [d = 0.48, 95% CI (0.34, 0.62)]. Substantial heterogeneity was evident at both time points (I^2 = 94.44% immediately; I^2 = 71.51% at follow-up). Two investigations reported non-significant negative effects at each assessment

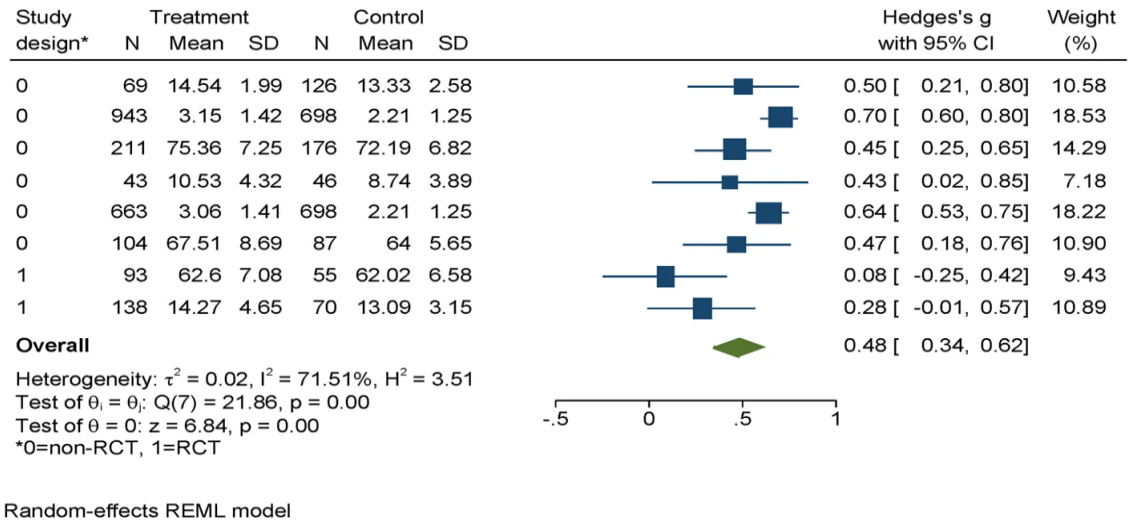

Figure 2. Evidence of intervention effectiveness on mental health literacy at follow-up
this figure summarizes the findings from the review examining long-term interventions aimed at enhancing mental health literacy and reducing stigma of mental illness among children and adolescents, covering studies published from January 1997 to May 2020. Project: Improving Mental Health Literacy to Reduce Stigma (IMPRES), Bielefeld, Germany, March 2018 – February 2021.

.

Stigmatizing attitudes

Ten studies, encompassing 4,272 participants, assessed stigmatizing attitudes immediately after the interventions, while nine studies with 3,710 participants reported follow-up results. Most post-intervention assessments occurred within 1–2 weeks, except for one study that measured outcomes after 52 weeks. Follow-up assessments averaged 23.62 weeks, ranging from 6 to 103 weeks. Overall, interventions demonstrated sustained improvements, with effect sizes of d = 0.30 (95% CI: 0.17–0.43) at post-assessment and d = 0.30 (95% CI: 0.24–0.36) at follow-up **(Figure 3).** At post-test, three randomized controlled trials (RCTs) showed non-significant reductions in stigmatizing attitudes, while the remaining studies reported significant improvements. During follow-up, approximately two-thirds of the studies observed positive but non-significant effects, only two of which were RCTs. Notably, a single study divided into two conditions contributed disproportionately (68.83%) to the follow-up results. Heterogeneity was high at post-assessment (I^2 = 74.13%) but dropped to 0% at follow-up.

