

Review

How can school-based programmes improve physical and mental health outcomes in low-and-middle-income countries? An umbrella review and logic model

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ABSTRACT

School-based programmes offer a promising approach for improving physical and mental health trajectories in low-and-middle-income countries (LMICs). This umbrella review and logic model explores how and in which contexts these programmes are effective. A systematic search of electronic databases identified 20 systematic reviews (5 meta-analyses) on school based (SB) physical ($n = 13$; primary studies = 214) and mental ($n = 7$; primary studies = 120) health programmes across a range of low, lower-middle, and upper-middle income countries. Programmes included universal (all students), selective (e.g., high-risk students), and indicated (e.g., students with symptoms) approaches. Evidence was stronger for proximal (e.g., nutritional knowledge), and intermediate (e.g., dietary behaviour) outcomes than for distal (e.g., obesity reduction) outcomes, and there were some variations in outcome by geographical region. Evidence for combined physical and mental health programmes was scant, with limited overlap between the two types of programmes (i.e. some shared components and outcomes). Moderators of programme effectiveness included recipient (e.g., gender, age) and programme (e.g., longer duration, multi-component) characteristics, and inner (e.g., school resources, support for teachers) and outer (e.g., partnerships with Non-Governmental Organisations) settings. Cultural adaptations and implementation quality were highlighted as important (yet rarely fully reported) factors in ensuring programme sustainability and scaling-up. There is some supportive evidence for SB programmes in LMICs, though evidence for effectiveness varies by temporality of outcome and geographical location. This highlights the importance of considering implementation barriers across outcome trajectories and ensuring sufficient attention is given to cultural adaptations. Dual programmes combining balanced physical and mental health modules might offer promise for addressing the growing burden of non-communicable diseases in LMICs.

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1. Introduction

The burden of non-communicable diseases (NCDs) is disproportionately high in low-and-middle-income countries (LMICs) (Akseer et al., 2020). NCDs, such as cardiovascular disease, diabetes, and mental health conditions affect individuals at a younger age and lead to worse outcomes in LMICs (Piot et al., 2016). This signals an urgent need for an understanding of how dual physical and mental health intervention programmes can address modifiable risk factors early in development (Hategeka et al., 2022).

Mental health disorders are the most common NCDs found in adolescents (Akseer et al., 2020). Indeed, youth mental health has emerged as a critical global concern with megatrends (e.g., intergenerational inequality, unregulated social media) and social shifts (e.g., falling social cohesion) undermining young peoples' mental wellbeing (McGorry et al., 2024). Large-scale studies indicate that the prevalence of youth mental health problems is higher in LMICs than in high-income countries (HICs) (Ramdhoney-Dowlot, Balloo, Morgül, and Essau, 2025; Suresh and Dar, 2025). Elevated rates are attributed to numerous factors including increased vulnerability from being left behind by migrant parents or due to orphan status, experiences of war conflict and violence, childhood maltreatment, and poverty (Ramdhoney-Dowlot et al., 2025). Additional challenges faced by youth in educational settings include academic pressures, social isolation, economic uncertainty, unregulated screen time, and sedentary lifestyles (Suresh and Dar, 2025). In a recent study across eight Indian cities, students exhibited moderate to high levels of anxiety (69.9%), depression (59.9%) and distress (70.3%) (Suresh and Dar, 2025). Despite high prevalence of mental health problems, a minimal number of students access mental health services in LMICs often due to stigma, cultural biases, and limited mental health awareness (Suresh and Dar, 2025).

School based (SB) programmes can help fill the treatment gap in low resource settings through the provision of early intervention for physical and mental health problems. Children and adolescents spend significant time in school and can be exposed to multi-component programmes addressing several (physical and mental) health outcomes simultaneously (Bella-Awusah and Omigbodun, 2020; Yuksel, Şahin, Maksimovic, Drid, and Bianco, 2020). Multi-component programmes are especially attractive in LMICs as they can have broad effects for the cost of a single programme and are thus less likely to be "pushed out" if policy priorities change (Skeen et al., 2019). In view of the strong correlation between physical and mental health (Cadenas-Sanchez et al., 2021) and the growing burden of non-communicable diseases in LMICs (Piot et al., 2016), diet and physical activity offer key modifiable targets for the prevention of chronic physical and mental health problems (Firth et al., 2019). Thus, SB programmes aimed at improving the well-being of young people should incorporate components targeting nutrition, physical activity, and mental health outcomes (Molendijk, Molero, Sánchez-Pedreño, Van der Does, and Martínez-González, 2018).

There are three main levels of school-based programme: universal, selective, and indicated (Gimba et al., 2020). Universal programmes are delivered to all students regardless of individual risk and are often aimed at reducing stigma and improving health literacy to prevent the development of mental or physical health problems (Abu Shihab et al., 2023; Bradshaw et al., 2021). Selective programmes target students (and sometimes their family members) who are susceptible to mental or physical health problems, but do not currently show the disorder or problem (Gimba et al., 2020; Uijtewilligen, Waters, Müller-Riemenschneider, and Lim, 2016). Approaches might include skills training for parents and psychoeducation for children exposed to harmful environments or predisposed to experiencing mild emotional or behavioural problems (Gimba et al., 2020). Indicated programmes focus on individuals who already manifest early signs and symptoms of a disorder or problem but do not reach diagnostic criteria. They include approaches such as social skills training for hyperactivity symptoms or cognitive behaviour therapy for PTSD symptoms (Grande et al., 2023).

Several systematic reviews and meta-analyses have examined SB programmes for mental (Bradshaw et al., 2021; Tareke, Asrat Yirdaw, Gebeyehu, Gelaye, and Azale, 2023) or physical (Adom, De Villiers, Puoane, and Kengne, 2019; Verstraeten et al., 2012) health outcomes in LMICs. These reviews tend to focus on one of the three levels of intervention such as universal mental health promotion for all students (Bradshaw et al., 2021), indicated mental health interventions (e.g., CBT) for students manifesting depression, anxiety or PTSD symptoms (Grande et al., 2023), selective mental health programmes for at-risk (e.g., conflict exposed) students (Gimba et al., 2020), and nutrition and/or physical activity programmes universally delivered (Kyere, Veerman, Lee, and Stewart, 2020) or indicated programmes delivered to overweight or obese students (Uijtewilligen et al., 2016). Therefore, the available evidence is fragmented, and to the best of our knowledge, there are no reviews bringing together evidence from SB physical and mental health programmes at the three levels of delivery to elucidate how they could be combined and implemented in LMICs.

1.1. The current study

We conducted an umbrella review to present an overview of a broad array of SB programmes drawing together disparate strands of evidence. An umbrella review is a systematic review of multiple systematic reviews and meta-analysis (SRMAs) on a specific topic. They are recommended when researchers need to examine the evidence on several different research questions, and multiple systematic reviews have already been published on the topic of interest (Belbasis, Bellou, and Ioannidis, 2022). Our overall aim was to combine evidence on different types of SB programmes for physical and mental health outcomes in LMICs to understand *how* and in *which contexts* these programmes might work. We developed a logic model (Baxter et al., 2014; Winsper, Crawford-Docherty, Weich, Fenton, and Singh, 2020) to collate and map out our findings in relation to the following research questions:

- (1) What are the types and components of SB physical and mental health programmes in LMICs?
- (2) What are the outcomes of these programmes including proximal (immediate, or soon after the intervention), intermediate (short to medium-term or mediating), and distal (long-term or ultimate) effects?
- (3) What are the moderators (i.e. facilitators and barriers) of programme outcomes?
- (4) What are the overlapping components and outcomes between physical and mental health programmes?

We anticipate our findings in relation to these research questions can help inform the development and implementation of multicomponent approaches (Topor and Ljungberg, 2016), and guide policy formation for SB programmes in LMICs (Davies, 2012; Pongutta, Ajetunmbi, Davey, Ferguson, and Lin, 2022).

2. Method

2.1. Search strategy and selection criteria

We conducted an umbrella review to systematically summarise multiple school-based (SB) programme studies based on systematic reviews and meta-analysis (Belbasis et al., 2022). The protocol was registered with PROSPERO (CRD42024578955) prior to commencing the searches.

We searched MEDLINE, Embase, PsycINFO, CINAHL, and Cochrane Library from 1st Jan 2010 to 15th August 2024 (Supplementary Table 1a details the search strategy and Supplementary Table 1b outlines inclusion and exclusion criteria). We conducted an updated search on 7th December 2025 to ensure inclusion of the most recent literature. The search algorithm comprised four parts with key words to capture: (1)

systematic reviews or meta-analyses; (2) physical and/or mental health programmes; (3) LMICs; and (4) SB programmes. These four parts were combined using the boolean operator AND (Goossen, Hess, Lunny, and Pieper, 2020). No language restrictions were applied. Database searches were supplemented by manual search of reference lists from included reviews. We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (Page et al., 2021).

