Supplementary Materials

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related to **'Barriers and facilitators for the implementation of preventative mental health interventions among secondary schools in high-income countries: A systematic review'**

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SM1. PRISMA 2020 checklist.

Table SM1. PRISMA 2020 checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Introduction
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Methods, Selection criteria
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Methods, Search strategy
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Methods, Search strategy
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Methods, Study selection
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Methods, Data extraction
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Methods, Data extraction
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Methods, Data extraction
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Methods, Quality appraisal
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Not applicable

Section and Topic	Item #	Checklist item	Location where item is reported
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Methods, Selection criteria, also see screening guidance via OSF
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Not applicable
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Methods, Data synthesis and analysis
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Methods, Data synthesis and analysis
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Not applicable
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Not applicable
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not applicable
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not applicable
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Results, Study selection,Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Results, Study selection
Study characteristics	17	Cite each included study and present its characteristics.	Results, Characteristics of included studies, Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Results, quality appraisal, Figure 2

Section and Topic	Item #	Checklist item	Location where item is reported
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Not applicable
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Not applicable
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Not applicable
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Not applicable
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Not applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not applicable
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Discussion
	23b	Discuss any limitations of the evidence included in the review.	Discussion, Limitations
	23c	Discuss any limitations of the review processes used.	Discussion, Limitations
	23d	Discuss implications of the results for practice, policy, and future research.	Discussion, Implications for the implementation of future interventions
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Methods
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Methods
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Methods, Supplementary Material 2
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Declarations, Funding
Competing	26	Declare any competing interests of review authors.	Declarations,

Section and Topic	Item #	Checklist item	Location where item is reported
interests			Competing interests
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Declarations, Availability of Data and Materials

Note. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

SM2. Domains of the Consolidated Framework for Implementation Research adapted to our research question

Table SM2. Domains of the Consolidated Framework for Implementation Research (CFIR)

CFIR domain	Description	Constructs	Applications for the current review
Innovation	"Thing" being implemented (e.g., a new treatment, program or service)	Source, evidence base, relative advantage, adaptability, trialability, complexity, design, costs	Structured psychosocial intervention aiming to prevent mental disorders, promote mental health, wellbeing or resilience
Outer setting	Setting in which the inner setting exists, which may have itself multiple levels	Critical incidents, local attitudes, local conditions, partnership & connections, policies & laws, financing, external pressure (i.e., societal pressure, market pressure, performance pressure)	The school district, the educational system as part of the political system
Inner setting	Setting in which the innovation is implemented, which may have itself multiple levels	Structural characteristics (i.e., physical, technology and work infrastructure), relational connections, communications, culture (i.e., human equality-centeredness, deliverer-centeredness, learning-centeredness), tension for change, compatibility, relative priority, incentive systems, mission alignment, available resources (i.e., funding, space, materials & equipment), access to knowledge & information	Classes and/or groups within schools
Individuals	Roles and characteristics of individuals	High-level leaders, mid-level leaders, opinion leaders, implementation facilitators, implementation leads, implementation team members, other implementation support, innovation recipients, need, capability, opportunity, motivation	Students, caregivers, teachers, other school staff, social workers or psychologists who deliver the intervention incl. their individual values, beliefs, and competences
Implementation process	Activities and strategies used to implement the innovation	Teaming, assessing needs (of deliverers or recipients), assessing context, planning, tailoring strategies, engaging (deliverers and recipients), doing, reflecting & evaluating (implementation and innovation), adapting	The processes used for implementing the intervention in the school context including specific implementation strategies (following Powell et al. [1])

Note. Domains are descripted based on the latest update of the Consolidated Framework for Implementation Research [2]. Adaptations for the purpose of the current review were made by the review team (SoS with supervision of DF and SKS).

SM3. Differences between protocol and review

Table SM3. Differences between protocol and final review (PROSPERO ID: CRD42023493299; OSF ID: 10.17605/OSF.IO/7E6PC)