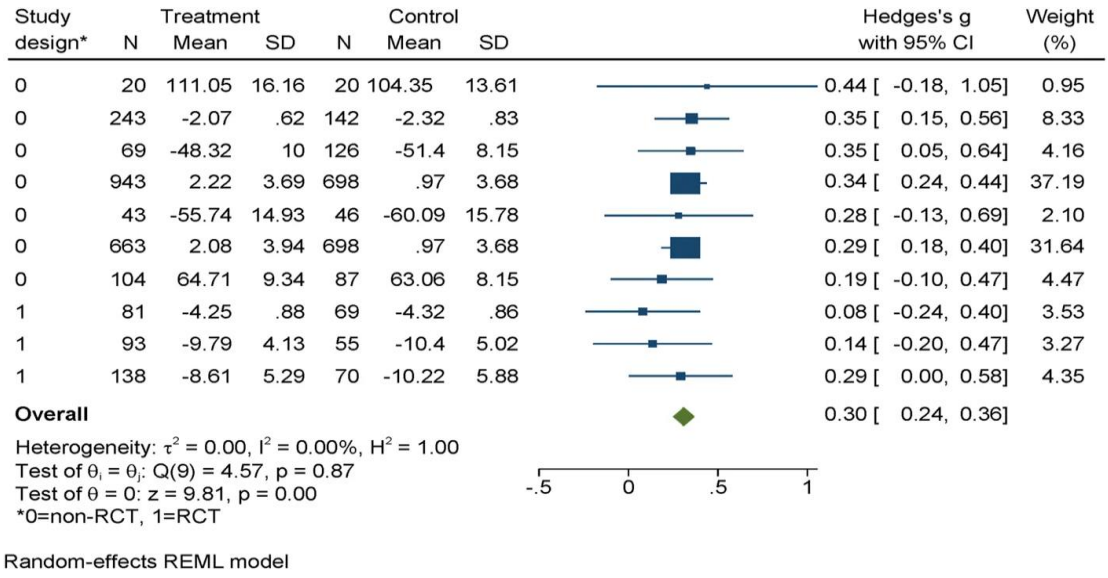

Figure 3. Evidence of Intervention Impact on Reducing Stigmatizing Attitudes at Follow-Up

This figure presents findings from the review evaluating long-term interventions designed to improve mental health literacy and reduce stigma among children and adolescents, covering studies from January 1997 to May 2020. Project: Improving Mental Health Literacy to Reduce Stigma (IMPRES), Bielefeld, Germany, March 2018 – February 2021.

Social distance

Social distance was examined in six studies including 2,908 participants at post-assessment and in four studies with 921 participants at follow-up. Most post-intervention evaluations occurred about one week after the program, except for one study that measured outcomes after 52 weeks. Follow-up assessments were conducted on average at 38 weeks, ranging from 6 to 103 weeks. Small improvements were detected both immediately after the intervention [d = 0.14, 95% CI: 0.02–0.25] and at follow-up [d = 0.16, 95% CI: 0.03–0.29] **(Figure 4).** Heterogeneity was moderate at post-test (I^2 = 17.74%) and absent at follow-up. Across both time points, non-significant effects were more common than significant ones, with four of six studies at post-test and three of four at follow-up showing non-significant results.

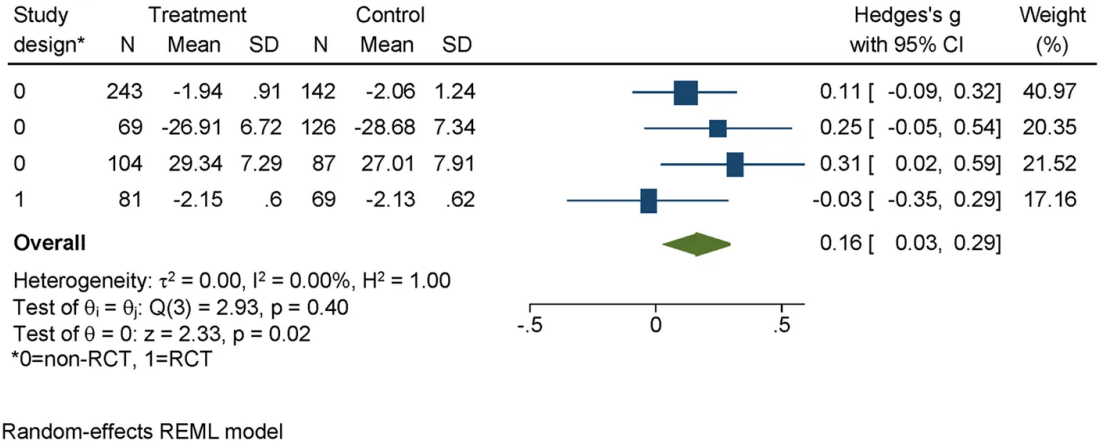

Figure 4. Evidence of Intervention Effectiveness on Reducing Social Distance at Follow-Up

This figure summarizes findings from the review investigating long-term interventions aimed at improving mental health literacy (MHL) and reducing stigma of mental illness among children

and adolescents, covering the period from January 1997 to May 2020. Project: Improving Mental Health Literacy to Reduce Stigma (IMPRES), Bielefeld, Germany, March 2018 – February 2021.