2.2. Screening procedure

CW and UA independently screened 100% of titles and abstracts (Supplementary table 2). Decisions, with reasons, were independently recorded. Reviewers discussed discrepancies and selected the article for full text screening if there was any doubt over whether it should be included. CW and UA then independently screened 100% of full text articles for final inclusion in the review.

2.3. Inter-rater reliability (IRR)

We used Cohen's Kappa (κ) to measure the level of agreement between reviewers for the title and abstract screening, full-text screening, and individual items of the critical appraisal (Chong, Pedron, Abdelmalak, Laxy, and Stephan, 2023). Kappa is a summary measure ranging between 0 and 1, which represents chance-corrected observed agreement (Warrens, 2014). Generally, a figure between 0.60 and 0.79 indicates a moderate level of agreement, and 0.80–0.90 indicates strong agreement.

2.4. Data extraction and synthesis of results

Prior to conducting the searches, CW developed a draft logic model (Supplementary fig. 1) to provide a framework for the data extraction form (Winsper et al., 2020). Our project partner teams in Nigeria and India provided input to the logic model (e.g., context specific programme components and outcomes) based on rapid reviews they conducted to inform the development of a programme as part of a larger research study. Data extracted included: (1) programme typologies including content of programmes (e.g., modules); (2) delivery modes (e.g., didactic, workshops); (3) proximal (e.g., changes in dietary knowledge), intermediate (changes in dietary choices), and distal (e.g., reduction in obesity/overweight) outcomes; and (4) and contextual moderators (e.g., programme duration). CW extracted data linked to these four elements, and main review features (e.g., author, date, number of studies, study countries, programme characteristics). SG extracted data from 25% of included reviews as a quality check.

We summarised data narratively, in tables, and using our draft logic model, which was refined as we consolidated extracted data. We did not rerun meta-analysis as there was limited overlap between meta-analysis reviews. Due to anticipated diversity of included reviews, we included all reviews with overlapping primary studies and investigated potential overlap at data synthesis stage (Lunny, Pieper, Thabet, and Kanji, 2021). We developed two citation matrices (physical and mental health programmes) to visually demonstrate overlap (Faulkner, Fagan, and Lee, 2022) and calculated the corrected covered area (CCA) to determine the degree of overlap (Pieper, Antoine, Mathes, Neugebauer, and Eikermann, 2014). The CCA is expressed as a percentage and reflects the covered area in the citation matrix, i.e. the total number of included publications (primary studies in matrix including double counting) divided by number of rows (total number of primary studies) multiplied by number of columns (total number of reviews).

2.5. Critical appraisal of review evidence

CW assessed reviews using the AMSTAR-2 for systematic reviews of randomised and non-randomised studies (Shea et al., 2017). DM assessed 50% of reviews as a reliability check. Of 16 domains, seven are

classified as “critical domains” (i.e. can critically affect the validity of review conclusions). The following scheme was used to rate overall confidence in the results of each review: (1) High: no or one non-critical weakness; (2) Moderate: more than one non-critical weakness (no critical flaws); (3) Low: one critical flaw, with or without non-critical weakness; and (4) Critically low: more than one critical flaw with or without non-critical weaknesses (Shea et al., 2017).

3. Results

3.1. Description of studies

Of the 543 abstracts from the original search, 38 full text articles were selected for retrieval. The updated search yielded a further 88 abstracts (total abstracts: 631), and nine articles for full text retrieval (totalling 47 full text articles). Of the 47 full text articles, 19 were selected for inclusion with an additional article (Xu et al., 2020) identified by reference list search (totalling 20 articles in the final review, Fig. 1). All reviews were published in the English language.

There was strong agreement between reviewers: abstract stage, Kappa = 0.88; full text stage, Kappa = 0.84. Discrepancies mostly related to uncertainty regarding whether the review comprised mainly SB programmes and/or LMIC countries. The reviewers settled disagreements through careful inspection of the articles. Reasons for exclusion of articles at abstract and full text stage are provided in Supplementary Tables 3 and 4.

Of the 20 reviews, 15 were synthesised narratively (Abu Shihab et al., 2023; Adom et al., 2019; Bradshaw et al., 2021; Ekubagewargies, 2025; Gimba et al., 2020; Harte and Barry, 2024; Klingberg, Draper, Micklesfield, Benjamin-Neelon, and van Sluijs, 2019; Kyere et al., 2020; Sadhu et al., 2025; Shinde, Wang, Moulton, and Fawzi, 2023; Tareke et al., 2023; Uijtdewilligen et al., 2016; Verstraeten et al., 2012; Wiafe, Ayensu, Yeboah, Eli-Cophie, and Benewaa, 2025; Xu et al., 2020), four were meta-analyses: one mental health (Grande et al., 2023); three physical health (Jauhari et al., 2025; Pongutta et al., 2022; Singhal, Herd, Adab, and Pallan, 2021), and one combined narrative and meta-analysis synthesis (Singla et al., 2020). Thirteen focused on physical health (nutrition and/or physical activity), and seven on mental health and/or life skills. Most physical health programmes were universal, with limited selective components for overweight/obese children. Mental health programmes included universal, selective, and indicated approaches.

Ten reviews covered a broad range of LMICs including countries across continents/sub continents including Asia, Africa, and Latin America (Bradshaw et al., 2021; Ekubagewargies, 2025; Gimba et al., 2020; Grande et al., 2023; Harte and Barry, 2024; Jauhari et al., 2025; Shinde et al., 2023; Singla et al., 2020; Verstraeten et al., 2012; Wiafe et al., 2025) (Table 1). These reviews tended to include more upper and lower-middle income countries, with fewer studies from low-income countries. Four reviews focused solely on African countries (Adom et al., 2019; Klingberg et al., 2019; Kyere et al., 2020; Tareke et al., 2023) including low (e.g., Uganda, Burkina Faso), lower-middle (e.g., Tunisia, Kenya) and upper-middle (e.g., South Africa, Botswana) income countries. One review on Arab states included low (e.g., Syria), lower-middle (e.g., Morocco, Jordan), and upper-middle (e.g., Iraq) income countries (Abu Shihab et al., 2023). The remaining five reviews did not include low-income countries. Three included Asian countries (Pongutta et al., 2022; Sadhu et al., 2025; Uijtdewilligen et al., 2016), one a range of lower-middle (e.g., Lebanon) and upper-middle (e.g., Mexico) countries (Singhal et al., 2021), and one countries from the WHO Western Pacific Region, including upper (e.g., Mongolia) and lower (e.g., Cambodia) middle income countries (Xu et al., 2020).

Thirteen physical health programme reviews included 214 primary studies with a total of 311, 468 participants. There was an overlap of 46 (21.5%) primary studies between reviews and 168 (78.5%) were unique (Supplementary Tables 5 and 7). The corrected covered area (CCA)