	Protocol	**Final Review**
Review design		No changes
Review question		No changes
Searches and search strategies	The search strategy for this review will focus on primary studies. Seven electronic databases will be searched from **January 1, 2013, to present**, including APA PsycNet […], CINAHL, Cochrane Central Register of Controlled Trials (CENTRAL), Embase […], ERIC, Scopus, and Web of Science. The strategy will comprise four clusters with search terms related to (a) population and setting (e.g., students, school), (b) interventions and programs, (c) intervention targets (e.g., mental health, wellbeing, resilience), and (d) factors (i.e., determinants, barriers and facilitators) affecting the implementation of those interventions. MeSH terms and Emtree terms will be used where applicable. […] Reference lists of all included studies and thematically related systematic reviews (e.g.,[3–6]) will be checked for eligible primary studies. In case we identify primary outcome papers of randomized controlled trials on eligible psychosocial interventions, we will search for related sister papers, which might report on determinants, facilitators and barriers of intervention implementation by means of Google Scholar citation search. Moreover, we will search Google Scholar for studies citing those studies eligible for our review.	No changes.
Types of studies	No changes were made with respect to population(s), intervention(s) and study type(s).	
Eligible outcomes	***Main outcomes:*** • Determinants of / factors associated with intervention implementation • Other information on barriers and facilitators of intervention implementation ***Additional outcomes:***	The outcomes were not modified. However, some additional outcomes (e.g. functional status, health service /care use) could not been extracted as the primary studies did not report on these outcomes. Other additional outcomes (i.e., mental health status) were not part of the synthesis.

	• Mental distress (e.g., general mental distress, depressive symptoms, […]) • Positive mental health (e.g., wellbeing, life satisfaction, […]) • Functional status (e.g., daily functioning, […]) • Adverse events • Health service/care use	
Data extraction	Two review team members will independently screen titles and abstracts of identified records to assess their eligibility. Irrelevant papers will be excluded immediately. Also at full text level, the eligibility of relevant papers will be checked independently and in duplicate. Any disagreements will be resolved by discussion or by consulting a third reviewer (SKS, KL, DF). We will use *Zotero* to collect and de-duplicate studies. The screening will be performed using *Rayyan* [7]. Inter-rater reliability for both title/abstract and full text screening will be calculated and reported by means of Cohen's kappa. The screening process will be reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart [8]. Based on the domains of the **Consolidated Framework for Implementation Research** (CFIR; [2]), we will develop a customized data extraction sheet for the purpose of this review. This has been done in other reviews on facilitators and barriers of intervention implementation [9]. A prefinal version of the data extraction sheet will be uploaded to the Open Science Framework project before the data extraction process will be started. Specifically, the included studies will be coded based on the following aspects: **General information**: • Full citation information • Population and participant characteristics (e.g., sample size, […]) • Details on study design • Outcomes, timepoints assessed, and outcome measures	No substantial changes were made. A pilot screening of 100 records was carried out before the initial screening process to ensure substantial agreement between raters. The outcomes of each intervention (i.e. the reported quantitative effects of the intervention on mental health, such as means [*M*] and standard deviations [*SD*s], as well as adverse effects) were not extracted as we were not interested in those intervention effects or in the association of implementation outcomes and intervention effects. In addition to the implementation factors, the implementation strategies used, and the frequency of their use were coded independently by two raters using the compilation provided by Powell et al. (2015) in the data extraction table. During the review process, we initially planned to report these implementation strategies along with information on their frequency, although this was not specified in our original review protocol. This addition arose because the review forms part of the larger STRESS-Care project, which aims to develop and evaluate a low-intensity stepped-care intervention for German secondary schools. However, we acknowledge that our search strategy was not ideally suited for a synthesis of implementation strategies and that such strategies were not the primary focus of this review. Therefore, we decided not to report on implementation strategies as part of this review.

	• Results (i.e., reported quantitative effects of the intervention on mental health outcomes […]) • Adverse outcomes **Information based on the CFIR**: • Intervention: Characteristics of the intervention implemented […] • Outer setting: Economic, political and social context of the organization in which the intervention is implemented • Inner setting: Structural, social and cultural environment of the organization in which the intervention is implemented • Individuals: Characteristics of the individuals involved in the delivery of the intervention […] • Process: Processes used to introduce and maintain an intervention within the organisation […] • Information on the rating of these factors as being either facilitators, irrelevant factors or barriers **Information for quality appraisal**: • Information related to study quality (i.e., statement on study aim, appropriateness of methodology, […]) • Potential conflicts of interest (e.g., study authors being involved in the commercial sales of the intervention) Data will be extracted by one reviewer and will be checked by a second reviewer. Any disagreements will be resolved by discussion or by consulting a third reviewer (SKS, KL, DF). The process will be reported in line with the PRISMA standards [8].	
Quality assessment	The study quality will be assessed using the checklist for qualitative studies of the **Critical Appraisal Skills Programme** (CASP; [10]; https://casp-uk.net/checklists/casp-qualitative-studies-checklist-fillable.pdf), assessing risk of bias using the following domains: 1. Are the results of the study valid? […] 2. What are the results? […] 3. Will the results help locally? […] Following the guidelines provided by CASP, we will not calculate an overall quality ratings per study, but report on item-level assessment of study quality based on the checklist. These results will be presented along with the review. Study quality will be rated by two	The quality of the included studies was assessed using the CASP checklists for qualitative research for 24 qualitative or mixed methods studies. In addition, the CASP checklist for RCTs was used to assess the quality of one included cRCT. One study with a pre-post design could not be assessed using the CASP checklists as no suitable tool was available. These quality aspects were amended by items specifically relevant to the review project: quality of information on study population; intervention; implementation, and assessment of implementation determinants (e.g., use of a specific framework, clearness of