To our knowledge, this is the first review evaluating interventions targeting sustained reductions in stigma or improvements in MHL in children and adolescents. We identified 25 controlled follow-up studies that addressed MHL, stigma, or both. Most interventions were conducted in school settings, usually spanning up to one week and totaling a maximum of 9 hours.

In several studies, content delivery was performed by personnel external to schools (e.g., mental health professionals, researchers), while in others, teachers themselves delivered the interventions. One comparative study indicated that combining professionals and teachers as facilitators enhanced both knowledge and attitudes [30]. Consistent with previous recommendations [45–49], interventions delivered by school staff within the school environment remain a practical and effective approach.

The complexity of intervention content is another important consideration. Most studies covered mental health and mental illness broadly, whereas some focused on particularly common conditions (e.g., depression) [50] or highly stigmatized disorders (e.g., schizophrenia) [51]. While detailed information on specific disorders is valuable, addressing broader topics—such as stigma surrounding mental illness and strategies to promote resilience and positive mental health—is equally important. However, no studies have directly compared the efficacy of interventions focusing on general mental health versus specific mental illnesses.

Overall, findings indicate stable improvements in MHL and, to a lesser degree, in stigmatizing attitudes and social distance. Similar to a prior review on long-term effects in adults, effect sizes for knowledge retention were greater than for attitudinal change [52]. Evidence for sustained reductions in stigma and social distance is less clear, as many studies reported non-significant improvements. Further research is needed to determine which factors (e.g., content, facilitator, setting, duration) enhance intervention outcomes. In other words, while exposure to mental health information generally improves MHL and slightly reduces negative attitudes, future research should move beyond assessing effectiveness to investigate which intervention components drive these improvements.

Educational interventions were found to significantly enhance knowledge retention compared to educational-plus-contact interventions. One randomized trial, excluded from the meta-analysis due to the absence of a control group, compared an educational intervention to an educational-plus-contact intervention. Both conditions shared identical educational content, except that the educational-only condition included a brief historical overview of mental illness instead of a personal contact component. Despite this high content overlap, the educational-only intervention was more effective in improving MHL (e.g., recognizing a mental illness in a vignette) and knowledge, although it did not significantly outperform the educational-plus-contact condition in reducing stigmatizing attitudes [38]. Our meta-analysis mirrored this trend: results for stigma variables in the education-only group were not significantly inferior to those in the education-plus-contact group. This contrasts with previous findings showing that, for adolescents (unlike adults), educational interventions are more effective than contact interventions in reducing stigma [16]. Comparative studies like Chisholm *et al*. [38] are crucial for identifying which intervention components most effectively target specific MHL outcomes.

Across the meta-analyzed studies, the average time between intervention and follow-up was approximately 5.5 months, ranging from 6 weeks to 2 years. Notably, longer follow-up intervals did not correspond to weaker outcomes, suggesting that knowledge retention and attitudinal changes were generally stable over this period. Further research is needed to examine effects beyond two years and to determine whether booster interventions are required to maintain positive changes.

Limitations

In the second search phase, study eligibility was assessed by only one researcher, which could introduce a minor bias; however, given the high agreement rate during the first phase, the overall risk of bias is considered low. Most studies reported significant positive outcomes, suggesting potential publication bias, particularly the "file drawer problem," which may lead to overestimation of effects—estimated to inflate treatment effects by up to 12% [53]. Nevertheless, the use of random-effects models in our analysis provides a more conservative estimate [54], potentially limiting this bias.