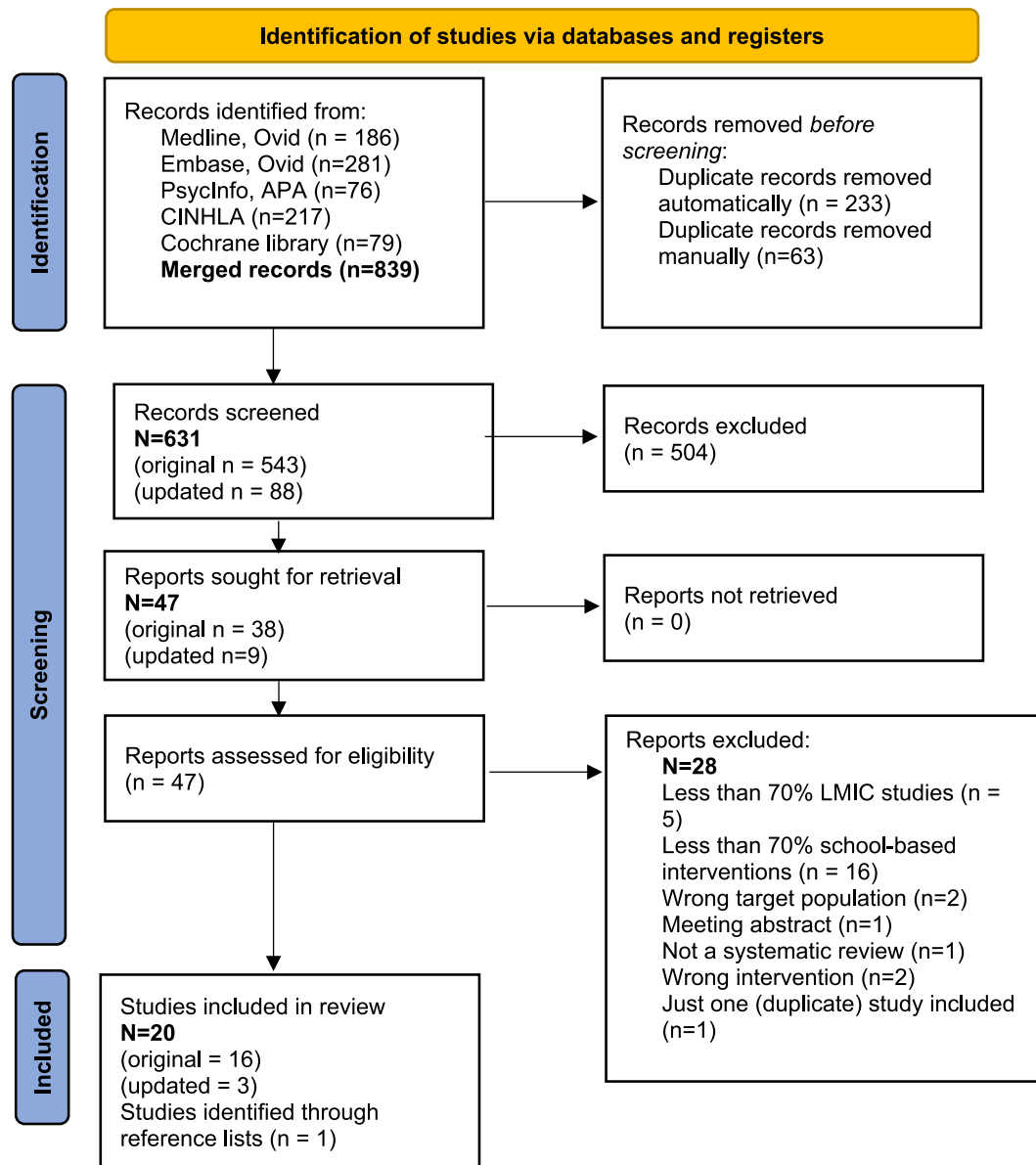


Fig. 1. PRISMA flow diagram for systematic search.

across reviews was 2.8%, representing a “slight” overlap (Pieper et al., 2014).

Seven mental health programme reviews included 130 primary studies with a total of 162,354 participants. There was an overlap of 27 (20%) primary studies between reviews and 103 (80%) were unique (Supplementary Tables 6 and 8). The corrected covered area (CCA) across reviews was 4.2%, representing a “slight” overlap (Pieper et al., 2014).

3.2. Critical appraisal

Raters achieved a moderate level of agreement ($\kappa = 0.70$). Disagreements were reviewed and consensus achieved through further discussion between reviewers. Most discrepancies related to whether reviews explicitly described how risk of bias could have impacted on individual study results (Supplementary Table 9). Eleven reviews (Abu Shihab et al., 2023; Bradshaw et al., 2021; Ekubagewargies, Ahmed, and Lee, 2025; Gimba et al., 2020; Grande et al., 2023; Harte and Barry, 2024; Klingberg et al., 2019; Kyere et al., 2020; Sadhu et al., 2025; Uijtdewilligen et al., 2016; Wiafe et al., 2025) received a critically low

rating, seven (Jauhari et al., 2025; Pongutta et al., 2022; Shinde et al., 2023; Singhal et al., 2021; Singla et al., 2020; Tareke et al., 2023; Xu et al., 2020) received a low rating, and two (Adom et al., 2019; Verstraeten et al., 2012) received a moderate rating. Eight did not refer to a study protocol, or a priori establishment of review methods. Ten did not fully describe their search strategy or justify reasons for limiters. Six did not provide adequate details on reasons for exclusion of studies. Twelve did not clearly describe how risk of bias impacted individual results.

4. Programme typologies, outcomes, and moderators

Fig. 2 outlines (1) programme typologies; (2) delivery modes; (3) proximal, intermediate, and distal outcomes; and (4) moderators (facilitators and barriers). Supplementary Table 10 details characteristics of programmes and Supplementary Table 11 overviews outcomes and moderators of programmes.

4.1. Programme typologies

We identified physical and mental health programmes at the

Table 1

Characteristics of systematic reviews of school based mental and physical health programmes in low-and-middle-income countries.

First author, publication year	Number of school-based intervention studies, no. of participants (age range), design of studies	Countries reviewed according to World Bank 2023 income status (Low, Lower middle, Upper middle)	Characteristics of interventions (target, delivery, duration)	Main outcomes	Synthesis approach	Main aim of systematic review & overall conclusions
1. Abu Shihab 2023	16, 13, 155 children and adolescents (2 to 18 years), RCTs, quasi-experimental, pre-post	<u>Low</u> : Syria <u>Lower middle</u> : Tunisia, Egypt, Morocco, Lebanon, Palestine, Jordan <u>Upper middle</u> : Iraq	Nutrition Universal 2 weeks to 3 years	Anthropometric measures (e.g., BMI) Food consumption Nutrition knowledge Psychosocial (e.g., self-efficacy)	Narrative	-To provide guidance for addressing obesity & overweight in the Arab world -Training teachers to be active members of nutrition interventions is an effective & low-cost approach to improving the health & well-being of students in the Arab world
2. Adom 2019	10, 10, 955 children and adolescents (6 to 15 years), RCTs, pre-post-test quasi experimental	<u>Lower middle</u> : Tunisia <u>Upper middle</u> : South Africa	Nutrition and physical activity Universal/selective 4 mths to 3 years	Anthropometric measures (e.g., BMI) Food consumption Physical activity	Narrative	-To summarise evidence on SB interventions for improving nutrition & physical activity knowledge, attitude, and behaviour -The dearth of studies & inconsistent results precludes definitive conclusions about the effectiveness of interventions
3. Bradshaw 2021	12, 15, 893 children and adolescents (6–18 years), cRCTs, RCTs, quasi-experimental, pre-post	<u>Low</u> : Uganda <u>Lower middle</u> : Nigeria, India <u>Upper middle</u> : Thailand, Turkey, Indonesia, Mexico, Malaysia, Mauritius, Colombia, China	Mental health Universal 1 wk. to 1 year	Mental health (depression and anxiety)	Narrative	-To narratively synthesise data on universal school-based (SB) interventions for childhood depression & anxiety -Authors were unable to conclude that SB interventions can reduce anxiety & depression due to the small number of studies & low study quality
4. Ekubagewargies, 2025	8, 6338 adolescents (10–19 years) quasi-experimental, RCTs	<u>Low</u> : Ethiopia <u>Lower middle</u> : Tunisia, India, Vietnam <u>Upper middle</u> : Iran, Malaysia	Nutrition Universal 3 wks to 3 years	Dietary intake Nutritional knowledge & attitudes Self-efficacy	Narrative	-Synthesise evidence on peer-led interventions for improving dietary behaviour in adolescents -Peer-led interventions are effective for improving dietary behaviours of adolescents in LMICs
5. Gimba 2020	11, 2, 535 adolescents (12–18 years), RCTs, quasi-experimental, mixed methods, cross-sectional	<u>Lower middle</u> : India, Nigeria, Palestine <u>Upper middle</u> : South Africa, Bosnia & Herzegovina, Kosova, Mauritius, Thailand	Mental health Universal/selective/ indicated 3 wks to 4 years	Mental health (e.g., PTSD, depression) Psychosocial (e.g., hopelessness, coping skills, social support) Well-being Mental health knowledge	Narrative	-To identify components of SB mental health programmes that have been implemented in LMICs -Seven core modules could be useful in developing SBMHPs (introduction; psychoeducation; relationship & communication; cognition; social support systems; behavioural & conclusion)
6. Grande 2023	6 (combined across 39 studies), 9, 017 children and adolescents (16–18 years), RCTs, non-randomised	<u>Low</u> : Burundi, Uganda <u>Lower middle</u> : Congo, Kenya, India, Lebanon, Nepal, Nigeria, Palestine, Sri Lanka <u>Upper middle</u> : Bosnia, Brazil, China, Indonesia, Iran, Malaysia, Mexico, South Africa, Turkey	Mental health Selective/indicated 6 wks to 12 mths	Mental health (e.g., ADHD, depression)	Meta-analysis	-To identify SB interventions to treat children & adolescents in LMICs -Overall interventions delivered in the school environment are effective in reducing mental health problems in children & adolescents (this effect was not found when interventions were stratified by condition, except for PTSD)
7. Harte 2024	25, 53, 594 children & adolescents (5 to 19 years), cRCTs, RCTs, quasi-experimental, pre-post, cohort, qualitative, pseudo-random, two-group comparison, cross-sectional	<u>Low</u> : Uganda <u>Lower middle</u> : Vietnam, India, Tanzania, Cambodia, Zambia, Egypt, Pakistan <u>Upper middle</u> : Brazil, China, Thailand, Mexico, Iran, Kosovo, Romania (now classed as high income), Colombia	Mental health Universal/selective 16 wks to 24 mths	Mental health Psychosocial (assertive behaviour, cooperation, empathy, determination) Knowledge about illness, attitudes/ behaviour towards people with mental illness Well-being, Quality of life School climate	Narrative	- To understand how SB interventions are implemented and adapted for local delivery in LMICs - Greater attention to reporting core components and implementation processes is needed to facilitate sustainability, replication & scaling up of interventions
8. Jauhari 2024	22, 20, 542 adolescents (8–24 years), RCTs, cRCTs, quasi-experimental, controlled trial	<u>Low</u> : Uganda <u>Lower middle</u> : India, Nigeria, Uganda <u>Upper middle</u> : China, Mexico,	NCD prevention Universal Not reported	Anthropometric measures Fitness Screen time Dietary intake	Meta-analysis	-Evaluate the effectiveness of educative interventions for NCD prevention in LMICs -Multi-session interventions and those involving parents and teachers showed greatest improvements.