	members of the review team independently. Any disagreements will be resolved by discussion or by consulting a third reviewer (SKS, KL, DF). We will not be able the assess the presence of a potential publication bias statistically. However, we will code for each record whether results have been published in a peer-reviewed journal or as part of the 'grey literature' (e.g., dissertations, project reports). Based on this information, we will compare whether results differ substantially by publication type. Such a difference can be interpreted as evidence in favor a publication bias.	presentation). Our quality appraisal tool is available from the related OSF project (https://osf.io/g8n67/). We documented for each record whether the publication was a journal article or a dissertation (part of the grey literature). We found no strong indication for differences between those publication types and performed no further analyses to contrast findings from peer-reviewed journals and the grey literature.
Data synthesis	Based on the extracted data, a narrative synthesis of the included studies will be carried out, describing the study population (e.g., descriptive statistics), interventions, measured outcomes and factors examined as potential facilitators or barriers for implementation in text and tabular form. Analyses will follow standards defined by the Cochrane Collaboration for synthesis without meta-analysis (SWiM guidelines; [11]). For single factors, we will follow a vote counting approach and report on all results related to a specific factor (i.e., we will also report on non-significant findings). Results will be presented using the implementation domains suggested by the Consolidated Framework for Implementation Research (CFIR; [2]).	No substantial changes were made. As measured outcomes (i.e., quantitative effects of interventions) were not extracted, they are not reported. In addition to descriptive information on population and intervention characteristics, characteristics of the population reporting on implementation factors (i.e., age, gender, roles) were provided in text form.

SM4. Search strategies per database

The search was based on the last 10 years. 01/01/2013 was chosen because some databases always require a search from 01/01 and a search from 12/13, for example, is not possible.

1. APA PsycNet (PsycInfo, PsycArticles, PsycExtra)

#	Query
1	(student* OR pupil*) in Title, Abstract, Keywords
2	(secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*) in Title, Abstract, Keywords
3	(train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*) in Title, Abstract, Keywords
4	(resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy") in Title, Abstract, Keywords
5	(barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)
6	(#1 OR #2) AND #3 AND #4 AND #5 from 2013 to 2023

Search string: ((title: (barrier*) OR title: (determinant*) OR title: (facilitat*) OR title: (factor*) OR title: (predict*) OR title: (enable*) OR title: (hinder*) OR title: (challenge*)) AND title: (implement*) OR (abstract: (barrier*) OR abstract: (determinant*) OR abstract: (facilitat*) OR abstract: (factor*) OR abstract: (predict*) OR abstract: (enable*) OR abstract: (hinder*) OR abstract: (challenge*)) AND abstract: (implement*) OR (Keywords: (barrier*) OR Keywords: (determinant*) OR Keywords: (facilitat*) OR Keywords: (factor*) OR Keywords: (predict*) OR Keywords: (enable*) OR Keywords: (hinder*) OR Keywords: (challenge*)) AND Keywords: (implement*)) AND ((((((Title:(student*) OR Title:(pupil*) (Title:(secondary) OR Title:(middle) OR Title:(high) OR Title:(comprehensive) OR Title:(vocational) OR Title:(technical)) AND Title:(school*)) OR (Abstract:(secondary) OR Abstract:(middle) OR Abstract:(high) OR Abstract:(comprehensive) OR Abstract:(vocational) OR Abstract:(technical)) AND Abstract:(school*) OR (Subject:(secondary) OR Subject:(middle) OR Subject:(high) OR Subject:(comprehensive) OR Subject:(vocational) OR Subject:(technical)) AND Subject:(school*))) OR (((Title:(student*) OR Title:(pupil*) (Title:(secondary) OR Title:(middle) OR Title:(high) OR Title:(comprehensive) OR Title:(vocational) OR Title:(technical)) AND Title:(school*)) OR (Abstract:(secondary) OR Abstract:(middle) OR Abstract:(high) OR Abstract:(comprehensive) OR Abstract:(vocational) OR Abstract:(technical)) AND Abstract:(school*) OR (Subject:(secondary) OR Subject:(middle) OR Subject:(high) OR Subject:(comprehensive) OR Subject:(vocational) OR Subject:(technical)) AND Subject:(school*))) OR (((title:(student*)) OR (title:(pupil*))) OR ((abstract:(student*)) OR (abstract:(pupil*))) OR ((Subject:(student*)) OR (Subject:(pupil*)))))) AND (((title:(train*)) OR (title:(program*)) OR (title:(intervention*)) OR (title:(promot*)) OR (title:(prevent*)) OR (title:(service)) OR (title:(communit*)) OR (title:(enhanc*)) OR (title:(increas*)) OR (title:(manag*)) OR (title:(therap*)) OR (title:(treat*)) OR (title:(coach*)) OR (title:(peer*))) OR ((abstract:(train*)) OR (abstract:(program*)) OR (abstract:(intervention*)) OR (abstract:(promot*)) OR (abstract:(prevent*)) OR (abstract:(service)) OR (abstract:(communit*)) OR (abstract:(enhanc*)) OR (abstract:(increas*)) OR (abstract:(manag*)) OR (abstract:(therap*)) OR (abstract:(treat*)) OR (abstract:(coach*)) OR (abstract:(peer*))) OR ((Subject:(train*)) OR (Subject:(program*)) OR (Subject:(intervention*)) OR (Subject:(promot*)) OR (Subject:(prevent*)) OR (Subject:(service)) OR (Subject:(communit*)) OR (Subject:(enhanc*)) OR (Subject:(increas*)) OR (Subject:(manag*)) OR (Subject:(therap*)) OR (Subject:(treat*)) OR (Subject:(coach*)) OR