Although the review focused on long-term follow-ups, outcome assessments were conducted on average five months post-intervention, making it difficult to infer

results beyond this period. Consequently, future studies should employ longer follow-ups and investigate whether single interventions suffice or repeated interventions are necessary. Another limitation relates to outcome categorization: the use of diverse measurement tools for the same constructs complicates comparability. We carefully assigned outcomes to appropriate categories to reduce heterogeneity, yet the MHL meta-analysis still showed high heterogeneity at both post- and follow-up assessments, whereas high heterogeneity for stigma studies was observed only at post-test. Regression analyses suggest that MHL outcomes were influenced by study design (RCT vs. non-RCT) and intervention type at both time points, whereas stigma results were affected only by study design at a single time point. Other factors such as content variability, intervention duration, measurement tools, and target populations may also contribute to heterogeneity, highlighting the need for cautious generalization and evaluation when applying intervention programs.

Risk of bias assessments indicated that most studies exhibited moderate to high risk, with only a few classified as low risk. This is partly due to incomplete reporting on assessed criteria, underscoring the importance of adhering to reporting guidelines to improve reliability. Regarding randomization, most studies (11 of 13) used group-level randomization, typically by school class, while the remainder employed individual-level randomization. Cluster randomization requires larger sample sizes to achieve adequate power, suggesting that results from these studies may be underestimated [55]. Additionally, randomization at the school level could lead to underestimation due to potential contamination when students share intervention information across classes.

Conclusion

A total of 25 studies were identified examining interventions targeting MHL or stigma, with variations in content, delivery methods, and follow-up durations. Schools were the primary setting, with interventions covering general mental health, depression, and schizophrenia. Meta-analytic findings suggest that interventions are effective in improving long-term MHL but provide less conclusive evidence for attitude changes. Stigma and social distance outcomes did not differ significantly across intervention types, though educational-only interventions led to superior MHL outcomes compared with education-plus-contact approaches. Further research is needed to determine which types of information, delivered in what manner, most effectively enhance both MHL and various dimensions of stigma.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et 1. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime Prevalence and Age-Of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry (2005) 62(6):593–602. 10.1001/archpsyc.62.6.593
2. Patel V, Flisher AJ, Hetrick S, McGorry P. Mental Health of Young People: a Global Public-Health challenge. The Lancet (2007) 369(9569):1302–13. 10.1016/s0140-6736(07)60368-7
3. Goodman A, Joyce R, Smith JP. The Long Shadow Cast by Childhood Physical and Mental Problems on Adult Life. Proc Natl Acad Sci (2011) 108(15):6032–7. 10.1073/pnas.1016970108
4. Wainberg ML, Scorza P, Shultz JM, Helpman L, Mootz JJ, Johnson KA, et al. Challenges and Opportunities in Global Mental Health: a Research-To-Practice Perspective. Curr Psychiatry Rep (2017) 19(5):28. 10.1007/s11920-017-0780-z
5. Jorm AF, Korten AE, Jacomb PA, Christensen H, Rodgers B, Pollitt P. "Mental Health Literacy": a Survey of the Public's Ability to Recognise Mental Disorders and Their Beliefs about the Effectiveness of Treatment. Med J Aust (1997) 166(4):182–6. 10.5694/j.1326-5377.1997.tb140071.x
6. Bonabi H, Müller M, Ajdacic-Gross V, Eisele J, Rodgers S, Seifritz E, et al. Mental Health Literacy, Attitudes to Help Seeking, and Perceived Need as Predictors of Mental Health Service Use. J Nerv Ment Dis (2016) 204(4):321–4. 10.1097/nmd.0000000000000488