(continued on next page)

Table 1 (continued)

First author, publication year	Number of school-based intervention studies, no. of participants (age range), design of studies	Countries reviewed according to World Bank 2023 income status (Low, Lower middle, Upper middle)	Characteristics of interventions (target, delivery, duration)	Main outcomes	Synthesis approach	Main aim of systematic review & overall conclusions
		Ecuador, Iran, Malaysia, Brazil, Kuwait (now classed as high income)		Mental health Knowledge about nutrition, health, obesity, physical activity		Sustained changes require targeted strategies beyond education alone
9. Klingberg 2019	14, 16, 573 children & adolescents (2–18 years), RCTs, pre-post-test with or without a comparison group	<u>Low:</u> Uganda <u>Lower middle:</u> Tunisia <u>Upper middle:</u> South Africa	Nutrition, physical activity Universal 6 dys to 3 yrs	Physical activity Food consumption Anthropometric (e.g., weight, BMI)	Narrative	-To review evidence on the effectiveness of behavioural childhood obesity prevention interventions -Barriers and facilitators to successful interventions were largely resource related
10. Kyere 2020	14, 6, 837 children & adolescents (5–19 years), RCTs, controlled before & after	<u>Low:</u> Burkina Faso <u>Lower middle:</u> Kenya, Nigeria, Tanzania <u>Upper middle:</u> South Africa, Botswana	Nutrition Universal 3 wks to 3 yrs	Nutrition status Anthropometric measures Nutrition knowledge, attitudes & behaviour	Narrative	-To evaluate the effect of SB nutrition interventions on child nutrition status, knowledge, attitudes & behaviour -There is sufficient evidence to warrant further trials of SB nutrition interventions in Sub-Saharan Africa. Future work should focus on the role of programme intensity & duration
11. Pongutta 2022	28, 16, 730 primary school children (not fully reported), cRCTs, RCTs, quasi-experimental	<u>Lower middle:</u> Lebanon, India <u>Upper middle:</u> China, Turkey, Iran, Malaysia, Thailand	Nutrition, physical activity Universal/selective 8 wks to 5 years	Anthropometric measures (e.g., BMI)	Meta-analysis	-To describe SB nutrition interventions in Asia and quantify effects on nutritional status -Overall primary school nutrition interventions reduce BMI in children, though the effectiveness varies with intervention characteristics, e.g., multi-component
12. Sadhu 2025	13 (11 school-based), 8492 adolescents (10–19 years), cRCTs, RCTs, quasi-experimental, post-test	<u>Lower middle:</u> India, Pakistan, Nepal	Mental health Universal/selective	Resilience	Narrative	-To study the literature on resilience programmes for adolescents in South Asia -Need to adapt and scale multi-level interventions outside of the school setting
13. Shinde 2022	58, 89, 001 children & adolescents, RCTs, controlled before & after studies	<u>Low:</u> Burkina Faso, Ethiopia, Mali <u>Lower middle:</u> India, Laos, Nepal, Palestine, Kenya, Benin, Zambia <u>Upper middle:</u> China, Iran, Malaysia, Turkey, Brazil, Mexico, Colombia, Ecuador, Peru, South Africa	Nutrition, physical activity Universal 1 wk. to 3 yrs.	Anthropometric measures Haemoglobin levels Nutrition knowledge Attitudes to healthy eating Food consumption	Narrative	-To synthesise evidence on the effects of SB interventions on nutrition and educational outcomes -Research needs a greater inclusion of theory-based approaches to guide implementation & more studies of integrated interventions including parents & the wider community
14. Singhal 2021	21, 48, 891 children, CRCTs	<u>Lower middle:</u> Lebanon <u>Upper middle:</u> Brazil, China, Mexico, Turkey, Iran, Thailand	Nutrition, physical activity Universal/selective 3 mths to 3 yrs	Anthropometric measures Physical activity Food consumption Quality of life	Meta-analysis	-To summarise evidence from RCTs on SB interventions for childhood obesity in middle-income countries -There is some evidence supporting SB interventions for childhood obesity
15. Singla 2020	45, 68, 561 adolescents, RCTs	<u>Low:</u> Uganda, Sierra Leone, Burundi <u>Lower-middle:</u> India, Sri Lanka, Cambodia, Nepal, Lebanon, Congo, Jordan, Bangladesh <u>Upper-middle:</u> Turkey, South Africa, China, Iran, Mauritius, Bosnia and Herzegovina, Indonesia	Mental health Indicated 8.4 to 18.6 wks	Mental health Life skills Health knowledge	Narrative synthesis Meta-analysis	-To examine key implementation processes & the effectiveness of adolescent life skills programmes -Comprehensive programs which focus on multiple life skills at the individual & social level hold promise for addressing the burden of poor mental health
16. Tareke 2023	14, 4, 262 adolescents, RCTs	<u>Low:</u> Sierra Leone, Rwanda, Uganda <u>Lower middle:</u> Nigeria, Kenya <u>Upper middle:</u> South Africa, Mauritius	Mental health Universal/indicated 90 mins to 6 mths	Mental health (e.g., depression, anxiety)	Narrative	-To review SB psychological interventions for depression, anxiety and PTSD -Cognitive behavioural therapy and Shamiri interventions were commonly delivered in school

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Table 1 (continued)

First author, publication year	Number of school-based intervention studies, no. of participants (age range), design of studies	Countries reviewed according to World Bank 2023 income status (Low, Lower middle, Upper middle)	Characteristics of interventions (target, delivery, duration)	Main outcomes	Synthesis approach	Main aim of systematic review & overall conclusions
17. Uijtendewilligen 2016	17, 30, 693 children and adolescents, RCTs, CTs	<u>Lower middle</u> : India, Pakistan <u>Upper middle</u> : China, Thailand	Nutrition, physical activity Universal/indicated 3 mths to 3 yrs.	Anthropometric (e.g., BMI) Food consumption Physical activity Nutrition knowledge	Narrative	settings and could be effectively delivered by non-professionals -To provide an overview of childhood obesity prevention programmes in Asia -The most substantial effects of interventions were on health knowledge and/or favourable lifestyle practices
18. Verstraeten 2012	25, 23, 638 children & adolescents, cRCT, before & after study, cohort analytic study	<u>Lower middle</u> : India <u>Upper middle</u> : Brazil, Mexico, South Africa, China, Iran, Thailand	Nutrition, physical activity Universal/indicated 1 h to 4 yrs	BMI Dietary behaviours Physical activity	Narrative	-To review the evidence on the effectiveness of SB interventions targeting dietary behaviour and/or physical activity -SB interventions have the potential to improve dietary & physical activity behaviour & prevent unhealthy body weights in LMICs
19. Wiafe 2025	18, 9, 341 adolescents CT, quasi-experimental, cohort, longitudinal	<u>Lower middle</u> : Egypt, Tunisia, Ghana, India, Kenya <u>Upper middle</u> : Brazil, Ecuador, Thailand, Iran, Malaysia	Nutrition, physical education, surgeryIndicated 6 wks to 3 yrs	BMI/zBMI Visceral fat Fat mass	Narrative	-To assess interventions used in the management of adolescent obesity -The few studies on adolescent obesity in developing countries are largely effective
20. Xu 2020	8, 18, 774 adolescents, RCT, non-RCT (e.g., pre-post-test), cRCT	<u>Lower middle</u> : Cambodia, Philippines <u>Upper middle</u> : China, Mongolia, Malaysia	Physical health Universal 6 wks to 3 yrs	Knowledge Attitudes Behaviours Anthropometric Changes in school environment & policy	Narrative	-To identify effective SB interventions & facilitating factors for adolescent health in the Western Pacific Region -SB interventions were effective in changing knowledge, attitudes, behaviours, health policies

RCT: Randomised Controlled Trial; cRCT: Cluster Randomised Controlled Trial; BMI: Body Mass Index; SB: School Based; SBMHPs: School-Based Mental Health Programmes; LMICs: Low and Middle Income Countries; ADHD: Attention Deficit Hyperactivity Disorder; PTSD: Post Traumatic Stress Disorder.