(Subject:(peer*)))) AND (((((title:("mental disorder")))) OR (((abstract:("mental disorder")))) OR (((Subject:("mental disorder"))))) OR ((((title:("mental health")))) OR (((abstract:("mental health")))) OR (((Subject:("mental health"))))) OR ((((title:(coping imagery)))) OR (((abstract:(coping)))) OR (((Subject:(coping))))) OR ((((title:(hardiness)))) OR (((abstract:(hardiness)))) OR (((Subject:(hardiness))))) OR ((((title:(resilien*)))) OR (((abstract:(resilien*)))) OR (((Subject:(resilien*))))) OR ((((title:("psychological distress")))) OR (((abstract:("psychological distress")))) OR (((Subject:("psychological distress"))))) OR ((((title:("mental distress")))) OR (((abstract:("mental distress")))) OR (((Subject:("mental distress"))))) OR ((((title:("mental burden")))) OR (((abstract:("mental burden")))) OR (((Subject:("mental burden"))))) OR ((((title:("psychological burden")))) OR (((abstract:("psychological burden")))) OR (((Subject:("psychological burden"))))) OR ((((title:("mental health literacy")))) OR (((abstract:("mental health literacy")))) OR (((Subject:("mental health literacy"))))))) *AND* **Year**: 2013 *To* 2023

2. Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Education Resources Information Center (ERIC) via EbscoHost

#	**Query**
1	TI (student* OR pupil*) OR AB (student* OR pupil*) OR SU (student* OR pupil*)
2	TI ((secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*)) OR AB ((secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*)) OR SU ((secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*))
3	TI (train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*) OR AB (train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*) OR SU (train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*)
4	TI (resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy") OR AB (resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy") OR SU (resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy")
5	TI (barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)) OR AB (barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)) OR SU (barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*))
6	(#1 OR #2) AND #3 AND #4 AND #5 from 2013 to 2024

3. Cochrane Central Register of Controlled Trials (CENTRAL)

#	Query
1	student* OR pupil*
2	(secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*
3	MeSH descriptor: [Schools] explode all trees
4	#1 OR #2 OR #3
5	MeSH descriptor: [Psychosocial Intervention] explode all trees
6	MeSH descriptor: [Health Promotion] explode all trees
7	MeSH descriptor: [Mental Health Services] explode all trees
8	MeSH descriptor: [Mentoring] in all MeSH products
9	train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*:ti,ab,kw
10	#5 OR #6 #7 OR #8 OR #9
11	MeSH descriptor: [Emotional Adjustment] explode all trees
12	MeSH descriptor: [Resilience, Psychological] explode all trees
13	resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy":ti,ab,kw
14	MeSH descriptor: [Stress, Psychological] explode all trees
15	"mental health literacy":ti,ab,kw
16	MeSH descriptor: [Health Literacy] explode all trees
17	#11 OR #12 OR #13 OR #14 OR #15 OR #16
18	barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* or challenge*
19	#4 AND #10 AND #17 AND #18 with Publication Year from 2013 to 2023, in Trials