7. Tully LA, Hawes DJ, Doyle FL, Sawyer MG, Dadds MR. A National Child Mental Health Literacy Initiative Is Needed to Reduce Childhood Mental Health Disorders. Aust N Z J Psychiatry (2019) 53(4):286–90. 10.1177/0004867418821440
8. Sickel AE, Seacat JD, Nabors NA. Mental Health Stigma Update: A Review of Consequences. Adv Ment Health (2014) 12(3):202–15. 10.1080/18374905.2014.11081898
9. Corrigan PW. Mental Health Stigma as Social Attribution: Implications for Research Methods and Attitude Change. Clin Psychol Sci Pract (2000) 7(1):48–67. 10.1093/clipsy.7.1.48
10. Corrigan PW, Watson AC. The Paradox of Self-Stigma and Mental Illness. Clin Psychol Sci Pract (2002) 9(1):35–53. 10.1093/clipsy.9.1.35
11. Rüsch N, Angermeyer MC, Corrigan PW. Mental Illness Stigma: Concepts, Consequences, and Initiatives to Reduce Stigma. Eur Psychiatr (2005) 20(8):529–39. 10.1016/j.eurpsy.2005.04.004
12. Schomerus G, Schwahn C, Holzinger A, Corrigan PW, Grabe HJ, Carta MG, et al. Evolution of Public Attitudes about Mental Illness: a Systematic Review and Meta-Analysis. Acta Psychiatr Scand (2012) 125(6):440–52. 10.1111/j.1600-0447.2012.01826.x
13. O'Reilly M, Svirydzenka N, Adams S, Dogra N. Review of Mental Health Promotion Interventions in Schools. Soc Psychiatry Psychiatr Epidemiol (2018) 53(7):647–62. 10.1007/s00127-018-1530-1
14. Gronholm PC, Henderson C, Deb T, Thornicroft G. Interventions to Reduce Discrimination and Stigma: the State of the Art. Soc Psychiatry Psychiatr Epidemiol (2017) 52(3):249–58. 10.1007/s00127-017-1341-9
15. Thornicroft G, Mehta N, Clement S, Evans-Lacko S, Doherty M, Rose D, et al. Evidence for Effective Interventions to Reduce Mental-Health-Related Stigma and Discrimination. Lancet (2015) 387(10023):1123–32. 10.1016/S0140-6736(15)00298-6
16. Corrigan PW, Morris SB, Michaels PJ, Rafacz JD, Rüsch N. Challenging the Public Stigma of Mental Illness: A Meta-Analysis of Outcome Studies. Psychiatr. Serv. (2012) 63(10):963–973. 10.1176/appi.ps.201100529
17. Wei Y, Hayden JA, Kutcher S, Zygmunt A, McGrath P. The Effectiveness of School Mental Health Literacy Programs to Address Knowledge, Attitudes and Help Seeking Among Youth. Early Intervention in Psychiatry (2013) 7(2):109–21. 10.1111/eip.12010
18. Seedaket S, Turnbull N, Phajan T, Wanchai A. Improving Mental Health Literacy in Adolescents: Systematic Review of Supporting Intervention Studies. Trop Med Int Health (2020) 25(9):1055–64. 10.1111/tmi.13449
19. Patafio B, Miller P, Baldwin R, Taylor N, Hyder S. A Systematic Mapping Review of Interventions to Improve Adolescent Mental Health Literacy, Attitudes and Behaviours. Early Intervention in Psychiatry (2021). 10.1111/eip.13109
20. Spiker DA, Hammer JH. Mental Health Literacy as Theory: Current Challenges and Future Directions. J Ment Health (2018) 28(3):238–42. 10.1080/09638237.2018.1437613
21. National Hearth, Blood and Lung Institute. Checklist for Quality Assessment of Controlled Intervention Studies. Internet. Available from: URL: https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools (Accessed 8, 2021).
22. Stata Statistical Software. Release 16. College Station, TX: StataCorp LLC; (2019).
23. Sedgwick P. Meta-analyses: what Is Heterogeneity? BMJ (2015) 350:h1435. 10.1136/bmj.h1435
24. Ahmad SI, Leventhal BL, Nielsen BN, Hinshaw SP. Reducing Mental-Illness Stigma via High School Clubs: A Matched-Pair, Cluster-Randomized Trial. Stigma and Health (2020) 5(2):230–9. 10.1037/sah0000193
25. Andrés-Rodríguez L, Pérez-Aranda A, Feliu-Soler A, Rubio-Valera M, Aznar-Lou I, Serrano-Blanco A, et al. Effectiveness of the "What's up!" Intervention to Reduce Stigma and Psychometric Properties of the Youth Program Questionnaire (YPQ): Results from a Cluster Non-randomized Controlled Trial Conducted in Catalan High Schools. Front Psychol (2017) 8:1608. 10.3389/fpsyg.2017.01608
26. Campos L, Dias P, Duarte A, Veiga E, Dias C, Palha F. Is it Possible to "Find Space for Mental Health" in Young People? Effectiveness of a School-Based Mental Health Literacy Promotion Program. Ijerph (2018) 15(7):1426. 10.3390/ijerph15071426
27. Esters IG, Cooker PG, Ittenbach RF. Effects of a Unit of Instruction in Mental Health on Rural

Adolescents' Conceptions of Mental Illness and Attitudes about Seeking Help. Adolescence (1998) 33(130):469–76.