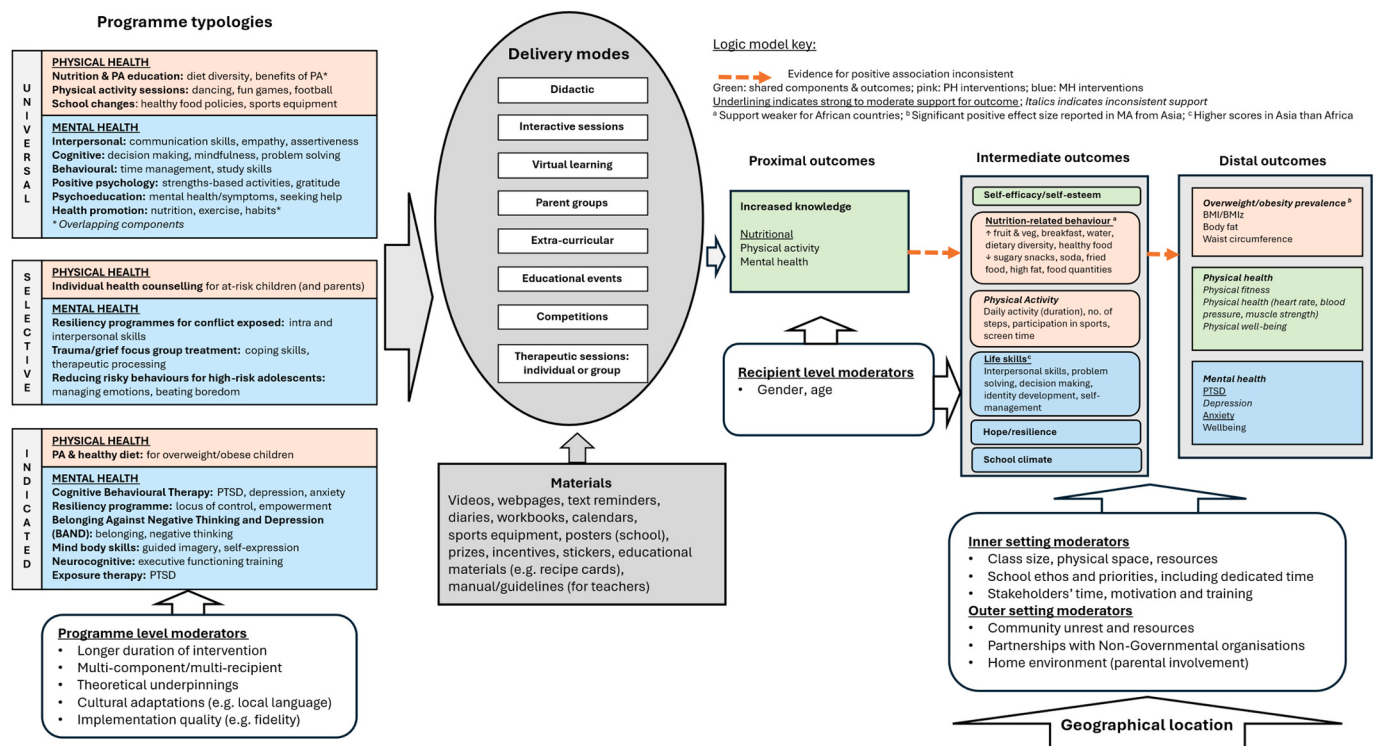


Fig. 2. Logic model of programme components, outcomes, and moderators.

universal (for all students), selective (for high-risk students), and indicated (for students with symptoms) level.

- Universal physical health programmes included: (1) nutrition and physical activity (PA) education (e.g., diet diversity, dangers of sedentary lifestyle); (2) PA sessions (e.g., fun games, after school football); and (3) changes to school climate including school policies (e.g., sale of healthy food in the cafeteria, banning fast food sellers), integrating physical health lessons into the curriculum, renovating school facilities, signs and broadcasting around campus, provision of sports equipment, and introduction of vegetable gardens.
- Universal mental health programmes included: (1) modules on interpersonal skills (e.g., communication, empathy, assertiveness); cognitive skills (e.g., self-talk, decision making, problem solving); behavioural skills (e.g., time management, study skills); positive psychology (e.g., strengths-based activities, positive thinking); psychoeducation (e.g., mental health/symptoms, seeking help); and physical or general health promotion (e.g., importance of exercise, nutrition, and habits); and (2) school-wide changes to improve school climate, e.g., setting a School Health Promotion Committee, awareness generation activities, competitions on intervention topics, healthy school policies, and platform for raising student concerns.
- Selective mental health programmes included: (1) resiliency programmes for conflict exposed students (e.g., cognitive restructuring, emotion regulation); (2) trauma treatment (e.g., coping skills, processing trauma exposure), and (3) risk reduction programmes (e.g., beating boredom, realities of drug use).
- Indicated physical health programmes included additional physical activity sessions for obese or overweight students, and targeted talks.
- Indicated mental health programmes included: (1) cognitive behavioural approaches (e.g., for depression, anxiety); (2) resiliency programmes (e.g., self-knowledge, internal locus of control); (3) combined cognitive-behavioural and interpersonal programs (e.g., belonging, negative thinking); (4) neurocognitive approaches (e.g., executive functioning training); and (5) exposure therapy (e.g., for PTSD).

4.2. Programme components aimed at parents/families

Most physical health programmes involved parents or families to some degree, providing them with supporting materials such as brochures, newsletters, diet sheets, recipe calendars, fridge magnets, and text reminders to encourage physical activity or improve nutrition. Some programmes held brief workshops and seminars to provide parents with information on healthy behaviours (e.g., on dietary guidelines and physical activity), others involved parents in activity sessions/tournaments or homework assignments. Mental health programmes also included components for parents/families. These included information sheets, activities and educational sessions. Some delivered bespoke workshops for families covering topics such as life skills and suicide prevention, child rights, gender equality, stress management, parenting skills, and family harmony in conflict prone areas.

4.3. Modes of delivery

Delivery modes included didactic, interactive, web-based moodle platform, parent groups, educational events, extra-curricular activities, competitions, and therapeutic sessions. Programmes often combined different modes (e.g., didactic and interactive sessions). The use of digital intervention was rare ($n = 1$). Materials supporting delivery of programmes included videos, webpages, sports equipment, stickers, workbooks, calendars, recipe cards, and manuals or guidelines.

4.4. Outcomes of physical and mental health programmes

We organised review results into proximal, intermediate, and distal outcomes (Roberts et al., 2019). We used these categories to represent potential chains of effect from SB programme to outcome. For example, the acquisition of nutrition-related knowledge (proximal outcome) facilitates changes in dietary behaviour (intermediate outcome) contributing to a subsequent reduction in body mass index (distal outcome). It should be noted that categorisation and timeframes pertaining to proximal, intermediate, and distal outcomes vary across the literature

and can overlap depending on context and programme intentions. Generally, proximal and intermediate outcomes tend to be measured over the shorter term (immediately after the programme to weeks or months) and distal outcomes in the longer term (months to years).

4.4.1. Physical health programmes

See Table 2 for an overview of the proximal (i.e. increased knowledge), intermediate (i.e. self-esteem, changes in nutrition related behaviour, physical activity), and distal (i.e. anthropometric, physical fitness) outcomes of SB physical health programmes.

Across reviews, evidence was strongest for proximal outcomes. Eight out of eight reviews reported increases in nutritional knowledge. Physical activity knowledge was less commonly assessed with some evidence for increases ($n = 2$).

Evidence for intermediate outcomes was mixed. Five reviews considered self-efficacy or self-esteem (e.g., child's ability to make changes to diet). While there was some support for programme effects on self-efficacy/esteem, these outcomes were considered in a limited number of individual studies. Reviews from African countries did not find strong support for changes in nutrition-related behaviour (NRB) (Adom et al., 2019; Klingberg et al., 2019; Kyere et al., 2020); however, reviews from across Asian (Uijtdewilligen et al., 2016), a broad array of LMICs (Ekubagewargies, 2025; Shinde et al., 2023; Singhal et al., 2021; Verstraeten et al., 2012), and Arab states (Abu Shihab et al., 2023) reported largely positive impacts on NRB. Eight reviews included physical activity (PA) outcomes. In two African reviews (Adom et al., 2019; Klingberg et al., 2019), half of studies reported a positive impact on PA. In a review of middle income countries, just over half of studies reported an increase in PA (Singhal et al., 2021). Similar findings were reported in reviews from a range of LMICs (Ekubagewargies et al., 2025; Singhal et al., 2021; Verstraeten et al., 2012) and Asian countries (Uijtdewilligen et al., 2016), though positive findings were mostly from upper-middle income countries. In contrast, Abu Shihab et al. (2023) reported a decrease in physical activity in two studies from the Arab states.

Twelve (out of thirteen) reviews assessed anthropometric (distal) outcomes. In most reviews across a range of continents, just half of included studies (or fewer) reported a significant decrease in overweight/obesity as indicated by body mass index (BMI). Evidence from three meta-analytical studies was similarly inconsistent. Pongutta et al. (2022) reported significantly greater reductions in BMI in experimental (compared to control) groups, with the strongest effects for multi-component programmes. Singhal et al. (2021) and Ekubagewargies et al. (2025) reported greater reductions in BMI in experimental groups, but differences did not reach significance in either review. Impacts on obesity were similarly inconsistent. Just four reviews assessed physical fitness (PF) outcomes (e.g., flexibility, strength). Impacts on PF in African reviews were variable with half of studies demonstrating a positive effect (Klingberg et al., 2019). PA and combined PA and nutrition programmes appeared effective in studies from Chile and South Africa (Verstraeten et al., 2012).