4. Embase via Embase.com including PubMed

#	Query
1	student* OR pupil*
2	(secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*
3	'school'/exp
4	#1 OR #2 OR #3
5	'psychosocial intervention'/exp
6	'health promotion'/exp
7	'mental health service'/exp
8	'mentoring'/exp
9	train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*
10	#5 OR #6 OR #7 OR #8 OR #9
11	'psychological adjustment'/exp
12	'psychological resilience'/exp
13	resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy":ti,ab,kw
14	'health literacy'/exp
15	#11 OR #12 OR #13 OR #14

16	(barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*:ti,ab,kw
17	#4 AND #10 AND #15 AND #16
18	#17 AND (2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py OR 2021:py OR 2022:py OR 2023:py OR 2024:py) AND ([article]/lim OR [article in press]/lim) AND [english]/lim AND ([embase]/lim OR [medline]/lim OR [embase classic]/lim OR [preprint]/lim OR [pubmed-not-medline]/lim) AND [medline]/lim

5. Scopus.com

#	**Query**
1	(student* OR pupil*) in Title, Abstract, Keywords
2	(secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*) in Title, Abstract, Keywords
3	(train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*) in Title, Abstract, Keywords
4	(resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy") in Title, Abstract, Keywords
5	(barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)
6	(#1 OR #2) AND #3 AND #4 AND #5 from 2013 to 2024

Search String: ((TITLE-ABS-KEY (student* OR pupil*) OR TITLE-ABS-KEY ((secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*))) AND (TITLE-ABS-KEY (train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*)) AND (TITLE-ABS-KEY (resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy")) AND (TITLE-ABS-KEY ((barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)) AND PUBYEAR > 2012 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "PSYC") OR LIMIT-TO (SUBJAREA , "NURS") OR LIMIT-TO (SUBJAREA , "ENVI") OR LIMIT-TO (SUBJAREA , "HEAL") OR LIMIT-TO (SUBJAREA , "MULT") OR LIMIT-TO (SUBJAREA , "NEUR"))

6. Web of Science

#	**Query**
1	(TS=(student* OR pupil*)) "
2	(TS=((secondary OR middle OR high OR comprehensive OR vocational OR technical) AND school*))
3	#1 OR #2
4	(TS=(train* OR program* OR intervention* OR promot* OR prevent* OR service OR communit* OR enhanc* OR increas* OR manag* OR therap* OR treat* OR coach* OR peer*))
5	(TS=(resilien* OR hardiness OR coping OR "mental health" OR "mental disorder" OR "psychological distress" OR "mental distress" OR "mental burden" OR "psychological burden" OR "mental health literacy"))
8	TS=((barrier* OR determinant* OR facilitat* OR factor* OR predict* OR enable* OR hinder* OR challenge*) AND implement*)
9	#3 AND #4 AND #5 AND #6 and 2024 or 2023 or 2022 or 2021 or 2020 or 2018 or 2019 or 2017 or 2016 or 2015 or 2014 or 2013 (Publication Years) and Article (Document Types) and Education Educational Research or Psychology or Behavioral Sciences or Health Care Sciences Services or Psychiatry or Public Environmental Occupational Health or Pediatrics or Sociology or Social Sciences Other Topics or Family Studies or Social Issues or Social Work or Neurosciences Neurology or Rehabilitation or Cultural Studies (Research Areas) and English (Languages)

SM5. Overview of implementation strategies

Table SM5. Implementation strategies that could be reported in primary

Implementation strategies defined by Powell [12]
Access new funding
Alter incentive/allowance structures
Alter patient/consumer fees
Assess for readiness and identify barriers and facilitators
Audit and provide feedback
Build a coalition
Capture and share local knowledge
Centralize technical assistance
Change accreditation or membership requirements
Change liability laws
Change physical structure and equipment
Change record systems
Change service sites
Conduct cyclical small tests of change
Conduct educational meetings
Conduct educational outreach visits
Conduct local consensus discussions
Conduct local needs assessment
Conduct ongoing training
Create a learning collaborative
Create new clinical teams
Create or change credentialing and/or licensure standards
Develop a formal implementation blueprint
Develop academic partnerships
Develop an implementation glossary
Develop and implement tools for quality monitoring
Develop and organize quality monitoring systems
Develop disincentives
Develop educational materials
Develop resource sharing agreements
Distribute educational materials
Facilitate relay of clinical data to providers
Facilitation
Fund and contract for the clinical innovation
Identify and prepare champions
Identify early adopters
Increase demand
Inform local opinion leaders
Intervene with patients/consumers to enhance uptake and adherence
Involve executive boards
Involve patients/consumers and family members
Make billing easier
Make training dynamic
Mandate change
Model and simulate change
Obtain and use patients/consumers and family feedback