28. Fraser E, Pakenham KI. Evaluation of a Resilience-Based Intervention for Children of Parents with Mental Illness. Aust N Z J Psychiatry (2008) 42(12):1041–50. 10.1080/00048670802512065
29. Ibrahim N, Mohd Safien A, Siau CS, Shahar S. The Effectiveness of a Depression Literacy Program on Stigma and Mental Help-Seeking Among Adolescents in Malaysia: A Control Group Study with 3-Month Follow-Up. Inquiry (2020) 57:46958020902332. 10.1177/0046958020902332
30. Lai ESY, Kwok C-L, Wong PWC, Fu K-W, Law Y-W, Yip PSF. The Effectiveness and Sustainability of a Universal School-Based Programme for Preventing Depression in Chinese Adolescents: A Follow-Up Study Using Quasi-Experimental Design. PLoS ONE (2016) 11(2):e0149854. 10.1371/journal.pone.0149854
31. Morgan AJ, Fischer J-AA, Hart LM, Kelly CM, Kitchener BA, Reavley NJ, et al. Does Mental Health First Aid Training Improve the Mental Health of Aid Recipients? the Training for Parents of Teenagers Randomised Controlled Trial. BMC Psychiatry (2019) 19(1):99. 10.1186/s12888-019-2085-8
32. Perry Y, Petrie K, Buckley H, Cavanagh L, Clarke D, Winslade M, et al. Effects of a Classroom-Based Educational Resource on Adolescent Mental Health Literacy: A Cluster Randomised Controlled Trial. J Adolescence (2014) 37(7):1143–51. 10.1016/j.adolescence.2014.08.001
33. Pinto-Foltz MD, Logsdon MC, Myers JA. Feasibility, Acceptability, and Initial Efficacy of a Knowledge-Contact Program to Reduce Mental Illness Stigma and Improve Mental Health Literacy in Adolescents. Soc Sci Med (2011) 72(12):2011–9. 10.1016/j.socscimed.2011.04.006
34. Robinson J, Gook S, Yuen HP, Hughes A, Dodd S, Bapat S, et al. Depression Education and Identification in Schools: An Australian-based Study. Sch Ment Health (2010) 2(1):13–22. 10.1007/s12310-009-9022-9
35. Ventieri D, Clarke DM, Hay M. The Effects of a School-Based Educational Intervention on Preadolescents' Knowledge of and Attitudes towards Mental Illness. Adv Sch Ment Health Promot (2011) 4(3):5–17. 10.1080/1754730x.2011.9715632
36. Wahl OF, Susin J, Kaplan L, Lax A, Zatina D. Changing Knowledge and Attitudes with a Middle School Mental Health Education Curriculum. Stigma Res Action (2011) 1(1):44–53. 10.5463/sra.v1i1.17
37. Campbell M, Shryane N, Byrne R, Morrison AP. A Mental Health Promotion Approach to Reducing Discrimination about Psychosis in Teenagers. Psychosis (2010) 3(1):41–51.
38. Chisholm K, Patterson P, Torgerson C, Turner E, Jenkinson D, Birchwood M. Impact of Contact on Adolescents' Mental Health Literacy and Stigma: the SchoolSpace Cluster Randomised Controlled Trial. BMJ Open (2016) 6(2):e009435. 10.1136/bmjopen-2015-009435
39. Conrad I, Dietrich S, Heider D, Blume A, Angermeyer MC, Riedel-Heller S. "Crazy? So what!": Health Edu (2009) 109(4):314–28. 10.1108/09654280910970893
40. Economou M, Louki E, Peppou LE, Gramandani C, Yotis L, Stefanis CN. Fighting Psychiatric Stigma in the Classroom: the Impact of an Educational Intervention on Secondary School Students' Attitudes to Schizophrenia. Int J Soc Psychiatry (2011) 58(5):544–51. 10.1177/0020764011413678
41. Gonçalves M, Moleiro C, Cook B. The Use of a Video to Reduce Mental Health Stigma Among Adolescents. APS (2015) 5(3):204–11. 10.2174/2210676605666150521232049
42. Hart LM, Cropper P, Morgan AJ, Kelly CM, Jorm AF. Teen Mental Health First Aid as a School-Based Intervention for Improving Peer Support of Adolescents at Risk of Suicide: Outcomes from a Cluster Randomised Crossover Trial. Aust N Z J Psychiatry (2019) 54(4):382–92. 10.1177/0004867419885450
43. Liddle SK, Deane FP, Batterham M, Vella SA. A Brief Sports-Based Mental Health Literacy Program for Male Adolescents: A Cluster-Randomized Controlled Trial. J Appl Sport Psychol (2021) 33(1):20–44. 10.1080/10413200.2019.1653404
44. Mulfinger N, Müller S, Böge I, Sakar V, Corrigan PW, Evans-Lacko S, et al. Honest, Open, Proud for Adolescents with Mental Illness: Pilot Randomized Controlled Trial. J Child Psychol Psychiatr (2018) 59(6):684–91. 10.1111/jcpp.12853