4.4.2. Mental health programmes

See Table 3 for an overview of proximal, intermediate, and distal outcomes of mental health programmes.

Just two reviews considered proximal outcomes. Harte and Barry (2024) reported a significant impact on mental health knowledge in three studies, whilst Singla et al. (2020) reported a significant improvement in health knowledge in their meta-analysis.

Intermediate outcomes included life skills, self-esteem, hope, resilience, and school climate. Four reviews reported positive impacts on life skills. The strongest evidence was from a meta-analysis of ten studies which reported a significant positive effect on life skills including prosocial behaviour, decision making, coping, and behavioural capability (Singla et al., 2020). Narrative reviews were generally supportive indicating positive effects on socioemotional competencies and coping skills (Gimba et al., 2020; Harte and Barry, 2024). Three narrative reviews

reported positive effects on self-esteem (Gimba et al., 2020; Harte and Barry, 2024; Tareke et al., 2023), whilst a meta-analysis reported a positive effect which didn't quite reach significance (Singla et al., 2020). Two narrative reviews demonstrated positive effects on resiliency (Harte and Barry, 2024; Sadhu et al., 2025) and one on school climate (Harte and Barry, 2024).

Distal outcomes included reductions in mental illness (depression, anxiety, PTSD), and increases in well-being, happiness, and physical health/fitness. Reviews suggested strong support for an impact on PTSD. Two meta-analyses (MA) reported a significant impact on PTSD outcomes across a range of LMICs (Grande et al., 2023; Singla et al., 2020). These findings were largely supported by narrative reviews from Sub-Saharan Africa (Tareke et al., 2023) and a range of LMICs (Gimba et al., 2020). Support for depression outcomes was mixed. One MA reported significantly greater reductions in depression scores in experimental versus control groups (Singla et al., 2020), whilst a second MA did not report a significant difference (Grande et al., 2023). In narrative reviews approximately half of included studies reported significant reductions in depression (Bradshaw et al., 2021; Harte and Barry, 2024). Findings for anxiety were largely supportive. One meta-analysis reported a significant positive effect (Singla et al., 2020), whilst a second reported a non-significant positive effect (Grande et al., 2023). In a narrative review of universal programmes, four out of five studies reported a significant improvement in anxiety outcomes (Bradshaw et al., 2021). Three reviews reported positive impacts on wellbeing (Gimba et al., 2020; Harte and Barry, 2024; Sadhu et al., 2025) and one on happiness (Harte and Barry, 2024) following psychosocial programmes focused on resiliency, mindfulness and positive psychology. Finally, two reviews suggested positive impacts on physical health/fitness (Harte and Barry, 2024; Singla et al., 2017).

4.4.3. Overlapping outcomes for physical and mental health programmes

Whilst physical and mental health programmes tended to assess different outcomes, there was a degree of overlap in proximal, intermediate, and distal outcomes. Both physical and mental health programmes increased knowledge and self-esteem/efficacy, though these outcome indices varied slightly (e.g., self-efficacy to change diet versus general self-efficacy, knowledge of diet diversity versus knowledge of mental illnesses). Whilst some mental health programmes improved physical health outcomes (e.g., cardiorespiratory fitness), physical health programmes did not tend to assess mental health and well-being outcomes.

4.5. Moderators of programme effectiveness

4.5.1. Recipient characteristics

Recipient characteristics appeared to impact on some outcomes. In Harte and Barry (2024) mental health programme effects were stronger for girls than boys in three studies (SEHER whole school health promotion, Cambodia life skills programme, Positive Child and Youth Development Programme). Singhal et al. (2021) reported a significant decrease in BMI in girls but not boys in a study from Brazil, whilst in a study from China there was a significant reduction in prevalence of overweight in boys only. In a review of African studies, there was a stronger effect on physical activity outcomes for younger age groups (i.e. Grade 3 learners). This was attributed to the suitability of the physical activity (in the form of playing) for the younger age group (Klingberg et al., 2019).

4.5.2. Programme characteristics

Physical (Abu Shihab et al., 2023; Pongutta et al., 2022) and mental health (Singla et al., 2020) programmes that targeted multiple recipients (e.g., students, parents, teachers, communities) and had multiple components (e.g., dietary education and physical activity, whole school approach to improve school climate) appeared more effective than single component programmes. Parental involvement (e.g., via educational

Table 2

Proximal, intermediate, and distal outcomes reported in physical health intervention reviews.

Review	Proximal outcomes	Intermediate outcomes			Distal outcomes	
	Knowledge	Self-esteem/efficacy	Nutrition-related behaviour	Physical activity	Anthropometric measures	Physical fitness
Abu Shihab 2023	↑ Nutritional (7/7 studies significant)	↑ (1/1 studies significant)	↓ soda (2/2 studies significant); ↓ snacks (2/2 studies significant); ↑ water (1/1 studies significant); ↑ fruit & veg (3/3 studies significant); ↑ breakfast (2/2 studies significant)	↓ (1/2 studies significant)	↓ Body Mass Index/obesity (3/7 studies significant)	Not reported
Adom 2020	↑ Nutritional (2 studies significant) ↑ Physical activity (1/2 studies significant)	↑ (1/3 studies significant)	Improved (2/4 studies significant) (e.g., ↓ sugar, ↑ fruit & veg)	↑ (3/6 studies significant)	↓ Body Mass Index (3/6 studies significant)	Ø (n = 2 studies) (e.g., shuttle runs, sit ups)
Ekubagewargies, 2025	↑ Nutritional (3/3 studies significant)	↑ (1 study, ns)	+ (n = 7/8 studies significant) (e.g., ↓ fast food, ↑ fruit & veg)	↑ PA (1 study significant)	Not reported	Not reported
Jauhari 2024 ¹	Risk Ratios (RR): Fruits: 1.24 (1.06, 1.46, 24% increase) Fats: 1.36 (1.28, 1.45, 36% increase) Snacking: 1.18 (0.85, 1.65, ns)	Not reported	Not reported	Not reported	Mean Difference (MD): ¹ BMI: 0.13 (−0.08, 0.33, ns) WC: 0.05 (−2.03, 2.13, ns)	Not reported
Klingberg 2019	Not reported	Not reported	Improved (2/6 studies significant)	↑ PA (6/12 studies significant) (e.g., 30 mins/6 dys week)	↓ Obesity/overweight (3/8 studies significant) ↑ Obesity/overweight (1/8 studies significant) ↓ Body fat (1/8 studies significant)	+ PF (6/12 studies significant) (e.g., flexibility, strength, balance)
Kyere 2020	↑ Nutritional (3/3 sig)	↑ (1/1)	Improved (2/7 studies significant)	Not reported	↓ BMI (3/9 studies significant)	Not reported
Pongutta 2022 ²	Not reported	Not reported	Not reported	Not reported	↓ BMI, MD: Overall: −0.36 kg/m ² (95% CI: −0.46, −0.25) multi-component: −0.54 kg/m ² (95% CI: −0.85, −0.23) vs single component: −0.12 kg/m ² (95% CI: −0.21, −0.04)	Not reported
Shinde 2022	↑ Nutritional (7/10 studies significant)	↑ (1/2 studies significant)	↑ vegetables (5/5 studies significant); ↑ fruits (3/5 studies significant); ↓ soda (4/7 studies significant); ↓ fried food (2/3 studies significant); ↑ diet diversity (1/4 studies significant)	Ø PA (n = 1)	↓ BMIz (4/6 studies significant) Ø BMI (5/5 studies nutrition education; 7/8 studies multi-component) ↑ BMI (3 PA studies significant) ↓ WC (3/6 multi-component studies significant; 0/2 nutrition studies significant)	Not reported
Singhal 2021 ³	Not reported	Not reported	Improved (9/13 studies significant) (e.g., ↓ soda & fast food, ↑ fruit & veg)	↑ PA (6/10 studies significant) (e.g., frequency & duration)	↓ BMI (7/19 studies significant) ↓ BMI, MD: −.23 kg/m ² (−0.82, 0.35, p = 0.43) ↓ Obesity: OR: 0.77 (0.63, 0.94, p = 0.009, 23% lower odds of obesity)	Not reported
Uijtdeuwilgen 2016	↑ Nutritional (3 studies significant) ↑ Physical activity (1 study significant)	Not reported	↓ fast food (1/2 studies significant) ↓ unhealthy snacks (2 studies significant) ↑ fruit & veg (1 study significant); ↑ breakfast (1 study significant)	↑ PA (2 studies significant) ↑ Outdoor activities (2 studies significant) ↑ MVPA (2 studies significant)	↓ BMI (1/6 studies significant) ↓ % overweight/obese (4/9 studies significant) ↓ % body fat (3/4 studies significant)	Not reported
Verstraeten 2012	Not reported	Not reported	↓ soda (2 studies significant); ↓ fast food (3 studies significant);	↑ PA (3/4 studies significant)	↓ BMI (8/12 studies significant) ↓ Obesity (3/7 studies significant)	↑ PF (3/3 PA studies significant) ↑ PF (2/2 PA & Nutrition studies significant)
Wiafe 2025	Not reported	Not reported	Not reported	Not reported	↓ BMI (2/7 studies significant); ↓ zBMI (1/4 studies significant) ↓ WC (5/7 studies significant); ↓ Weight (3/5 studies significant)	↑ PF (1 study significant)
Xu 2020	↑ Nutritional (1 study significant)	Not reported	Not reported	Not reported	Ø BMI (1 study significant); Ø WC (1 study significant); Ø body fat (1 study significant)	Not reported