Implementation strategies defined by Powell [12]
Obtain formal commitments
Organize clinician implementation team meetings
Place innovation on fee for service lists/formularies
Prepare patients/consumers to be active participants
Promote adaptability
Promote network weaving
Provide local technical assistance
Provide ongoing consultation
Provide clinical supervision
Purposely reexamine the implementation
Recruit, designate, and train for leadership
Remind clinicians
Revise professional roles
Shadow other experts
Stage implementation scale up
Start a dissemination organization
Tailor strategies
Use advisory boards and workgroups
Use an implementation advisor
Use capitated payments
Use data experts
Use data warehousing techniques
Use mass media
Use other payment schemes
Use train-the-trainer strategies
Visit other sites
Work with educational institutions

Note. Definitions of the respective implementation strategies can be found in Powell [12]. We found no evidence in the primary studies, that implementation strategies were used to exploit facilitators or to overcome barriers.

SM6. Summary of barriers and facilitators by CFIR domain

Table SM6. Barriers and Facilitators for the implementation of school-based interventions to prevent mental disorders or promote mental health in secondary schools categorized based on the Consolidated Framework for Implementation Research

CFIR domains	Subdomain(s)	Barriers	Facilitators
Innovation	Source	NR	Trust and reputation of the provider [13]
	Evidence base	Worries about insufficient evidence [14]	Provision of evidence [13,14]
	Relative advantage	Worries about adverse effects [14]	NR
	Adaptability	NR	Flexibility of intervention delivery [13]
	Trialability	NR	NR
	Complexity	High complexity of the intervention (e.g. encompassing too many components), multiple models of implementation [15]; time-consuming training for intervention providers [14]	High complexity of the intervention, multiple models of implementation (e.g. providers freedom to decide which components to implement) [15]; time-consuming training of additional teacher skills [14]; clear instruction on service use provided by research team [16]
	Design	Session duration was either too short to cover all materials [17–19] or too long, making it difficult for students to stay focused [20–23]; age-inappropriate materials [15,20,22,24,25]; digital components consume too much data volume, were perceived as boring, not sufficiently engaging, could not compensate interpersonal relationships [21,24–26]; outdated technique, content, gamification and graphics, problems with usability, lack of personalization, repetitive and theoretical [13,20,23,27]; small group sizes making activities challenging, discomfort with physical activities or role plays within the group [28–30]; overemphasis on text-based and sit-down activities	Structured, client-driven, manualized programs easy to deliver [18,32]; adequate intervention frequency (e.g. one session per week), caseload and workload [16,26,27]; rich intervention material (e.g. booklets, posters, presentations) and techniques [26,27,33]; content relevant to daily life, appropriate communication on mental health, provision of useful strategies (e.g. problem solving), insights into mental health topics [22–24]; clear intervention content, purpose of activities helped to remember the session [14,17]; interactive, student-led activities and games promoted student engagement [17,22,31]; group environment counteracts stereotypes, increases comfort and offers the opportunity to meet new people [29]; personalization

		over interactive components [25,27,31]; screening questions were perceived as confusing and not engaging [16,23]; content not culturally sensitive [24]; distraction through food offers [17]	and age-appropriateness [13,27,33]; user-friendly gamified app on students' devices, web-based psychoeducation [13,16,24]; data-driven assessment tools improved implementation and enhanced staff capacity to meet students' needs [13,32]
	Cost	High costs of training for intervention deliverers [14]; intervention not sustainable due to high costs [22]	NR
	Critical incidents	COVID-19-pandemic: social distancing and school closures required program adaptions (virtual/remote) [13,23,32]; too much screen-time due to online learning [23]	NR
	Local attitudes	Transgenerational distrust in the government hindered participation in online intervention [24]; ambiguous support of schools by the ministry [26]	NR
	Local conditions	Gap in services for youth under 18 years with mild to moderate symptoms [24]; linkage services (e.g. transportation) as barrier to accessing treatment [24]; intervention not assigned the same importance as school subjects by government [22]	Continued support of students after implementation outside of the program [24]
Outer setting	Partnerships & connections	NR	External agency as providers for mental health support [27]; seamless referral to community partners [32]; cooperation with other schools [14]; academic-community partnership within the school district as a foundation for tailoring and delivering the curriculum [31,32]
	Policies & law	Conflict with existing "no-phone" school policies; high demands on schools to adapt standards in key curriculum areas and respond rapidly to policy changes [14]	NR
	Financing	Only temporary financial support, end of funding with termination of research program [24]; unexpected expenses for intervention materials (e.g. snacks, posters) and travel costs [34]	NR