45. Ng P, Chan K-F. Attitudes towards People with Mental Illness. Effects of a Training Program for Secondary School Students. Int J Adolesc Med Health (2002) 14(3):215–24. 10.1515/ijamh.2002.14.3.215
46. Schulze B, Richter-Werling M, Matschinger H, Angermeyer MC. Crazy? So what! Effects of a School Project on Students' Attitudes towards People with Schizophrenia. Acta Psychiatr Scand (2003) 107(2):142–50. 10.1034/j.1600-0447.2003.02444.x
47. Swartz K, Musci RJ, Beaudry MB, Heley K, Miller L, Alfes C, et al. School-Based Curriculum to Improve Depression Literacy Among US Secondary School Students: A Randomized Effectiveness Trial. Am J Public Health (2017) 107(12):1970–6. 10.2105/ajph.2017.304088
48. Wahl O, Rothman J, Brister T, Thompson C. Changing Student Attitudes about Mental Health Conditions: NAMI Ending the Silence. Stigma and Health (2018) 4(2):188–95.
49. Yap MBH, Mackinnon A, Reavley N, Jorm AF. The Measurement Properties of Stigmatizing Attitudes towards Mental Disorders: Results from Two Community Surveys. Int J Methods Psychiatr Res (2014) 23(1):49–61. 10.1002/mpr.1433
50. Liu Q, He H, Yang J, Feng X, Zhao F, Lyu J. Changes in the Global burden of Depression from 1990 to 2017: Findings from the Global Burden of Disease Study. J Psychiatr Res (2020) 126:134–40. 10.1016/j.jpsychires.2019.08.002
51. Reavley N, Too T, Zhao M. National Surveys of Mental Health Literacy and Stigma and National Survey of Discrimination and Positive Treatment: A Report for the Mental Health Commission of NSW. Sydney: Mental Health Commission of NSW; (2015).
52. Mehta N, Clement S, Marcus E, Stona A-C, Bezborodovs N, Evans-Lacko S, et al. Evidence for Effective Interventions to Reduce Mental Health-Related Stigma and Discrimination in the Medium and Long Term: Systematic Review. Br J Psychiatry (2015) 207(5):377–84. 10.1192/bjp.bp.114.151944
53. Moher D, Cook DJ, Eastwood S, Olkin I, Rennie D, Stroup DF. Improving the Quality of Reports of Meta-Analyses of Randomised Controlled Trials: the QUOROM Statement. The Lancet (1999) 354:1896–900. 10.1016/s0140-6736(99)04149-5
54. Russo MW. How to Review a Meta-Analysis. Gastroenterol Hepatol (N Y) (2007) 3(8):637–42.
55. Dreyhaupt J, Mayer B, Keis O, Öchsner W, Muche R. Cluster-randomized Studies in Educational Research: Principles and Methodological Aspects. GMS J Med Educ (2017) 34(2):Doc26. 10.3205/zma001103