ns = non-significant; ↓ = reduction; ↑ = increase; Ø = no effect; ¹ in Jauhari effect sizes were expressed as Risk Ratios (RR) for binary outcomes comparing experimental & control groups and Mean Differences (MDs) for continuous outcomes (in original units for BMI); ² In Pongutta, effect sizes were expressed as mean changes in body mass index between experimental & control groups; ³ in Singhal effect sizes were expressed as Odds Ratios (OR) for dichotomous outcomes and mean differences

(MD) for continuous outcomes (in original units for BMI); NR = not reported; daily PA includes increased number of steps, increased daily exercise; WC: Waist Circumference; MVPA: moderate to vigorous physical activity; PF = physical fitness.

Table 3

Proximal, intermediate, and distal outcomes reported in mental health intervention reviews.

Review	Proximal	Intermediate					Distal			
	Knowledge	Life skills	Self-esteem/efficacy	Hope	Resilience	School climate	Mental health	Wellbeing	Happiness	Physical health/fitness
Bradshaw 2021	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	↓ Depression (5/9 studies significant, $d = 0.06-0.28$) ↓ Anxiety (4/5 studies significant, $d = 0.09-5.89$)	Not reported	Not reported	Not reported
Gimba 2020	Not reported	↑ (2 studies significant: coping skills) ↑ (2 studies significant: interpersonal relationships)	↑ (3 studies significant)	↑ (1 study significant)	Not reported	Not reported	↓ Depression (4 studies significant) ↓ PTSD (2 studies significant)	↑ (1 study significant)	Not reported	Not reported
Grande 2023 ¹	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	SMD ¹ Depression, 0.80 (−0.47, 2.07, ns) Anxiety, 0.11 (−0.13, 0.36, ns) PTSD, 0.61 (0.37, 0.86, sig)	Not reported	Not reported	Not reported
Harte & Barry 2024	Mental health (3 studies significant)	↑ (3/5 studies significant: prosocial behaviour) ↑ (2/3 studies significant: socio-emotional competencies)	↑ (2 studies significant)	↑ (1/2 studies significant)	↑ (3 studies significant)	Positive effects for school climate scores	↓ Depression (5/8 studies significant) ↓ Anxiety (3/4 studies significant)	↑ (2/3 studies significant)	↑ (2/2 studies significant)	↑ (1 study significant)
Sadhu 2025	Not reported	Not reported	↑ (3 studies significant)	Not reported	↑ (9/11 studies significant)	Not reported	↓ Psychiatric symptoms (2 studies significant) SMD ² Depression, 0.24 (0.05, 0.44, $p = 0.016$) Anxiety: 0.48 (0.18, 0.77, $p = 0.002$) PTSD: 0.60 (0.32, 0.88, $p < 0.001$)	↑ (2 studies significant)	Not reported	Not reported
Singla 2020 ²	SMD ² : Health: 0.12 (0.01, 0.34, $p = 0.035$)	SMD ² 0.48 (0.27, 0.69, $p < 0.001$) (includes interpersonal, behavioural, cognitive & parental)	SMD ² 0.42; (−0.01, 0.85, $p = 0.06$)	Not reported	Not reported	Not reported	↓ Depression (7/10 studies significant) ↓ Anxiety (3/6 studies significant) ↓ PTSD (2/3 studies significant)	Not reported	Not reported	SMD ² : 0.56 (0.10, 0.57, significant)
Tareke 2023	Not reported	↑ (1 study significant) (coping skills)	↑ (1 study significant)	Not reported	Not reported	Not reported	↓ Depression (7/10 studies significant) ↓ Anxiety (3/6 studies significant) ↓ PTSD (2/3 studies significant)	(1 study, ns)	(1 study, ns)	Not reported

↓ = reduction in illness/symptoms; ns = non-significant; d = Cohen's d effect size; ¹ In Grande effect size expressed as standardised mean difference; ² In Singla effect size expressed as standardised mean difference (SMD) between experimental and control group using pooled standard deviations; ² In Singal effect size expressed as standardised mean difference using mean and SDs; PTSD: Post Traumatic Stress Disorder

sessions, text and video messaging) was associated with increased effectiveness (prevention of obesity, improved dietary habits and physical fitness) in both combined (Singhal et al., 2021) and single (Jauhari et al., 2025) component physical health programmes.

However, parental involvement did not increase effectiveness in terms of significant reductions in body mass index (Pongutta et al., 2022). Mental health programmes which involved families produced more sustained effects by creating environments supportive of positive mental

health (Harte and Barry, 2024).

Programmes of longer duration, i.e. > 6 months (Abu Shihab et al., 2023; Adom et al., 2019; Shinde et al., 2023), with a theoretical underpinning, e.g., social cognitive theory, health belief model (Abu Shihab et al., 2023; Kyere et al., 2020), and that were culturally adapted (Bradshaw et al., 2021; Gimba et al., 2020; Harte and Barry, 2024; Kyere et al., 2020) were more effective. Examples of the adaptation process included: (1) involvement of stakeholders (particularly young people) in initial assessment of original programme and co-production of adaptations; (2) changes to language (e.g., translation into local dialects, rephrasing of mental illness terms) and content (e.g., inclusion of traditional folk stories, culturally appropriate sessions); (3) changing delivery methods (e.g., individual web-based to group-based face-to-face); (4) piloting of programme to check for cultural appropriacy; (5) involvement of key community members (e.g., pastors, local healers) in programme delivery; and (6) final adjustments following consultation with the implementation team (Bradshaw et al., 2021; Gimba et al., 2020; Harte and Barry, 2024; Singhal et al., 2021).

4.5.3. Implementation quality

Implementation quality (e.g., fidelity, quality of delivery, adherence, training and supervision, participant responsiveness/attendance) was important for programme effectiveness and sustainability (Harte and Barry, 2024). Delivery agent appeared to moderate programme effectiveness differentially for physical and mental health programmes. Delivery by lay counsellors was more effective (than by teachers) for depression outcomes (Bradshaw et al., 2021), whilst delivery by a teacher was more effective than external delivery (e.g., by researchers) for obesity programmes (Singhal et al., 2021; Verstraeten et al., 2012).

4.5.4. Inner setting

Barriers to implementation within schools included large class size (India, Uganda), timetabling constraints (India), limited physical space (Kosovo), technical difficulties setting up online accounts (Thailand), lack of resources (South Africa), low priority of physical education (South Africa), stakeholders' lack of time, training and motivation (South Africa, Cambodia), and teachers' fear of criticism/lack of ongoing support for teachers (Harte and Barry, 2024; Klingberg et al., 2019). Implementation facilitators included dedicated time slots for sessions, support of management and staff, additional programme materials such as sports equipment and food provision (South Africa), after school delivery, complementary school ethos, teachers' positive attitudes (South Africa) and stakeholder working groups (China) to oversee implementation of school policy (Adom et al., 2019; Harte and Barry, 2024; Singhal et al., 2021; Xu et al., 2020).

4.5.5. Outer setting

Macro level barriers included community unrest and strikes impacting teacher turnover (Klingberg et al., 2019). Macro-level facilitators of programme delivery and sustainability included effective partnerships with communities, universities, and Non-Governmental Organisations (Harte and Barry, 2024). Home environment (e.g., parental involvement to role model nutritional choices) was highlighted as important in the etiology and prevention of weight-related problems (Abu Shihab et al., 2023; Adom et al., 2019; Xu et al., 2020). The benefits of involving parents in universal (as opposed to targeted) mental health programmes was less clear. None of the studies in Bradshaw et al. (2021) directly involved parents/guardians in the programme.