Inner setting	External pressure	Societal pressure	NR	NR
		Market pressure	Conflict between program objectives and an ongoing construction project, which negatively affected room availability [28]	NR
		Performance pressure	Governmental pressure on schools to deliver mental health support [25]	NR
	Structural characteristics	Physical infrastructure	Poor room availability due to construction works [28]; location too small for group size [18]	School setting as familiar, comfortable and safe surrounding [27]
		Information technology infrastructure	Poor implementation of the room booking system resulting in last minute room changes [28]; low accessibility of technology infrastructure in rural areas and communities with low socioeconomic status [13]; technical barriers with program accessibility, email system and internet connectivity [16,21,35]; problems with survey delivery [34]	Email system used to notify counsellors was valuable [16]
		Work infrastructure	NR	NR
	Relational connections		NR	Staff involvement from the early start of the implementation [15]; already available support structures [14]
	Communications		Lack of communication between providers and/or staff members involved in planning and delivering the intervention [13,15,36]; intervention is presented in a way staff it feels like an “add-on” task [15]	Program presented in a way that the staff feels it can be integrated into the regular curriculum [15]; on-going communication between teachers, administrators and providers with clear allocations of responsibilities and task-sharing [13,31]; sharing intervention experiences with colleagues [14]
	Culture	Human-equality centeredness	Issues with representation, language, participation of minority groups and cultural diversity [13,37]; values of teachers, school administrators and caregivers not in line with the intervention content [19]	Establishing structures and rules to keep a positive, non-judgmental climate [29,31]

	Recipient-centeredness	Pre-existing class dynamics (e.g. lack of classroom management, poor school attendance, disruptive behavior) [31]; presence of mental health stigma, low mental health literacy, visibly recruiting students from class to attend the intervention [13,29]	Intervention in line with school values in terms of student welfare and care [27]; viewing all young people as deserving support regardless of context and actions [38]
	Deliverer-centeredness	NR	NR
	Learning-centeredness	NR	NR
Tension for change		NR	Intervention addressing unmet needs, appropriateness for students' needs [13]
Compatibility		Busy school environment in terms of time frames for delivery and communication between teachers and providers, difficulties in coordinating multiple schedules, infrequent intervention scheduling [22,29,30,33,36]; pressure on teachers to fulfil multiple roles in promoting students' academic success and mental health, lack of time for the staff [14,25,34]; inflexible school curricula [14]; problems with scheduling due to travel [34]; students did not completed homework in health subjects [36]; other external projects and groups were scheduled during intervention time [30]	Compatibility with the school context [13]; program delivery within school hours to enhance access for students [29]; starting the program early in the academic year as the academic year gets busier throughout the year [33]
Relative priority		Conflict between intervention and academic obligations, including negative impact on grades, impeding exam season, disruptions to normal lessons, conflicts with extracurricular activities [13,18,19,23,24,27–29,37,39]; teachers struggling with time constraints, prioritizing the intervention, protecting time for planning and ongoing communication in school day [13,15,19,22,29,36];	Sufficient staff time, reserved space in the curriculum, time to embed intervention within the school [14]

		teachers discouraging students from participating in the program due to academic obligations [17,37]; holiday breaks [28]; students with academic difficulties lose learning time due to their participation [24]; difficulties with peer leaders during exam season due to academic obligations [37]	
Incentive systems		NR	NR
Mission alignment		Mental health not being a priority in school [13]	Commitment to the intervention within school [14]; curriculum responsive school needs [31]; establishing the intervention as part of the school culture, preparing the community for change [14,26]; understanding, that commitment is required [14]
Available resources	Funding	Little or no financial resources for implementation [13,15]	Financial resources for staff training and ongoing support [14]
	Space	Shortage of available classrooms [27], sharing facilities with other scheduled groups [29], disruptions, room changes due to other school events [17], surrounding noise [29]	Appropriate physical space that is private, comfortable in terms of temperature, provides equipment that facilitates learning [29]
	Materials & equipment	NR	Provision of high-quality resources (WLAN, devices) by the research team [13]
Access to knowledge & information		Lack of information about the intervention before and during implementation [22,27,29,36]; inadequate or minimal training provided for providers [18,26,36]; difficulties with timely training for team members, inability to train all members at once, supervisors were trained last [32]; lack of ongoing guidance, support or supervision [25,36,37]	Clear communication about who the program was for, ensuring providers and staff have a solid understanding of the intervention [29,32]; importance of training to be comfortable with intervention contents [32,33]; intermittent, ongoing training opportunities, communication with educators, communication about student progress [29,32]; Developing a shared language about the intervention within the school [14]

individuals	characteristics	Need	Mismatch with recipients' needs (e.g., intervention needs, needs with respect to complexity [27,32,35]); students feeling to down to use the service [21]; waiting time for additional treatment for students with mild to moderate symptoms [24]	NR
		Capability	Lack of confidence, skills, expertise, qualification or capacity to implement intervention as school staff were trained poorly [14,19,33,37]; varying quality of delivery [22,28]; students faced challenges engaging with program activities, difficulties using technology, and completing tasks like gratitude letters [24,26,31]; peer leaders misunderstood the intervention goal, teachers experiences role conflicts [19,22,37]; staff turnover, changes in leadership resulting in rapid loss of expertise and capacity [14]; relationship building between external providers and students was difficult over a short time period [22]	Supportive leadership, teams, involving individuals with capacity and expertise [13,14,32,38]; provider qualities: building relationships with students, self-efficacy, engaging personality, being aware of students' needs, ability to reflect on practice, self-awareness and self-disclosure, flexibility [14,17,22,32,38]; teachers being engaging, trusted by students, and experienced in classroom management and education [20]
		Opportunity	High caseloads and limited capacity of providers and teachers led to delays in care [13,21,24,25,35]	NR
		Motivation	Teachers' and students' enthusiasm, interest, and commitment diminished over time [14,22,23]; lack of motivation, openness, willingness to change [15,21,25,35]; disruptive student behavior, negative group dynamics including interrupting and disrespecting the provider, off-task behaviors, refusing task completion, teachers hesitation and opposition to intervention process, caregivers having other priorities [13,17,24,33]; not valuing the program or taking it seriously [33,37]; staff worries that approach is insufficient for change [13]	Enthusiasm and commitment at leadership level [14,15,26]; motivation for staff-buy-in [13]; perception that the intervention was viewed as an effective practice and was experienced as a needed improvement [26,32]; support for the intervention by caregivers [26]

Implementation process	Teaming	Issues with communication among providers, having conflicting ideas within the team about which activities to implement [37]	Benefits of offering individual and group supervision facilitating peer-to-peer learning and focusing on students' needs [32]; combination of formal and informal structure that supported the implementation [32]; valuable input from multiple stakeholders, students involved in decision making [26]
	Assessing need - deliverers	NR	NR
	Assessing need – recipients	Selection of participants by teachers based on observed behavior [28]	Mental health counsellors assessing youth based on individual needs [24]
	Assessing context	NR	NR
	Planning	NR	NR
	Tailoring strategies	NR	NR
	Engaging: Innovation deliverers	Lack of leadership and administrative support [15,29,34]; caregiver consent affected by the level of interest from school administrators and teachers as well as and seasonal factors [34]; teachers' mixed attitudes towards the intervention and relationship with providers [22]	Support and involvement from leadership with staff recruitment and allocation of time for planning and preparation [13,15]; teachers' enthusiasm, willingness and involvement in the implementation process [14,26]; supervisor buy-in [32]
	Engaging: Innovation recipients	Difficulties with student and teacher buy-in due to limited accessibility, believing the intervention is unnecessary, self-referral to intervention, unawareness of obligatory caregiver involvement and discomfort with sharing feelings in the classroom [16,24,27,36,37]; lack of caregiver consent due to poor marketing and communication about intervention, family dynamics, fear of stigma, obligatory caregiver involvement [13,24,29,36]; worries about privacy and confidentiality [21,24]; contacting caregivers hindered student progress [24]	Intervention actively sought student participation through addressing students' interests or sending text messages [17,27]; students were more interested when the intervention was presented by external institutions [16]; positive perception of the intervention as beneficial for both staff and student well-being, improving mental health, academic attainment, promoting development [14]; supportive environment and relationships because of teacher engagement [24]; caregivers attended appointments to ensure their adolescents had access to mental health care [24]
	Doing	NR	Measurement-based care allowed supervisors to monitor implementation fidelity and quality [32]

	Reflecting & evaluating – implementation	Teachers' implementation performance was not evaluated [36]; difficulties with standardizing processes into an implementation protocol due to heterogeneous approaches, techniques and preferences of providers [24]	NR
	Reflecting & evaluating – innovation	NR	Getting feedback from teachers about issues with implementing group content in classroom (e.g. disruptive student behavior) [31]
	Adapting	Lack of caregiver involvement through intervention process as it depended on capacity and student contribution [28]; content adaptations leading to additional time pressure and workload [25]; poor implementation adaptation based on students' and settings' needs [36]; some provider were misinformed, had differing version of the intervention or conflicting goals [14,28]	Teachers integrating content of intervention into the regular curriculum; continuously improving and adapting the intervention to fit the school community; employing innovative modifications for intervention components that student found difficult [31]

Note. The Roles section of the CFIR outlines applicable roles within the inner and/or outer Setting [2]. In our review, this section was solely used for this purpose, so no barriers or facilitators were coded here in this table. The term "provider" refers to anyone leading or delivering an intervention. NR - not reported.

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