4.5.6. Geographical region

Some outcomes appeared to vary by geographical region. In a meta-analysis of life skills programmes, Singla et al. (2020) reported higher pooled effects on life skills in Asian (China, Bangladesh, India: Standardised Mean Difference [SMD]: 0.67; 0.41, 0.93) compared to African (Uganda, Sierra Leone, Cambodia, South Africa, Mauritius: SMD: 0.21; 0.09, 0.33) countries (though these pooled effects were not directly

compared through meta-regression). Conversely, programme impact on PTSD symptoms was slightly higher in African (SMD: 0.71; 0.02, 1.40) compared to Asian (SMD: 0.64; 0.09, 0.98) countries. In terms of anthropometric outcomes, a meta-analysis (Ponguttha et al., 2022) of Asian countries (including Lebanon, India, China, Turkey, Iran, Malaysia, and Thailand) reported a significant positive pooled effect on reduction in BMI. This compares to weaker evidence from narrative reviews across African countries, where fewer than half of studies reported significant impacts on BMI reduction (Klingberg et al., 2019; Kyere et al., 2020).

5. Discussion

We summarised evidence on SB physical and mental health programmes delivered in LMICs. Overall, evidence for programme effectiveness was equivocal, with more support for proximal (e.g., increased nutritional knowledge), followed by intermediate (e.g., improved nutrition-related behaviour, life skills), then distal (e.g., reductions in BMI, depression symptoms) outcomes. While reasons for this are hard to disentangle, there are several plausible explanations. First, it might be that study duration was insufficient for the programme to be fully embedded and for some physical and mental health impacts to be realised (Harte and Barry, 2024; Shinde et al., 2023). Second, programme characteristics could have moderated some distal (and to a lesser extent intermediate) outcomes. Verstraeten et al. (2012) found that obesity programmes improving both proximal and distal outcomes shared common features including a multi-component design (including additional physical activity sessions), education-based modules, and delivery by teachers (though the opposite pattern was found for mental health programmes). There was some indication that SB programmes involving parents were more effective across both physical and mental health domains. Level of involvement might be a pertinent factor, e.g., effective obesity programmes involved at least two educational sessions with parents (Singhal et al., 2021) and should be given ample consideration to tackle challenges associated with engaging parents (Klingberg et al., 2019). Third, implementation quality could have moderated effectiveness and sustainability thus impacting longer-term outcomes (Harte and Barry, 2024). Finally, contextual factors could have impacted on intermediate and distal outcomes.

We observed geographical variations in outcome, though these were difficult to verify due to the size and heterogeneity of continents covered and lack of direct comparisons within reviews. Across reviews, SB programmes appeared to be more effective in reducing BMI in Asian compared to African countries. Whilst programmes yielded positive impacts on nutrition-related knowledge in both Asian and African studies (Kyere et al., 2020), this knowledge was not consistently converted into improvements in nutrition related behaviour (Prestwich et al., 2014) and reductions in BMI (Kyere et al., 2020) in African studies. Reasons for bottlenecks in outcome pathways in Africa could include level of poverty, high costs of healthy food, lack of control over food choices, safety concerns restricting physical activity, and body image and beauty ideals (Klingberg et al., 2019; Kyere et al., 2020). This underlines the importance of cultural adaptations to ensure effectiveness and sustainability of programmes across different regions in LMICs (Bradshaw et al., 2021; Gimba et al., 2020; Harte and Barry, 2024).

We did not identify any reviews (or individual studies within these reviews) combining physical and mental health programmes in a fully composite dual programme (i.e. equally targeting physical and mental health outcomes). We did identify some overlap between physical and mental health programmes, including nutritional and well-being programme modules, proximal (e.g., increased knowledge), intermediate (e.g., self-efficacy) and distal (e.g., improvements in physical health) outcomes. It should be noted that physical health programmes did not assess mental health outcomes so we could not determine whether dietary and physical activity programmes might concomitantly improve mental health outcomes. Whilst dual-focused programmes for emotional

and physical health exist, these tend to be aimed at the parents of younger children (Cooper et al., 2025) rather than youths. These dual approaches could provide a model for SB programmes as an effective way of addressing upstream drivers of health disparities. However, these programmes will require an integrated approach to facilitate cross-domain results (Cooper et al., 2025). This might include education on the inter-relationship between physical and mental health, and balanced provision of physical (nutrition, physical activity, sleep hygiene modules) and mental (life skills, including cognitive, interpersonal and emotional domains, awareness of mental illness, help-seeking) health components. As there is a strong correlation between physical and mental health (Cadenas-Sanchez et al., 2021), and potential shared mechanisms via which programmes could improve physical and mental health concomitantly (Firth et al., 2019; Mahindru, Patil, and Agrawal, 2023), composite SB physical and mental health programmes are a promising area for future research.

Considering school-wide components to improve school climate might be especially important for both physical and mental health programmes. In line with socio-ecological and health promotion models, changes to the school environment create broader support systems to reduce mental health stressors (Gimba et al., 2020; Harte and Barry, 2024) and make healthy behaviours more accessible (Ekubagewargies, 2025). For example, Singla, Shinde, Patton, and Patel (2021) demonstrated that improvements in school climate (reflecting the quality of school social environment) mediated the effects of their whole school programme on depression, bullying, and perpetration of violence. Potential active ingredients (i.e. mechanisms of action) included the nurturing effects of supportive relationships with teachers and peers, and feelings of school connectedness through increased participation in school events. Though not tested directly, it is plausible that school climate changes could similarly underpin improvements in physical health. For example, changes in nutritional behaviour and subsequent reductions in BMI could be facilitated through school policies, e.g., increased provision of sports equipment and healthy foods (Adom et al., 2019; Ekubagewargies, 2025). The beneficial effects of improving school climate could extend beyond SB programme outcomes. It has been shown that a supportive school climate can reduce stress on parents and students, thus reducing conflict, and enhancing the effectiveness of parenting programmes (Varner et al., 2025). Future youth programmes in LMICs (including SB and community approaches) would benefit from including school environments as important targets for supporting physical and mental well-being.

5.1. Review strengths and limitations

Our review has strengths. We used a robust search strategy and developed a logic model to delineate programme components, outcomes (proximal, intermediate, and distal) and moderators to provide a comprehensive overview of research on SB programmes for physical and mental health in LMICs. Further, our logic model was informed by input from our local teams in Nigeria and India to ensure we fully considered contextual influences on programme content and implementation.

The main limitations of this review relate to shortcomings of the reviews included, and limitations of primary studies included in each review. First, according to the AMSTAR-2 assessment, the most common limitations of reviews were the absence of a pre-determined protocol, no explanation for choice of study design, incomplete information on search strategy and data extraction, and incomplete discussion on the impact of risk of bias on review results. Shortcomings of primary studies included a lack of reporting of adverse outcomes (Adom et al., 2019; Kyere et al., 2020), limited consideration of cost effectiveness (Singhal et al., 2021; Verstraeten et al., 2012), and incomplete information on cultural adaptations and implementation processes (Harte and Barry, 2024). We recommend that future studies in LMICs utilise published frameworks to guide detailed recording of these factors. For example, the RECAP cultural adaptation tool comprises eleven items relating to

four areas: (1) set-up; (2) formative research methods; (3) programme adaptation; and (4) measuring outcomes and implementation (Heim et al., 2021). Other reference tools include the checklist for key implementation processes which could act as a blueprint for scaling up psychological treatments by addressing the areas of who, what, where and how (Singla et al., 2017).

Second, we developed a logic model guided by previous literature on the chains of effect underpinning mental and physical health programmes (Bauman et al., 2012; Prestwich et al., 2014; Winsper et al., 2020). However, we were restricted by the available literature, which provided limited analysis explicitly testing potential mechanisms (e.g., mediational analysis). Whilst we mapped out different components of each programme type, we could not identify statistical analysis examining how each component influenced outcomes. This highlights the need for process evaluations to understand mechanisms (McGill et al., 2020), translation of proximal into intermediate and distal outcomes (Verstraeten et al., 2012), and effectiveness of individual or clusters of programme components (Uijtendewilligen et al., 2016).

Third, reviews tended to consider universal, selective, and indicated programmes in isolation (i.e. they did not explore how these components might be combined). In view of the reluctance to seek help for mental health problems in LMICs, the development of multi-faceted programmes (e.g., education, screening, and targeted counselling) is an important area for future study.

Finally, whilst we did not place language limitations on our search, we only identified English language studies. This might reflect the underrepresentation of LMICs in the research literature, signalling the need for more cross-national collaborations to address the current barriers LMICs encounter (Woods, Watson, Ranaweera, Tajuria, and Sumathipala, 2023).

6. Conclusions

Whilst schools appear to be an ideal setting for early intervention due to compulsory attendance and a non-stigmatising environment, programme effectiveness has been limited by a lack of multi-component programmes offering both universal and targeted elements. Therefore, future programmes should ensure a whole systems approach including cultural adaptation and robust monitoring of implementation. Including both physical and mental health components in dual composite programmes could help tackle the growing burden of non-communicable diseases in LMICs (Piot et al., 2016).

CRedit authorship contribution statement

CW and DG conceived the review design. CW led the writing of the manuscript. CW and UA conducted the systematic screening process (abstract and full text). CW and DM conducted the critical appraisal. All authors reviewed the first draft of the manuscript and provided comments on the first and subsequent drafts.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cpr.2026.102727>.

Data availability

No data was used for the research described in the article.

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